FUNDAMENTALS OF SCALAR MOTION

IN A MULTIPLE REFERENCE POINT UNIVERSE OF MOTION

LAWRENCE E. DENSLOW

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Other books on the *Reciprocal System of physical theory*

Dewey B. Larson

Structure of the Physical Universe (1959)
Nothing But Motion (1979)
Basic Properties of Matter (1988)
Universe of Motion (1984)
Beyond Space and Time (1996)
Quasars and Pulsars (1971)
The Neglected Facts of Science (1982)
Beyond Newton (1964)
The Case Against the Nuclear Atom (1964)
New Light on Space and Time (1965)
The Road to Full Employment (1976)
The Road to Permanent Prosperity (2008)
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Collected Writings of KVK Nehru on the Reciprocal System of theory (1982)

Ronald Satz

Unmysterious Universe (1971)

Arnold Studtmann

Towards a Unified Cosmological Physics (1965)

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PREFACE

This present volume is solely an attempt to provide a clear straightforward presentation of some of the simpler aspects of the *Reciprocal System of theory*. It is not intended to supply any new developments other than terminology and the identification of the origin of certain fundamental concepts that are often assumed as a result of general familiarity with mathematics and the physical sciences. In that sense, it is an introduction to some of the concepts of scalar motion and their consequences for a theoretical universe of motion. The concepts introduced and the terminology used in this volume may be completely new and different from that familiar to most students of the physical sciences as previously presented on this planet. It is impossible to present new ideas completely in terms of old ideas, and therefore, it has become necessary to invent new ways of expressing the ideas so that they will not be mistaken for the old ideas.

It cannot be claimed that this or any other specific way of describing any aspect of the theoretical development is necessarily the correct way, or that this description is what the original author of the theory, Dewey B. Larson, thought, had been developed as consequences for the postulates for the Reciprocal System of theory. As must be recognized for the development of any set of theoretical ideas, each contributor makes his own interpretations of previously available information and puts his stamp on those and other ideas as he sees them. It is the responsibility of all students of science to gather as much information and as many differences of viewpoint as possible from which to make the most intelligent interpretation possible for himself/herself of the world of which he/she is capable.

Subsequent to initial reading, this volume should be studied in conjunction with the other volumes dealing with the development of the Reciprocal System of theory and the theoretical structure of the physical universe written by Dewey B. Larson: *New Light on Space and Time, Case Against the Nuclear Atom, Beyond Newton, The Neglected Facts of Science, Nothing But Motion, Basic Properties of Matter,* and *The Universe of Motion.* These and other titles by Dewey B. Larson, as well as other books and pamphlets are available from *International Society of Unified Science*. Membership in the society is open to all persons interested in the advancement of scientific knowledge. Membership includes a subscription to the journal of ISUS, *Reciprocity.*

Thanks go to the many members of ISUS who have made comments and suggestions concerning the contents of this volume. In consideration of the numerous controversies which have been spawned by the differing viewpoints of the members of ISUS concerning various details of the development, further comments are solicited from all persons interested in the achievement of the ultimate goal of science, a completely consistent and comprehensive theoretical description for this physical universe.

Lawrence E. Denslow
July, 1996

PROLOGUE

The *Reciprocal System* is a complete general theory of the physical universe. It contains no hypotheses other than those relating to the nature of space and time and it produces complete comprehensive explanations for all physical phenomena simply by development of the consequences of the initial postulates. Descriptions developed in conjunction with the Reciprocal System of theory for the physical processes and relationships of everyday life differ very little from previous descriptions. One reason for this is that in our everyday experience we are dealing with motion in dimensional space, and the laws and principles governing such motion are already firmly established. Any correct theoretical development must necessarily lead to these same laws and principles, purely from the development of the consequences of the postulates of the theory.

From *NEW LIGHT on SPACE and TIME* by D.B. Larson pages 76 through 78:

> *"The Reciprocal System admittedly conflicts with many tenets of present-day scientific doctrine, but it can be shown that these are not conflicts with established facts, and hence can have no bearing on the points at issue.*
>
> *"It is worth noting, however, that the conflicts with the current thought of the scientific profession are not as numerous as might be expected from the basic nature of the new concepts that are being introduced. Surprising as it may seem, in view of the drastic nature of these conceptual changes, the new system is in full agreement with the bulk of existing physical theory. There are some rather spectacular conflicts with the so-called "modern" developments, to be sure, but in spite of the prominence that "modern physics" has acquired in recent years, these subjects in themselves represent only a relatively small part of the total field. Almost all of the theoretical relations applicable to our immediate environment which have been firmly enough established to enable the applied scientists —the engineers—to use them on a practical basis can be derived from the postulates of the Reciprocal System in essentially the same form in which they are now known. These relations… Newton's Laws of Motion, the gas laws, the laws of thermodynamics, the laws of optics, the kinetic theory, Newton's Law of Gravitation, Kirchhoff's Laws, Ohm's Law, Hess' Law, Faraday's Law, Avogadro's Law, Pascal's Law, and so on—are incorporated into the Reciprocal System practically intact. Where some change has been necessary, as in the laws of motion, this change has usually been in the definition of the concepts entering into the relation itself. Newton's Laws of Motion, for instance, are retained in his original form, but the concept of time has been altered.*
>
> *"The new system is likewise in harmony with at least some of the original concepts and ideas of the so-called "modern" physics: those portions of modern theory which are based directly on empirical findings. Planck's original theory of the quantum of radiant energy is fully compatible with*

the consequences of the postulates of the system, as is Einstein's extension of Planck's hypothesis to the photoelectric effect. The Lorentz transformations are likewise acceptable to the Reciprocal System as also the Special Theory of Relativity is in mathematical agreement, although the new information developed from this present investigation shows that the Special Theory is conceptually wrong.

"Within the realm of everyday experience… the fields of the engineer, the chemist, the geologist, etc… the role of the Reciprocal System has been primarily to fill in the gaps in existing knowledge. In such fields as that of chemical combination, for example, where existing theory is painfully inadequate, it has been possible to establish complete and correct theoretical structures. Furthermore, the new system has made a major contribution by extending the scope of theory to the magnitudes of physical quantities. Of course, previously existing theory covers the mathematical relations between physical quantities… indeed the quantitative treatment is often regarded as the essence of science… but in general, these previous theories have not been able to account for the individual magnitudes. They have not been able, for example, to specify the magnitude of the gravitational constant, or the molar gas volume, or Planck's constant h, or the Faraday constant, and so on; it has been necessary to measure these quantities and to use the values thus determined.

"Likewise, the theorists have not heretofore been able to devise any means whereby we can calculate from purely theoretical foundations (except in rare and very special cases) the numerical values of the properties of physical entities… such properties as density, specific heat, refractive index, etc… even though these properties have definite magnitudes which clearly must be subject to some kind of physical laws. The development of the postulates of the Reciprocal System yields not only qualitative relations but also quantitative relations and the absolute magnitudes (or at least the possible magnitudes) of such items as the foregoing from theory alone.

"In the far-out regions the task of the new system has been to build a completely new theory. Here, where the empirical knowledge has been too scanty and too confused to constitute any effective restraint on the imaginations of the theorists, previous theory constructors have attempted to explain the observed phenomena by pure speculation and ad hoc modification of the principles applicable to the more familiar regions, and as a result it is here that theoretical science is finding itself unable to keep up with the progress of experimental discovery. The Reciprocal System is not subject to the handicaps that conventional theory encounters in these less accessible regions, as this system derives its entire theoretical structure from a logical and mathematical development of the consequences of the Fundamental Postulates, and does not depend on observational or experimental information for guidance or assistance as to the next step. By reason of this purely theoretical derivation, the new system has been able to arrive at complete and consistent theories covering the phenomena not only of those regions where observational

data are meager, but also some other regions which are still completely unknown observationally.

"The most drastic changes made by the new system, as distinguished from additions to or clarifications of previous theories, come in those areas where scientists have, without being aware of the fact, made contact with regions of the universe other than the one in which we happen to be located and to which our familiar physical relations apply. It is here that the theorists have attempted the impossible; they have attempted to fit the relations appertaining to one region of the universe to the phenomena of other regions that are actually governed by totally different, and in some cases diametrically opposite, relations. And it is here that they have, as a consequence, found themselves in a state of confusion and uncertainty.

"In the light of the information developed in this investigation it is clear that the existing confusion was inevitable. The theorists who have attacked these problems have lavished an immense amount of intelligence, ingenuity, and perseverance upon them, but a problem cannot be solved, no matter how great the ability of those who undertake its solution, or how much effort they apply to the task, if the basic nature of the problem is misunderstood."

CHAPTER I: INTRODUCTION

INTRODUCTORY OBSERVATIONS

Each person has learned to deal with his/her world in ways that made sense to oneself. The way each one sees his/her world is the result of personal experience which has had to be resolved individually and made to fit together in a personally rational manner. Our experiences are made up of the things shown to us, told to us, or read by or to us individually, as well as the things which we have done. Each of us has had to deal with other people telling us one thing and in the very next breath saying the opposite. Each has had to deal with conflicts of all sorts, all of which we have had to resolve and integrate into a Personal Conceptual Framework. Every time something new came along that did not initially fit, we determined whether it represented a conflict with previously accepted concepts or merely had to be added to the previous pattern of concepts, thereby expanding the Personal Conceptual Framework.

If a new concept conflicts with a concept previously accepted as valid, one may have difficulty. The ability to resolve such conflicts often rests on **how** the previous concept was integrated into the Personal Conceptual Framework. Any previously held concepts which have emotional overtones may be genuine stumbling blocks. However, those which were gained through the educational process, which is generally based on logic, can usually be resolved by spending time with the new idea and playing with its ramifications. Concepts can be categorized into various groupings such as social, political, religious, scientific, etc. Among these each person can probably identify several concepts which fall into both the emotional and the logical learning modes.

In reading and studying this introduction to the *Fundamentals of Scalar Motion* you may come face to face with concepts that have definite conflict with previously accepted ideas. You will be faced with the necessity of examining the bases from which all of your interpretations regarding descriptions of this physical world are made. The situation being faced is well described by two ideas which apply to all categories: “The most difficult task anyone ever faces is to take an old set of data [the way one is used to interpreting his world] and interpret it from a new perspective”, i.e., using a totally different set of rules and “One cannot confute with logic that which was not learned by logic”.

HISTORICAL PERSPECTIVES

Consider from a historical perspective of western cultures the picture that is presently held for the universe in which we live. Prior to the publication in 1543 of Nicoiaus Copernicus’ *De Revolutionibus*, the geocentric or earth centered universe was the only available explanation for the positional relationships among the objects observed in the heavens. Even after Copernicus published his work, the vast majority of natural philosophers (the scientists of the era) continued to hold onto the ideas of geocentrism due to the lack of adequate supporting evidence to the contrary and mathematical analysis of currently available evidence.

In 1601 the mass of astronomical data, particularly of the relative positions of the planets, accumulated by Tycho Brahe (1546-1601) became the property of Johannes Kepler

(1571-1630), who had been Brahe's assistant. Kepler published the first of his works on the analysis of that and other data in 1609. With the publication of the last of his four volumes, he had shown that the data supported elliptical rather than circular orbits around the sun for the planets in a heliocentric system as previously proposed by Copernicus. The three empirical laws which Kepler had derived placed the sun at one focus of a unique ellipse for each planet and showed that a radius vector from the sun to each planet would sweep out equal areas in equal time intervals. It was also shown that the square of the Period of revolution divided by the cube of the average distance from the sun remained a constant value for all of the planets. Another way of expressing the relation between the Period of revolution and the average distance of each planet from the sun is by the relation:

$$\frac{P_i^2}{d_i^3} = \frac{P_o^2}{d_o^3}$$

Galileo Galilei (1564-1642) is recorded as the first person to have used experimental as well as philosophical evidence to decide between conflicting ideas. He used telescopic evidence of the visual phases of Venus and verbal discourse to show the validity of the heliocentric concept as it contradicted the geocentric system and its multiple epicycles. Galileo was not much different from most of us today; he bowed to the pressure of the church (the establishment of the day) rather than face imprisonment and torture (the equivalent today is to lose one's job and not have one's work published). Fortunately, his *Dialogue Concerning Two Chief World Systems* was published in Protestant Holland and soon his ideas met with widespread acceptance which caused the eventual death of the geocentric theory.

It was many long years after Kepler and Galileo that the majority of scientists accepted heliocentrism since it was not until 1687 that Issac Newton integrated most of the concepts in his *Principia*. Newton's invention of the reflecting telescope was no small contribution to the advancement of experimental science, but the derivation of the three laws of motion has been shown to be an even greater contribution to theoretical science. Although he proposed no theoretical basis for why these laws should exist, the relations themselves have been the impetus for nearly all subsequent scientific work. The empirical relation for the effect recognized as gravity does not conform to his previous definition for a force and, therefore, remains only as an observed relationship. Newton's insistence that space and time were not only separate entities but were unrelated continues to limit the theoretical development of explanations for the behavior of the universe.

It is interesting to note that prior to Olaus Roemer's determination in 1675 of the speed of light, light had been assumed to have instantaneous propagation or infinite velocity. That determination along with subsequent experimental evidence that light is not propagated instantaneously led to a reversal of viewpoint and the conclusion that there can be no instantaneous effect of any kind, which may or may not be true.

Because of the environment of people and other organisms on this planet, the concept of an "ether" in which the planets and stars "floated" was a natural development and thoroughly accepted concept well into the early part of the 20th century. The Michelson-Morley experimental results (1887) verifying the constancy of the velocity of light regardless of direction or velocity of the emitter tended to confound more than clarify the thinking of a majority of physicists at that time.

Einstein claimed to have not heard of their results at the time he developed his Special Theory of Relativity. In the development of the Special Theory, the medium-like properties that previously had been reserved for the "ether" that was said to permeate all of space were attributed to space. By redefining the properties of space and elevating to the level of postulates, the constancy of the speed of light and the idea that all inertial frames of reference are equivalent, the contribution of the possibility of a curvature of space has led to speculations which can be shown to be completely unnecessary, and thereby, unwarranted. In developing the mathematics of the Special Theory, Einstein indicated that he was working from the descriptions and difficulties with magnetic induction. There is no argument with the mathematics of the Special Theory, only certain subsequent interpretations, thereof.

Prior to the development of the atomic theory of matter, all solid materials were considered to be continuous substance. With the advent of the atomic theory of matter as derived for the behavior of gases, the continuity concept was modified to become atoms in contact in the solid phase. This is a concept which dominated the thinking of members of the scientific professions until around the turn of the last century and led Ernest Rutherford to the conclusions to which he came as a result of his now famous gold foil experiment. The idea that atoms in solids are like marbles arranged neatly in a box and that their different sizes control the geometries in which they can be stacked for the many different crystalline and amorphous solid structures observed is an assumption, not an experimental observation. There is a difference between the experimental observation that the atoms of the different elements seem to require varying interatomic distances in their associations with each other and the statement that atoms have different sizes; the statement being based on the assumption of geometric solidity for each atomic structure. In spite of more recent modifications, this assumption has continued to place conceptual blinders on virtually all people who have come in contact with Rutherford's explanation of the experimental results of bombarding a thin gold foil with positively charged helium atoms, alpha particles. The interpretation of experimental results in terms of current theories implies that the amount of measurable space between the centers of location for atoms of gold is essentially unoccupied. Whether that space is totally unoccupied or is occupied very sparsely or what the meaning of occupancy may be is a matter of theoretical interpretation.

Another result of the idea of semi-solid atoms is that added heat causes the atoms to have more violent translational movement and become far enough apart on an average (linear and volume expansion) allowing the individual atoms or molecules to slip out of geometric positions to positions in between others, thereby melting becomes thought of as a function of the entire aggregate. A similar conclusion concerning the gas phase is that atoms or molecules having sufficiently greater translational movement in random directions in space causes them to be able to eliminate any permanent positional relationships with their neighbors. Both of these conclusions are subject to reinterpretation by noting the difference between experimental observation and interpretation of those observations.

As a result of the idea that atoms are in contact in the solid phase of matter, the conclusion that the mass encountered at the center of the region allotted to each atom in any crystal structure is the nucleus of the atom seems completely logical and beyond question. However, the idea that the apparently small massive effect at the center of the allotted region may be the entire atom is also a possible interpretation. But such an interpretation at this point in scientific investigations into the nature of matter upsets

many favored ideas and, thus, is generally ignored. Not only would it wipe out the idea of a nuclear atom constructed from sub-atomic particles which must be arranged in some reasonable and consistent pattern in each different kind of atom, but it would demolish the necessity of having hypothetical forces to hold the particles together, as well as the necessity of proposing unobservable properties for these and other hypothetical particles. It has been mathematically shown that the experimentally observed relations among electrostatic charges are definitely inadequate to produce and maintain the proposed nuclear arrangements, thereby, making it necessary to propose a theoretical nuclear force.

Since almost all of our explanations about atoms, molecules, crystals and such, are based on the concept of a nuclear atom, there are a multitude of ideas that would change as a result of considering the idea of extremely small atoms held apart by a heretofore unknown force. What we would **not** need to do, as a result of the abolishment of the nuclear atom, is go through basic chemistry and physics and try to identify all the things that would need to be changed. To properly consider the idea of a previously unknown force holding very small atoms apart, that which should be done and has been done, is to develop a completely self consistent set of explanations that do not violate or contradict **any** verified experimental evidence. Thereby, all explanations become reoriented so as to make it possible to merely **abandon** all previous explanations based on the nuclear concept of atomic structure.

LAWS OF BEHAVIOR OF MATTER

We observe and interact with a world that for all practical purposes is made up of matter having energetic behavior and have deduced some of the laws for its behavior. The first such law was formulated by Newton in what we now call the First Law of Motion: objects stay in the same state of motion until acted on by an unbalanced force. For defining that motion, use of our everyday concept of space is adequate: space is a fixed three dimensional framework for defining locations of objects. The velocity of an object is defined in terms of its rate of change of location in that space; i.e. the amount of change of spatial location in ratio to the corresponding amount of a progressive characteristic of that which is called time:

Equation 1: Speed

$$v = \frac{\Delta s}{\Delta t}$$

Even though it is observed that objects may remain in the same state of motion—i.e., they are either apparently motionless or are moving with constant velocity—they are observed to undergo changes in their state of motion when acted upon in some manner. If the rate of change of location does not remain constant the rate at which the rate of change of location undergoes a change is called acceleration and is analyzed in the same manner.

Equation 2: Acceleration

$$a = \Delta v / \Delta t = \Delta s / \Delta t / \Delta t$$

The Second Law of Motion is usually stated as the acceleration which an object experiences is directly proportional to the magnitude of the force applied and inversely proportional to the mass of the object undergoing the change in its state of motion. Thus the empirical relation for acceleration is equated to the statement of the second law by relating the two concepts implied by the statement of the First Law of motion in an inertial frame of reference, mass and force.

Equation 3: Force to Mass Relationship

$$\frac{\Delta v}{\Delta t} = a = \frac{F}{m}$$

Mass may have been initially defined in some other way, but it is now used as a measure of inertia, the magnitude of the inherent material characteristic of resisting any change in the state of motion of an object. By the use of measured values of mass obtained by comparison effects and acceleration based on accepted arbitrary definitions, the definition of force is refined by appropriate algebraic manipulation:

Equation 4: Force

$$F = ma$$

Since we are not able to experimentally show that mass is the effect of anything else more fundamental, notwithstanding certain interpretations of high velocity effects, *mass is assumed to be a fundamental measure of existence for anything that is to be called matter*. From this assumption and the observations which led to the laws of motion, all of the relationships referred to under the heading of mechanics were derived. Position, velocity, acceleration, force, momentum, impulse, work, kinetic and potential energy and all the other relationships of mechanics are represented either as directionless or as directed quantities depending on the requirements due to experimental observations and mathematical concepts. After gaining the mental ability to handle mathematical abstractions, a personal system of coordinates previously incorporated into the Personal Conceptual Framework is given quantification and representation in an arbitrarily chosen graphical depiction for locations of objects. Consider these diagrams for a system of coordinates used on a personal basis for locating objects in the personal environment; how far right or left of the XZ plane and how far above or below the XY plane and how far in front of or behind the YZ plane is a given object located?

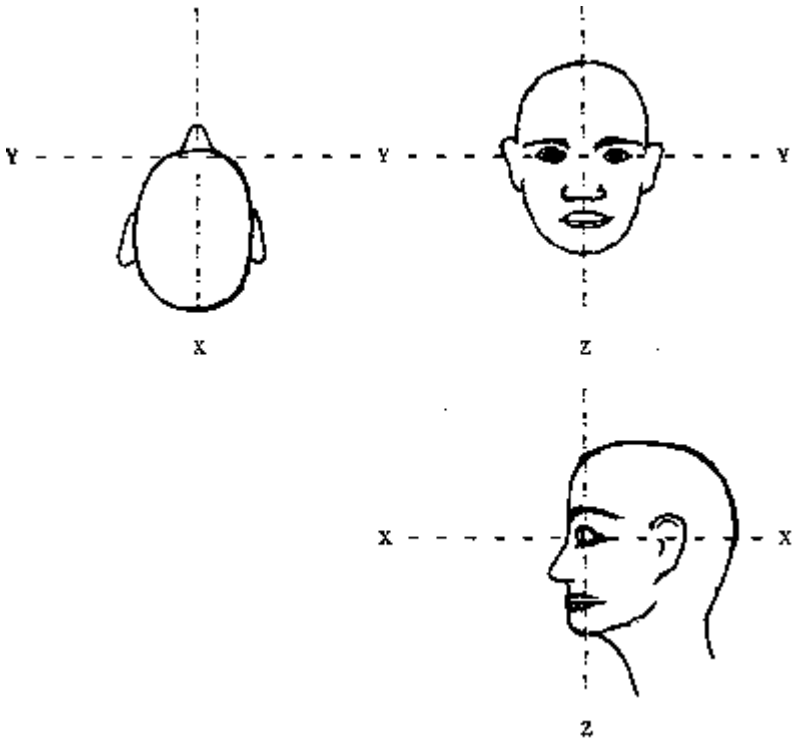


Figure I: Coordinate Systems

The mathematical formula for physical processes involve the use of units of mass, length of space, time, intensity of radiation, and strength of charge or the field surrounding at a

specified distance either an electric charge or magnetic source. Molecular quantities, and sometimes temperature, are also considered to be fundamental quantities because both have to be arbitrarily defined in terms of the presence of matter. Since charge effects and magnetic effects are not observed to exist except in the presence of matter (existence other than this is only a hypothesis) and since radiation cannot be produced except by interactions of matter, it is left to mass, space, and time to supply the actual fundamental entities of the physical universe.

Since the various entities do not carry labels which brand them as fundamental or not fundamental, any development of concepts and theory, should involve an attempt to eliminate ambiguities in definitions by defining all terms and concepts sharply and explicitly, as well as, identify the most fundamental entities from which all others can be derived. All conclusions that are reached—the intermediate as well as final results—should be capable of being verified by comparison with the findings of observation and measurement, to the extent that observational knowledge becomes available. There should be no deliberate attempt to minimize or maximize the use of mathematics. An approach that is intended primarily to clarify the conceptual framework would be composed mostly of words and would not require the use of complex mathematics, even though such skills would be found to be invaluable when it comes to clarity of thinking, and therefore, would not be avoided. All of the phenomena and entities, such as light, atomic and sub-atomic particles, and other objects developed with that approach, would be built up from simple foundations and thus may require only simple mathematics to represent the quantitative aspects thereof.

All previous theoretical approaches have been based on units of something having some kind of mass effect and none have produced the desired result of a complete general theory for the structure of the physical universe. Most people who support a relational hypothesis of space and time use the idea that observable "events" require the presence of matter. The underlying assumption for these kinds of "events" is that the matter involved must be logically prior to space and time and thereby, that the space and time by which the "events" are identified could not be more fundamental than matter. But it must be remembered that that assumption is purely hypothetical, even though we as observers of phenomenal "events" require the presence of matter from which to make our observations. The opposing concept of space and time existing prior to observable "events", and therefore prior to matter, cannot be ruled out from a purely logical viewpoint. In this latter concept it is implicit that space and time become the cause of matter and "events".

MOTION: DEFINITIONS AND ASSUMPTIONS

The principal common denominator of all phenomena seems to be related in some way to motion, whether we define the commonality as motion or not. But, WHAT IS MOTION? In our present ideas there are many unspecified or hidden assumptions that we make about motion that may not be true even though they seem to be implicit in our observations. The first hidden assumption is that space is immovable and provides a fixed reference system from which to make statements about movement and motion in general. We observe it to be that way with respect to ourselves, and therefore, assume that that is a fundamental characteristic of space.

Another hidden assumption is that there must be something there that can move before there is motion. We ignore the fact that the "something" identified as moving does not enter into the mathematical relation we call motion, but only makes its appearance in the

definitions of force, momentum, and energy, as well as other derived functions. We have completely ignored the mathematical implication because the only movement we can directly observe is the movement of matter. The movement of light and other radiation becomes a non-material phenomenal requirement due to the mathematics of its analysis. From an everyday practical activity viewpoint light might as well be instantaneous.

It is quite probable that the reader has never paid any real attention to the fact that all observable motions are vectorial motions because the quantity of space is always a directed quantity, a vector. To be accurate, a true scalar quantity does not have a directional property and ignoring the direction does not make the space involved in any measurement a true scalar quantity. Any measurement of a quantity of space automatically imputes a direction whether that direction is used as part of the data for calculations or not. The specific direction can be ignored if one chooses to because of the isotropy of space but that does not eliminate the directionality of the measurement. If space were not homogeneous and isotropic it would be very obvious that direction would always have to be included in calculations involving spatial quantities.

Because of these and perhaps other hidden assumptions or general practices resulting from the homogeneous and isotropic character of space, it becomes necessary to come up with other assumptions about the universe and then develop the consequences of those assumptions and compare the new theoretical consequences with the observed facts. Since only a relatively small portion of the universe is accessible to direct and accurate observation, we cannot make completely general determinations directly. But from those which we can make, if any disagreement occurs one or more of our assumptions is incorrect and we must go back and start over with new assumptions. We've been doing that for quite a while so we could do it again just as easily as adding assumptions of impotence. If there seems to be full agreement between theoretical and practical consequences, the validity of the assumptions is substantiated to a degree which depends on the number and variety of the correlations that were made.

The most important of all possible assumptions are those which scientists have accepted as conditions for becoming scientists and which are seldom even mentioned in scientific discourse. In order to make science possible it is assumed that the universe is rational, that the same physical laws apply throughout the universe (perhaps not the same mathematical form of expression but the law is still the same), and that the results of experiments are reproducible. It must also be assumed that the accepted principles of mathematics, to the extent that they are used in any development, are valid.

In the course of the development of any theory, the use of one other assumption that is far superior to any other subsequent assumption must be made. This assumption is that the relations which are found in the region accessible to observation must also hold good in regions not directly accessible for observation. This is called an extrapolation assumption and is the single most important tool that any scientist has ever had. There are many "so-called" errors or failures from the use of this extrapolation assumption, but all previous "failures" of extrapolated relations can be shown to involve undeclared and erroneous assumptions, which of course, lead to erroneous results. Such failures resulting from erroneous assumptions become completely irrelevant in judging the reliability of the extrapolation process.

The extrapolation process is of such great importance because it is not usually possible to test the consequences of a single physical hypothesis in isolation. Most of the phenomena which are used for test purposes are complex events resulting from several properties and long sequences of operations which increase the chances for error in the extrapolation.

When such complex theoretical events and processes correlate exactly with observations, the probability of errors of assumption, as well as extrapolation errors, is greatly reduced.

Before making any assumptions beyond those already specified, the *general nature of space and time* and the *relation between them* must be determined through a critical examination of current observations.

CHAPTER II: THEORETICAL DESCRIPTIONS

REPRESENTATIONS OF *MOTION*

The "Frame of Reference" from which observations are made, and therefore, the "Frame" in which mathematical representations of all of our observations must be made, involves the three dimensional framework called space and the scalar quantity called time. Observations require classification of the movements of things as being vectorially in linear translation, linear oscillation, unidirectional rotation, rotational oscillation, or some combination of these four classifications of movement. To mathematically define movement in any mode requires specification of a reference point or line and the designation of three mutually perpendicular dimensions having origin at the specified reference point or orientation to the line. Any motion in such a system is represented by a vector which has both magnitude and direction, and always in one specific direction which requires all three Euclidean dimensions to adequately set boundaries by which to define relations.

The mathematical limitations are a direct result of limitations on existence in this three dimensional spatial reference system. Anything which is observed to have motion in space is observed to have movement in only one direction of one dimension and/or rotation in a specific direction around an axis that is oriented in a single direction of one dimension only. Any attempt to give an object any compound motion (movement in two or three dimensions concurrently) results in merely changing the direction in space of the one dimensional linear movement of the atoms of the object. As a direct result of this limitation of having any spatial motion reduced to one dimensional movement, the ability to observe effects of scalar motion is severely limited, even to the point of **failing** to **recognize** scalar motions as such or that they really exit as something different from vectorial motions.

SPACE AND TIME

Space as it is known and used in equations of physical processes is *three-dimensional*. The sector of the universe in which observation is made definitely presents a three dimensional aspect for those observations—no more, no less. Space as it is found from experimentation, not as it may be interpreted to be from any theoretical viewpoint, is *homogeneous*. So far as can be determined each part of space is exactly like every other part of space. It is *isotropic*; its behavior is the same in all directions. Space is three-dimensional, homogeneous, and isotropic in the local environment that is accessible to direct experimental observation. Mathematical continuity does not require infinite divisibility, but even if it did, such divisibility would be beyond observational range, both practically and theoretically. Certainly, infinite space cannot be verified either.

Considering the little that is known about space, direct knowledge of time is still more limited. The most conspicuous feature of time (as we observe it regardless of how we define it) is that it progresses. It is only as a progression that time is known at all. Whatever properties are recognized for time are simply characteristics of the progression; so far as can be determined, the progression is *uniform*. The most obvious mathematical property observed is that in the context of the familiar phenomena of everyday life, time

is *scalar*. In the velocity equation v = s/t the term t is a scalar quantity. As observed, time *appears* to flow steadily onward in the same scalar direction. The formulation of the Second Law of Thermodynamics gives expression to this empirical observation. In spite of the fact of contrary assertions contained in various verbal descriptive statements of the Second Law[1], the term t **is** *mathematically reversible*. At present that interpretation in the equations representing various physical phenomena is not allowed. In spite of the constant direction of "Time's Arrow" in the everyday phenomena of this local environment, it would be presumptuous to be other than cautious about extrapolating the same *constancy of direction* to all regions of the universe.

In the equation v = s/t any change of location in space s is a vector quantity because it has direction *in space*. It follows that the velocity v also has a direction *in space*, and thus the relation is a *space velocity* equation. In this equation the term t is necessarily scalar because time has no direction in space. Time is scalar in this space velocity equation *irrespective of its own dimensions*, because no matter how many dimensions it may have, one or many, time has **no direction** *in space*. Time is definitely directional in its flow characteristic in that we experience only the "now" of time subsequent to the "past" and prior to the "future". That which is called the direction of the flow of time is not identifiable with any direction in space, and therefore, **time has no direction in space**. *Time is a scalar quantity relative to the dimensionality of space*.

If time is multidimensional, then that property which corresponds to the spatial property that is called "dimension" becomes a temporal property. Whatever the temporal properties are called, whether they are referred to as "dimensions of time" and "magnitudes of time" or given altogether different names, those properties are temporal properties, not spatial properties. The names by which the properties of time are described does not give magnitudes or directions of time any direction or magnitude in space. Regardless of how many dimensions time may have, time cannot be a vector quantity in any equation in which the property of having direction in space is that which qualifies the quantity as vectorial.

Although these items constitute all that is actually known about space and time individually from direct observation of each alone, there is one more source of direct information. There, is some observational knowledge of the RELATION **between** space and time. The first item of this nature is that the relation between space and time in this sector of the universe is motion. The second item is that in any motion illustrating this relation, the space and time thereof are reciprocally related from a scalar standpoint. This means that moving a greater distance in the same time has exactly the same effect on the speed, the scalar measure of the motion, as moving the same distance in less time.

SUMMARIZING these observations from the local environment:[2]

- *Space* is three dimensional, homogeneous, and isotropic.
- *Time* progresses uniformly and (perhaps only in the local region) unidirectionally.
- The *scalar relation* between space and time is *reciprocal*, and this relation constitutes *motion*.

GENERALIZING these findings and expressing them as hypotheses applicable to the entire universe, we have:[3]

- Space is three-dimensional, homogeneous, and isotropic throughout the universe.
- Time progresses uniformly throughout the universe.

- Throughout the universe, the relation between space and time is reciprocal, and this relation constitutes motion.

DEDUCTIONS FROM THE HYPOTHESES

The first consequence deduced from the extrapolated hypotheses is that a general reciprocal relation exists between space and time and that there must be complete symmetry of representation for these two entities in order to have a scalar reciprocity be completely generalized. Symmetry of representation implies that all properties which are possessed by either space or time individually are properties of both space and time. The interpretation of this is that *both space and time are three-dimensional, homogeneous and isotropic, and both progress at a uniform rate relative to the other*.

A GENERAL reciprocity has to include all characteristics observed concerning both aspects involved in the relation called motion. The idea of scalar reciprocity is not at all difficult to grasp, but the idea of reciprocity of dimensionality is, for most people, virtually impossible. Reciprocal dimensionality of the aspects of motion leads to the observed inability to represent the dimensionality of the other while representing the dimensionality of the one; thus, the three dimensionality of time is exactly like the three dimensionality of space; it just isn't observable. Reciprocity of progression is also not particularly difficult to grasp because all that is specified is a progression, not a progression in a particular direction. Therefore, the progression required is scalar, not vectorial, although it must be represented in a dimensional system. The difference between the usual scalar reciprocity and reciprocity of progression will become clearer as the discussion continues.

A conclusion that all properties of either space or time are properties of both space and time would be demolished immediately if any of the properties extrapolated from one to the other could be shown to be inconsistent with established facts. In view of the great differences which appear to exist between space and time as we ordinarily envision them, it would seem that discrepancies of this kind should be easy to locate.

It is true that the concept of three-dimensional time is in conflict with prevailing ideas, but it is only conflicts with established *facts* that are fatal to any conceptual hypothesis. The historical record of human ideas as to the dimensions of time does not make any idea factual for any theoretical interpretation of actuality.

A dimension of time is not a dimension in space, it is not anything in space; it is a property of time itself. As previously pointed out, the scalar nature of the time term in the equations of motion is not a result of time being one dimensional. The scalar nature of time results from the fact that *time has no direction in space*, regardless of how many dimensions or directions it may have of its own. There is nothing at all in **any** of our observations that precludes time from being three dimensional.[4]

To those who are accustomed to thinking along different lines, the idea of a progression of space similar to the observed progression of time may seem even more outrageous than does the concept of three-dimensional time. The fact is that there is actual observational evidence of a spatial progression.

Since a spatial location can be of any size, any identifiable portion of a reference system may be called a location in that system. Because of the hypothesized three dimensional homogeneous isotropy of space, a scalar progression of space from one location to another would require all locations to progress outward away from all other similarly

defined locations at a uniform rate. Jumping ahead for a moment, a location might contain observable "things" which have a simultaneous inward scalar progression. If such is the case, the combination of a uniform outward scalar progression of similarly defined locations which also contain objects having an inward scalar progression brings about an equality between the two opposing scalar progressions at some distance from each "thing" or object. For objects at distances greater than that at which an equality of the two opposing progressions exists, this theoretical development requires that the objects involved should be moving steadily radially outward away from each other at a rate proportional to the distance of their separation. That rate is the difference between the effects of the two progressions at the specified distance of separation. Of course, locations in space cannot be seen, but objects which occupy locations in space can be seen.

Observations of distant galaxies indicate that they are massive objects which have a gravitational characteristic and that their observed locations are indeed being carried outward away from our location. They are so far away that any lateral motions which they possess are unobservable, and the effect of mutual gravitational movements are attenuated to the point that the gravitational movement due to either or both galaxies is no longer the controlling factor in their relative movements. Mutual gravitation is merely a modifier for the rate of outward movement in exact accord with this theory.

The scalar progression of space is derived by theoretical reasoning based on extrapolation of our observations of space and time in our everyday experience. A hypothesis such as the scalar progression of space that is corroborated by an entirely different phenomenon extremely remote from our daily experience is of an entirely different character than any of the many *ad hoc* hypotheses presently found in modern physics. This corroboration for the progression of space takes the hypotheses out of the realm of being strictly hypothesis and puts them into the realm of experimental observation. We are now in a position to assert that we have increased factual knowledge of the physical universe. From this we can look forward with confidence to additional applications of the progression hypothesis in other physical areas, which will not only represent further advances in those areas of scientific knowledge, but will reinforce the already strong position of the hypotheses as absolute knowledge for all areas of science.[5]

OTHER INFERENCES

To answer the question of whether space and time are continuous or exist in discrete step type units, one can refer to fundamental language definitions of concepts. Motion must be continuous if it is to conform to the basic concept from which the word is derived (L. *motionis*) as well as be isotropic and homogeneous. For application to physical concepts ordinary mathematics requires the use of real numbers in its definitions. The concepts of motion must conform to the rules of ordinary commutative arithmetic if motion is to be a principal ingredient of physical phenomena. Since space and time are hypothesized to be reciprocally related in a general concept of motion, they must be represented by real number units. Identification of abstract points within units of motion does not imply step discreteness any more than identification of phase differences implies the necessity of different frequencies. The concept of abstract points is merely a tool for analysis of effects.

Considering the observed relation of space and time, the question is encountered as to whether we should consider space and time as separate (as did both Einstein and Newton) but related entities (as Einstein later recognized) or as two different aspects of the same

basic entity by which neither can exist without the other. The question of relatedness has no bearing on the development of thought beyond the question of whether space can exist without time or vice versa.

Since we are hypothesizing that space and time are *reciprocally* related throughout the universe as well as being homogeneous and isotropic, it is appropriate and necessary for logical consistency to hypothesize that space and time are the two different aspects of the one thing defined by their relation, motion. By this proposition, neither exists without the other. In this way the questions of infinite or zero motion or effect of motion are avoided by it being impossible to have infinite space and zero time and vice versa. Although extremely high velocities, s/t ratios, and infinitesimal velocities are possibilities, values closer to one are more probable than large values or very small values, maximum probability exists at the one for one ratio of space to time.

It is observed that throughout the history of science there has been a steady growth in the recognition of discontinuity in the physical world. At the time the atomic nature of matter was first proposed, all primary physical phenomena were thought to be continuous and infinitely divisible. As knowledge has grown, more and more phenomena have been found to exist only in discrete units. The discrete unit nature of electric charge and of radiant energy are already well confirmed, and there is increasing evidence for the existence of basic units in other phenomena. However, since the subsequent theoretical development is not an outgrowth of experience and observation, but is deductively derived from the consequences of the postulates utilizing only the assumptions, hypotheses and logic that originally led to the postulates for the Reciprocal System of theory, experience and observation occupy only a corroborative role for those consequences.

THE POSTULATES

The basic postulates for the development of a theoretical physical universe of motion are:[6]

1. The physical universe is composed entirely of one component, MOTION, existing in three dimensions, in discrete units, and with two reciprocal aspects, space and time.

Motion is defined as the relation between two uniformly progressing reciprocal quantities, *space* and *time*.

2. The physical universe conforms to the relations of ordinary commutative mathematics, its primary magnitudes are absolute, and its geometry is Euclidean.

The net result of the basic postulates for the theoretical universe of motion, plus the limitations of the previously specified assumptions and observations is to assert the existence of **any** kind of motion that is not excluded by those assumptions whether it is observable or not. The effect of this interpretation of the postulates is to stipulate that in the theoretical universe of motion anything that *can* exist theoretically *does* exist.

INITIAL CONSEQUENCES

The first postulate specifies “motion”. It does not specify vectorial motion only, nor does it specify scalar motion only, therefore, both kinds of motion must be observed either directly or as an effect. The first postulate states that motion exists in three dimensions; therefore, the representation of both scalar and vectorial motions must be in three

dimensions. This statement is NOT equivalent to saying that there are three dimensions of scalar motion and three dimensions of vectorial motion.

The basic entities of which the theoretical universe of motion is constructed are units of motion, and the existence of different observable entities and phenomena is due to the fact that scalar motion or the effect of a scalar motion necessarily assumes a specific direction when it becomes manifest in the context of a dimensional frame of reference.

One of the original assumptions was that the generally accepted principles of mathematical analysis are valid. Even so, it has been found necessary to state specifically as a postulate that the theoretical universe of motion, in general, conforms to the relationships of ordinary commutative mathematics including probability relations. By making the original assumption part of the postulates the magnitude of the primary quantity is absolute, the geometry of motion is Euclidean, and the fundamental characteristics of the mathematical system cause the modes and sequence of representation for the relations among primary and displacement motions to have very specific values less than unit primary motion in the aspect of representation.

The determination of what entities, phenomena, and processes can exist in the theoretical universe reduces to a matter of determining what kinds of motions and combinations of motions can exist in such a universe, and what changes can take place in and among the three dimensional representations of these motions and their effects. The physical processes of the theoretical universe thus developed include a continuing series of interchanges among the representations and combinations of scalar motions and their effects in the three dimensionality of space. In all of these interchanges, causality is maintained; no motions of any type occur except as a result of previously existing motions and the consequences of the possibilities and probabilities for representation of the combined units of motion. The only sense in which determinism applies to the universe of motion is in the degree to which an added unit of scalar motion can affect the resulting vectorial representation required by a three dimensional frame of reference. In many situations, the directional representation of scalar motions or their effects in three dimensional space are continually being re-determined by chance processes, with apparently initial results being chaos.

A point of considerable significance is that the postulates imply the existence of independent motions, although they do not provide any mechanism for originating or terminating the existence of independent motions. Consequently, the number of effective units of such motion now existing can neither be increased nor decreased by any process within the physical system. The only thing that any physical or chemical process can do is to shift the associations of the already existing units of motion. This inability to alter the existing number of effective units of independent motion is the basis for what will be called the *general conservation law*, and the various subsidiary conservation laws applying to specific physical phenomena.

The question of how the universe came into being and its ultimate fate is not addressed by the Reciprocal System of theory. It is, therefore, completely neutral on the question of creation. The subsequent development in this discussion of the structures of sub-atomic particles and atoms of matter is not a description of **how** they were formed or came into being, but is merely a description **of** their structures. The discussion of chemical and physical phenomena is greatly simplified and is not intended to be a definitive description either of the theory or how motion becomes manifest.

ESSENTIAL CONSIDERATIONS

One of the first essentials for an understanding of the system of motions that constitutes the theoretical universe of motion defined by the Reciprocal System of theory is to relate all motions to the natural reference system. Eliminating the confusion that has been introduced in all theoretical, as well as experimental, scientific inquiry by the use of the fixed reference system of everyday experience will probably be the *most difficult task* which the reader faces. This is not to say that limited application of a three dimensional framework has not been proper in its place; it is just that insistence upon continuing to use a limited concept of three dimensionality in areas in which those limitations may not apply is inappropriate and not truly scientific. Scalar motions are either positively or negatively directed. It is the three dimensionality of space and time individually that proliferates the appearances and lets us observe translations, rotations, and oscillations, as well as, numerous other effects.

To understand this system, the reader **must** accept the postulates and their validity as a working premise. This is the only appropriate approach for study of any theoretical construct based on any theory. There are several points about which the reader must withhold argument:

1. Motion is the relation of two reciprocally related quantities called space and time. The term "motion" has no other significance. It is not of something; motion is nothing other than the relationship between space and time. It is a concept; it is not a "thing".
2. Both space and time have a three dimensional characteristic; a dimension of time is NOT a dimension in space, NOR is a dimension of space a dimension in time; related to the other, yes; but in the other, no!
3. Both space and time have a flow characteristic, but the flow of time is not a flow in space nor is the flow of space a flow in time, although each is like the other. All properties of space and time are reciprocally related to the corresponding property of the other.
4. Motion is unitary, it exists only in units. Space and time manifest only in units because motion is unitary. Units of motion are a progression of one unit of space for a progression of one unit of time.
5. The universe is three dimensional, not six dimensional, and not four dimensional (time is not dimensional or even quasi-dimensional in three dimensional space, it is scalar).
6. Motion is either purely scalar with absolutely no preferential direction or it is scalar plus vectorial due to effects of dimensionalizing scalar motion in a generalized three dimensional reference system of space or of time. The effect in the generalized dimensional system of space is determined by the representation in the individual three dimensional system.
7. Progressions of scalar values are either outward from a reference point or inward toward the reference point. Since no two geometric locations can be closer than zero separation in either aspect and both aspects must be present to have motion, and thus, at least one unit of each must be present, the outward direction from one unit is the normal or natural direction for progression of the natural reference system with respect to a dimensional system.

Because each of these points follows from the previous points, the apparent progression must be outward from unit value of motion and be represented by greater values of motion or by lesser values of motion. This is accomplished for effective values of displacement motion greater than unity by having more space represented than time, and vice versa for lesser values of motion. Representation of lesser values can be accomplished in two ways: by the quantity of space represented remaining effectively at unit value and time progressing toward larger values, or by the net value of displacement in all directions being less than the value of primary motion.

CHAPTER III: PROGRESSION VS. PROPAGATION

The presently accepted theoretical viewpoint avoids recognition of true generalized scalar motion by *assuming* that motion can only be the result of vectorial movement is the primary source of all theoretical difficulties. The idea that the expansion of space is a vectorial expansion is derived from the movement of matter assumption which then becomes the cause of the ideas expressed in a BIG BANG origin for the physical universe. In the matter movement assumption by which to define motion for a BIG BANG, it is implicit that the universe is now expanding at a somewhat slower rate than at initial expansion of the BIG BANG universe and, thereby, that the physical universe will have some kind of ending. It is also assumed that all points in the presently accepted three dimensional fixed reference system were coincident in a required initial singularity.

From the viewpoint that this universe is a Universe of Motion, the natural progression rate in three dimensional space and in three dimensional time is constant at unit velocity. Unit velocity, $s/t = 1$, is the reference datum from which all phenomena extend or are generated rather than from the mathematical zero of any specific three dimensional reference system. Rather than having to start with numerous hypothetical massive particles, and/or constructing the larger massive particles from just a few small massive particles, only the concept of motion is required. Deductions concerning dimensionality in a universe of motion provide the extra dimensions often described by other theoreticians as a requirement for generalizing their calculations for matter based constructs; e.g., Hilbert space. These concepts will, no doubt, be just as odd and difficult to become accustomed to as those encountered in any other theoretical development; but new ideas are of that nature. The primary difference here is two fold: one, all phenomena are developed from a single conceptual postulate along with the mathematical postulate that dictates the mathematical procedures by which the consequences of the conceptual postulate are derived and two, the additional dimensions result from recognizing the dimensionality of time.

Many students of the physical sciences have complained that the development of this new theoretical system is devoid of “real” mathematics. Whenever there is as much discrepancy between the concepts upon which a previous theoretical approach has been based and the concepts required for understanding the basis for a new theory as is evident in the present situation, it should not be at all strange that considerable emphasis must be placed on conceptual understanding before the “real” mathematics of the system can be dealt with. Until the new conceptual basis is understood at least as well as that of the previously accepted theoretical systems, any attempt to develop mathematical relations other than the simplest of arithmetical concepts will be met with incredulity and total lack of understanding.

THE NEW REFERENCE: UNIT VELOCITY

For most of our everyday activities here at the surface of our planet we need never be aware of the rotation of the planet beyond time of day; remember that recognition of planetary rotation was less than 500 years ago. The orbital movement of the planet around our star is of concern only as it effects the seasons. The movement of the entire

solar system in our galaxy is of no concern to the vast majority of people and even for those astronomers who make measurements of intragalactic motions it is seldom given more than peripheral importance since the results are always given with respect to our planet and solar system. Movement of our solar system relative to other stars in this immediate neighborhood within our galaxy has been of importance only to prove the rotation of galactic systems.

It is recognized that all "things" move, and therefore, for a theoretical system based on motion, there must be some absolute reference for all motions. The postulate and definition of motion as having the two reciprocal aspects, space and time, requires that a unit of space be equivalent and reciprocal to a unit of time. The opposite way of saying the same thing is that a unit of elapsed time, a unit movement in time, is equivalent to a unit movement in space. Unit movement requires all natural locations in space and in time to be moving at unit velocity away from all other natural locations in both the spatial and temporal reference systems. From a purely arithmetical viewpoint, the identity element for multiplication requires the fundamental value of motion to be one, unity. No other initial reference velocity is possible, since infinity and zero have already been ruled out.

Any measurement of any motion, vectorial or scalar, in a spatial reference system must be as speed, or really as a velocity since all measures of space are necessarily vectorial even though we may ignore the direction. Unit speed is not only the measure by which all motions must be interpreted; it is the measure of the natural progression regardless of the reference system in which it is measured. Motion is a continuous progression within the units of motion as well as from unit to unit. A universe in the neutral condition of only unit progression everywhere and everywhen would be one vast domain of perfect uniformity unbroken by anything happening because nothing could happen in neutrality.

All variability of motion must result from combining primary and displaced units of motion. The fact of combining individual units of motion into compound motion structures for manifestation in a temporal or spatial coordinate system must, for a specific number of units of displacement motion, always cause the least possible deviation from unity. Consideration of the combined effect of the modes by which representation in Euclidean dimensionality of the individual units of motion is made provides the means for determining quantitative relations.

The natural direction of motion for the natural reference system of scalar motion is outward with respect to a stationary system. An object that does not have independent motion representable in all three dimensions of either space or time, and/or is not subject to any externally applied force effect, does not remain stationary in a fixed spatial or temporal reference system. It will remain in the same absolute location, its location in the natural reference system, and thereby move outward at unit speed from its initial spatial and/or temporal location, and therefore, away from any object which occupied its initial location in the stationary reference system.

Now that we are acquainted with the idea of having a reference system for motion that originates at and progresses relative to any location representable in our accepted three dimensional reference system, recognition that theoretical phenomena generated by opposition to an outward progression from those natural locations becomes not only easier, but an absolute necessity.

By the same process used in recognizing the observed recession of distant galaxies in space as resulting from the progression of natural locations in the spatial aspect of

motion, a similar view of the nature of the progression of temporal location in the time aspect of motion also becomes natural and obvious. To be sure, it is not easy to suddenly start thinking in terms of motion taking place in all directions in space and in all directions in time and from all locations in both space and time simultaneously. As with many acquired skills, continued practice leads to fewer mistakes and better performance.

REAL UNITS OF MOTION

The postulates require the existence of real units of motion; units that are similar to the units of motion involved in the progression of the natural reference system, except that they actually exist in geometric dimensionality relative to the background of primary scalar motion. These are independent units of motion.

Previous physical theory assumes *matter* to be *superimposed on* or *placed within* the basic space-time background and that matter is **not** an integral part **with** the background of space-time. Development of consequences for the postulates for the Reciprocal System of theory requires the background motion to be an integral part of the phenomena of matter and its behavior. For the space time background to be an integral part of all particles of matter, the motion of the background relative to the particles seems to take on a strange almost fictitious character. The fictitious character is caused by our relating of all motions to our conventional stationary reference system. Since the progression of the natural reference system must always be present, the seemingly fictitious nature of a background scalar progression as seen from our biased viewpoint must be converted to reality by the development of the consequences of the postulates for the theory.

To show the reality of a postulated outward natural progression, its presence must first be assumed for development of a few consequences of such an assumption. If the reality of the progression could be shown without making its assumption, it would not have to be assumed and the consequences of the idea would already be well known. As these theoretical consequences are developed, correlations with observations must be made. All of the correlations, when taken together, ultimately show the validity for having assumed the initial presence of a natural outward progression for the concept of motion, and thus, its reality.

Noting that the development of the theory requires an outward progression of a natural reference system and that independent units of motion merely have a reverse sense of direction from that assumed for the background, everything resulting from that development is a motion or an effect of motion. In this manner, *independent units of motion are interrelated with the units of the background motion, rather than being separate and distinct from it* by having merely being placed within it.

The fact that representation must be made in a three dimensional spatial reference system designates the outward direction relative to individual locations in the spatial system as the direction of natural progression for the spatial aspect of the natural reference system for the theoretical universe of motion as developed by the Reciprocal System of theory. The outward progression of the natural reference system is referred to as primary motion. The discrete unit postulate prevents effective addition of primary motion units to already effective primary motion, so far as any difference of representation possibilities are concerned.

Designation of the outward direction as the direction for positively oriented primary motion of the background makes it impossible for independent outward motion to exist. Therefore, all independent motion must have a **net** negative magnitude. Since negative is

the opposite of positive, negative orientation is inward relative to the outward of primary motion. But, independent continuous linearly inward motion is not possible by itself either. To be continuous, an inward motion must not only be *able* to exist **with** an ever present outward progression of primary motion, it must exist *simultaneously* with primary motion.

The relation between a single unit of time and a single unit of space is always unity. There can be **no** deviation in this absolute value of the basic speed of scalar motion. This relation must hold true regardless of the number of units of motion in any compound combination of motion units. A *displacement* from the unit value of primary motion is all that can provide a reference from which independent motion, or any effect thereof, can be represented in any reference system. The velocity of the background primary motion in the spatial aspect is used as the basis from which to determine the net value for the motion exhibited at a reference point.

The first postulate requires that motion exist in discrete units. All units of displacement scalar motion participating in any compound motion, represented in either three dimensional aspect, must be conserved because no mechanism for creating or destroying displaced units of motion is provided by the postulates. This conservation automatically gives rise to a *general conservation* law expressed through the formulation of specific conservation laws.[7]

DISPLACEMENTS AND DIMENSIONALITY

All units of motion have two principal characteristics:

1. *continuity* within each unit of motion and between contiguous units of motion.
2. *progression* with respect to the origin of the reference system in which a particular motion is represented.

All units of *primary motion* progress outward, designated as positive in direction, from all points of reference in randomly selected directions in a generalized three dimensional reference system. Motion randomly oriented with respect to vectorial space results in an inability for a generalized reference system to differentiate between directional orientations of units of independent and primary motion.

In an analysis of any concept, it is necessary to use a system of mathematics for the quantification and dimensionalization of both the procedures and the results of that analysis. The postulates specify that motion exists in three dimensions and that its geometry is to be Euclidean. It would be pointless to start with anything other than a three dimensional rectangular system of coordinates in which to represent any and all units of motion since a minimum of three dimensions is required for general representation of locations in the observable generalized system.

The representation of units of motion in any one specific coordinate system would have maximum probability for a totally random relationship to the orientation of any other coordinate system in which to represent other units of motion because a three dimensional coordinate system can be oriented in so many different ways, an astronomically large if not an infinite number. A totally random orientation of many coordinate systems means that the orientation of individual reference point systems, and thereby, the units of motion represented therein, can have no preferential spatially dimensional orientated relationship other than as specified later in this presentation. Notice that even though individual units of motion may be represented in a dimensional

system, the relationship of units of motion represented at any one reference point can have no relationship other than a scalar relationship to those in or at any other reference point outside unit separation in space or in time. Therefore, even though dimensional, a general representation of those motions and their net effects in a generalized three dimensional system is basically a scalar relationship.

It is at this point in the development of the consequences of the postulates for the Reciprocal System of thought that it is absolutely necessary to spell out the nature of some of the limitations imposed in the region in which our normal experiences occur. We observe the movement of material objects to be in one and only one direction at any given instant. In the reality of the dimensional aspect observable by us, ALL available dimensions are required for adequate representation of any ONE direction of any movement in space. We have developed means of mathematically expressing observable relations in accord with our generalized observations of vectorial motion. As a direct result of observational conditions, theoreticians have assumed that vectorial is the only way in which the concept of motion could be rendered.

Another point that needs to be clarified concerning the concept of motion is the representation of direction in any three dimensional coordinate system, whether in conventional space or in an individual coordinate system. Even though scalar motion is described as being in either a positive or negative direction, which is usually represented as either outward or inward, the idea of positive or negative can also apply to direction around an axis of rotation. Rotation is often thought of as the result of a continuous change of linear direction of movement of something that is moving linearly, but it need not be that alone. In the concept of motion continuity is the essence of that motion, and therefore, directionality around an axis can be just as continuous as directionality along an axis. Direction, whether represented as linear or rotational, is as much a property for representing motion in a dimensional system as is magnitude.

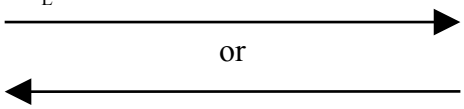
In any generalized three dimensional system each mode of motion requires a specific number of dimensions and number of directions by which to express that mode in an unambiguous manner. Development of the consequences of postulating the concept of motion as the fundamental idea from which all other concepts and relations are to be developed requires a more fundamental conception for expressing motions than that which subsequently becomes a developmental consequence several steps down the line from that more fundamental conception for expression.

The conception of motions within a specific coordinate system need not be restricted by any of the necessities of representation with respect to other coordinate systems because they become scalar with respect to any other coordinate system. This modification of the concept of representation allows thinking within an individual coordinate system without being at all concerned about the idea of representation with respect to anything other than that specific reference point coordinate system. Motions within a specific coordinate system may be one directional or two directional in one dimension or in two dimensions, *all concurrently.* There is no *a priori* requirement for a unit of motion in an individual reference point system to be limited to one direction at any given instant within the normal progression of motion, if that individual reference point system is the only origin that is being considered for dimensional representation of the unit of motion. Remember, it is a concept that is being represented, NOT the movement of a “thing”.

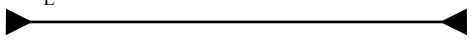
The proposed more logically fundamental manner of representing the concept of motion involves rendering motion in six ways rather than being limited to the conventional four. Since the indicated modes of motion by these diagrams do not also require use of a third

dimension, the third dimension of each indicated system is inferred to be normal to the plane of the paper. The One Dimensional one directional rotational representation, $1D1d_R$, is around any one axis, here diagrammed as being around the axis normal to the paper. The Two Dimensional one directional rotational representation of a unit of motion, $2D1d_R$, is here represented around the axes in the plane of the paper.

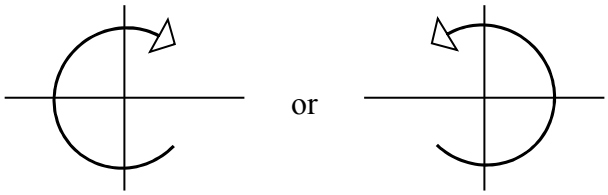
Linear translation $1D1d_L$ (1 dimension, 1 direction, linear)



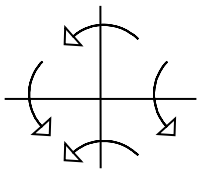
Linear oscillation $1D2d_L$ (1 dimension, 2 directions, linear)



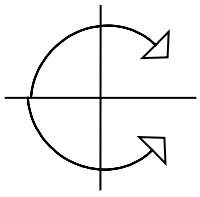
Unidirectional rotation $1D1d_R$ (1 dimension, 1 direction, rotational)



Unidirectional rotation $2D1d_R$ (2 dimensions, 1 direction, rotational)



Rotational oscillation $1D2d_R$ (1 dimension, 2 directions, rotational)



Rotational vibration $2D2d_R$ (2 dimensions, 2 directions, rotational)

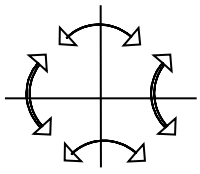


Figure II: Modes of Motion

As a consequence of the availability of these six modes of representation in the individual coordinate systems, it becomes necessary to distribute the motions within each individual system in a probabilistic manner that results in a required sequence for compounding the

modes. Subsequent randomization of the orientation of each individual coordinate system provides maximum directional distribution or scalarization of an effect in a generalized system of three dimensional coordinates.

For each individual coordinate system this gives six possible directions for the outward linear progression from any specific orientation of a set of coordinate axes with six possible directions for a corresponding inward linear progressional direction. There are also six possible orientations for positively directed rotational representation because of the ambiguity concerning clockwise vs. counter-clockwise appearance. As a further result of this ambiguity, there are six possible orientations for one Dimensional one directional opposition or displacement, $1D1d_R$, from the corresponding positively directed rotational directions.

Since summation of individual displacements causes the effect of net values of motion representable in a generalized system to be greater than or less than unity, the net effect distributed in a generalized system must be in the dimensionality of either the temporal or the spatial aspect. For material structures the net motion at individual reference points must be less than unity for the effects of such motions to be distributed in the dimensionality of space. Regarding the motions at any individual reference point, it is the requirement to represent motion in three dimensions that is important. Rather than being concerned about whether the individual coordinate system is spatial or temporal, it should be noted that all representations of motion or effects of motion are in the generalized coordinate system identified as space. Inside unit distance the dimensionality is opposite to that outside unit distance. Therefore, the dimensions inside unit spatial distance are essentially in the temporal aspect. The individual dimensionalization of space and time through representation is that which makes it possible to observe any motion or its effect, whether the motion represented is primary motion or temporally or spatially displaced motion.

All of the subsequently developed structural representations for compound motions have components that are coincident with the background motion and even though those components can not be *effective* from the physical viewpoint they must be present for the compound motion to have stability, and thereby, exist. The effective **physical** magnitude of such components is zero when it comes to determining the net numerical value of motion for the compound system of displacement motions in a generalized three dimensional system, because at that point in the analysis one is determining the effective magnitude of displacement from unity.

Scalar motion has no intrinsic direction in any generalization of either a spatial or temporal reference system; scalar motion has only magnitude. It is the representation of a magnitude of motion in a specific individual dimensional system that gives a magnitude of motion a direction. The order in which the modes of dimensional motion are compounded follows the order dictated by probability distributions of magnitudes resulting from the dimensionality and directionality required for representation of the six kinds of dimensional motion possible. Since we observe four modes of motion in the conventional generalized reference system, those *four modes are the effective result of the limitations on representation of motion in either dimensional aspect*. The "how" of this result will be discussed in a later mathematical presentation. Qualitatively, the concept is grasped intuitively after "playing" with the six modes and the descriptions for atomic and sub-atomic structures.

Vectorial motion is motion with an **inherent** vectorial direction; that is, a movement in a specific direction that can be **fully** represented in a generalized stationary coordinate

system. Scalar motion is either negatively or positively oriented as viewed from the origin of any specific individual three dimensional system and with respect to one of its aspects, space or time. Scalar motion is given a vectorial direction by the factors involved in its relation to an individual reference system and is represented by negative or positive scalar magnitudes only; values between -1 and +1. The imputed vectorial direction of a scalar motion is independent of its direction in the individual coordinate system except to the extent that the **same** factors affect both.

TRANSMISSION OR PROGRESSION

Primary motion is always represented in the first possible mode of representation with respect to a specific reference point coordinate system. A displaced unit of motion maintains the dimensional and directional representation originally represented in an individual reference system so long as it remains with the original unit of primary motion. Upon transference to another unit of primary motion the displaced unit of motion may change generalized directionality or mode of representation; that question is resolved by equivalency relations. The dimensional relationship between units of displacement represented as two directional linear in one Dimension and the direction represented by the linear primary progression is represented as a perpendicular relation because the displacement has offset the representation of primary progression in one of three possible perpendicular dimensions.

The spatial orientation of the dimension of displacement and the direction of progression in the stationary reference system are determined completely by chance, or by the characteristics of the originating object and its required orientation in the generalized spatial or temporal system. The characteristics of the originating object and its environment also determine the space-time relationship for the number of oscillations to be represented as the two directional motion, thereby determining the apparent rate of oscillation per unit of primary motion. The number of units of displaced motion in each of the represented dimensions remains fixed relative to primary motion until subsequent appropriate interaction with some other complex motion structure.

There is **no inherent relationship** between numbers in perpendicular spatial dimensions as observed, and thereby, this observation declares this to be an inherent characteristic of the mathematical system. Therefore, there is no inherent relationship between the number of displacement units in a coordinate system dimension and the direct representation of primary motion in another dimension of that same coordinate system. The only requirement concerning representation, other than continuity of numerical and dimensional relationship, is that transfer to a different unit of primary motion constitutes the start of a new location in the natural reference system. As long as a compound motion remains in a specific unit of primary motion it maintains continuity of direction relative to both three dimensional aspects of the individual coordinate system and, thereby, the generalized system of coordinates. Compound motion structures remain in straight line motion until transferred to primary motion having a different direction of apparent translation in the generalized reference system of space.

The generalized effect of oscillation is defined for a generalized three dimensional coordinate system as being in one dimension, or around an axial dimension, in one direction followed sequentially by the opposite direction of that dimension, or the opposite direction around that same orientation of axial dimension. By sequentially opposed directional representation, both directions of a two directional reference point motion are given equal probability for representation of effect. Both directions, of

representation are required for completion of the probability relations between the scalar motion, its mode of representation, and the effect of the representation. As a direct result of this probability relation $1D2d_L$ displacement can be represented only by a linear oscillation effect in the generality of three dimensional space.

If the compound motion has displacement represented in all reference point dimensions, it cannot remain in the same unit of primary motion, and therefore, is not remaining in the same location in the natural reference system or precisely the same location in the generalized system of space or time. This is the case for compound motions appearing to be stationary in three dimensional space. Collisions and other associations among displacement structures will be discussed in later chapters after more of the basics have been explored.

Compound motion structures in the theoretical universe of motion represented as being composed of one Dimensional two directional motion progressing linearly in a perpendicular dimension have characteristics and behavior which correspond to those of photons of "electromagnetic" radiation observed in the physical universe. Other compound motion structures correspond to various sub-atomic particles and atoms of matter. Therefore, whenever such entities are being referred to in the theoretical universe, they will be referred to by the names given to experimentally observed objects according to their properties—photons, electrons, protons, neutrons, neutrinos, atoms, etc. Reference to the processes by which the various particles and effects are emitted or otherwise released for observation by subsequent interactions in which they engage are referred to by the names given to the corresponding physically described processes.

The problem of how radiation is transmitted through space has been easily solved—radiation is not transmitted at all. "The photon remains *permanently* in the same space-time location in which it originates, but space-time itself progresses, carrying the photon with it, and the photon is therefore able to interact with any objects which are not carried along by the progression and which are therefore encountered enroute."[8] The other behavioral characteristics of photons with atoms of matter are just as easily solved since all structures are basically the same: scalar motion compounded in its representations due to the individual dimensionality of its reciprocal aspects. Mathematical description of the interactional characteristics of all scalar motion structures requires only a description of the representational modes for all displacement motions involved in each of the compound motion structures in terms of their scalar values, dimensional and directional characteristics and/or effects. This may seem like an over-simplification, but the greatest hurdle is that of conceptual understanding and subsequent description verbally of the various structures and interactional processes.

The principal conceptual hurdle is that of *"thinking from"* the *natural reference system*. Displaced objects are progressing inward toward the natural location of objects such as photons and sub-atomic particles which are not displaced in all spatial dimensions. From the point of view of the natural reference system, photons are not moving or going anywhere, they remain in the same unit of primary motion in which they were produced. Because of our dimensional bias, we observe compound motion structures composed of multi-dimensionally distributed displacements as being stationary and one dimensionally displaced structures as progressing outward away from the multidimensionally displaced objects.

DISPLACEMENTS

The measure of motion is speed and the units of motion are always one unit of space, either inward (-) or outward (+), for each unit of time, either outward (+) or inward (-); not respectively and deliberately reversed for emphasis so as to not imply an always relation. From the standpoint of the natural scalar reference system the absolute measure or value of each unit of motion is the same whether negatively or positively oriented in space or in time.

Because of the status of unity as the natural reference datum, a deviation of m-1 units of motion to a speed of 1/m has the same natural magnitude as a deviation of m-1 units of motion to a speed of m/1, even though, when measured from zero speed in the conventional manner, the changes seem very disproportionate. In order to reflect the fact that these deviations are actually equal in magnitude from the natural standpoint, it is necessary to set up a new system of speed measurement in which the magnitude of the speed is expressed in terms of the scalar direction of deviation from unit speed to speeds greater than unity or to speeds less than unity. Obviously, such speeds are not commensurable with speeds measured in the conventional manner, and must therefore, be referred to as "speed displacements" or simply as "displacements" **if** NO ambiguity is generated by such simplification.

The difference in effective value of motion occurs when the magnitude of all displacements is related to individual dimensional representations since the net effect of the resulting compound motion is localized at each reference point in dimensional space or time. Displacement from the natural progression, unity, as it appears in a spatial or temporal reference system, is that which makes the displaced compound motion have an effect or interactional appearance in the dimensional aspects of either space or time.

A positive *displacement* or a negative *displacement* always involves the addition of some number of units of motion in which the effect in one of the aspects is changed to negative while the other aspect continues unidirectionally positive. This means that the apparent magnitude of one aspect can stay at the unit level in the compound motion while the magnitude of displacement in the other is effectively changed to a larger value.

In a universe of motion there is no such thing as physical space or physical time independent of motion, but we can *abstract* the space or time aspect of the motion and imagine it independently and think in terms of manipulating it independently. When adding motions together we are **not** adding independent quantities of time or space to obtain the new value of displacement motion. The added displacement motion is placed in concurrency with an original amount of displacement motion to obtain a new value of displacement motion to be represented in the three dimensional aspect. Added motions may be represented in the same dimension or in a dimension perpendicular to the previous motion. Each added displacement may be either positively or negatively displaced from unity, either linearly or rotationally directed. Probabilities for stability of effects for different combinational representations determine a specific sequence for compounding displacement motions to obtain different magnitudes of effect. The dimensionality and directionality or mode of representation of each unit of displacement motion added has a very specific effect on the total magnitude of effective displacement. The precise sequence of net effects is incremented as the sequence of minimum values resulting from the previously determined probabilities of representation.

REPRESENTABLE MOTIONS

The motion units involved in all compound motion structures developed in the Reciprocal System of theory are represented as linearly or rotationally directed in one of the following ways: both the space and the time aspect oriented in the same scalar direction; i.e., both (+) or both (-). Both combinations yield the same effect and are indistinguishable in a generalized three dimensional coordinate system; both aspects positively oriented is primary motion; both aspects negatively oriented is equivalent primary motion.

With the space and time aspects oriented in opposite directions the unit of motion is referred to as a displacement, as previously described; i.e., having (+) space with (-) time or (-) space with (+) time orientation. The displacement unit having (+) space with (-) time orientation is referred to as a negative displacement unit. Similarly, a displacement unit having negatively oriented space and positively oriented time is referred to as a positive displacement unit. More consequences fall into line with current terminology by this assignment than by the opposite assignment.

Directionality of positive and negative displacement units of motion is represented as either linear or rotational, thereby, making diagrams difficult, if not impossible. Oppositely directed pairs of displacement motions of the same mode of representation cannot be directly added together in the same reference point dimension, because each offsets the other. Positive and negative displacements can be used in other combinations, so long as they do not have the same descriptors in the same reference point dimension of a given individual coordinate system. Positive displacement can be added in a dimension in which a positive displacement of the same mode is being represented, even though negative displacement may not. As with positive displacements, negative displacement of the same mode of representation can be added in a dimension in which negative displacement is already represented.

Mode, direction, and dimensionality of displacement combinations modify the net effect of the total effective displacement. Any displacement not exactly negating another previously present unit of displacement may be added to the compound motion structure for the purpose of modifying effects. Each superimposed or compound motion has its own degree of stability ranging from very weak or loose to very strong or tight, but none which cannot be separated under appropriate conditions.

Don't be overly concerned if the previous paragraphs of this section are not completely understood on first reading; after all, the concepts were not fully developed upon first conception of them. After the structural representations for various atomic and sub-atomic structures are discussed, these statements will become somewhat more understandable.

Any displacement added as a *positive displacement* to a compound motion causes the value of the combination motion to be **less than** its previous value. Displacing the time value in the representation of the net compound motion toward a larger value effectively increases the amount of time in association with the representable quantity of space; thereby, reducing the effective value of net motion in the spatial aspect.

Because the value of the represented motion is less than unity, it is not progressing with the natural reference system at the normal rate of primary motion in the spatial aspect. This is what makes net positively displaced motions representable in dimensional space. The representable motion having been displaced from the natural rate of progression of

the spatial aspect, the compound motion becomes something in dimensional space that has less than unit rate of progression or is actually moving inward in all directions in the spatial aspect of motion. Thereby, values of motion less than one are represented in dimensional space, and thus, can be perceived as having reality. Examples will be forthcoming in the next chapter.

Similarly, a *negative displacement* **increases the speed** by adding units of motion in which the space units are unidirectionally positive and the time direction is negative. Values of net motion greater than unity are representable only in dimensional time and thus to us they have no reality. But to that sector of the universe they appear in the same manner as things in our sector appear to us. From the viewpoint of that sector those values of motion are less than unity. In the reciprocal or cosmic sector, the time of the material sector has the conceptual position of the three dimensional aspect we call space. Also, as it would be considered in the reciprocal sector, the space of this material sector has the conceptual position of our scalar progressive time. Admittedly different, but never-the-less this is a necessary condition in the development of the consequences for the postulates.

Additional units of motion unidirectionally positive, both aspects coincident with the natural progression of primary motion, are NOT effective from the physically representable standpoint. Because adding precisely identical representations, (+1) / (+1), cannot change the representable value of primary motion, they can be considered as not having been added. Each unit of displacement is in opposition to a unit of appropriately oriented primary motion of the required sequential mode. By opposing that mode of primary orientation, an effect is generated. A change of total effective displacement motion due to added displacement motions causes a different effect to be manifested by the difference of representations in the newly compounded motion. The difference for the added motion may be caused by the dimension of representation, or the mode of representation, and/or the magnitude of the representation.

Reiterating a point concerning photons of radiation and their representation in dimensional space. The displacement motion has no direct representation dimensionally in either generalized space or generalized time. Only the effect of the one Dimensional two directional linearly represented motion, $1D2d_L$, at the individual photon energy reference point is representable in either generalized three dimensional system of coordinates. All photons of all frequencies exist in an interface between the material and cosmic sectors and are only observable due to interactions in whichever sector the interaction takes place. It is the interaction with the compound motion of another Notational Reference Point system that identifies the effect of the photon as a photon. The total quantity of motion encapsulated, as it were, with the primary unit of motion represented as progressing relative to a spatial coordinate system is what determines the *energy* transferred through interactions in dimensional space, and thus the energy content of that photon unit. Each frequency representation, being encapsulated in a unit of primary motion, is represented by us as being either within a unit of space or within a unit of time, whichever is most convenient, because less than one unit of each aspect cannot be represented; motion is unitary.

The Photon Interface is not any specific place, it is everywhere and everywhen material matter and cosmic matter are not. The Time Region is inside atoms of Material Matter and the Space Region is inside atoms of Cosmic Matter. The Material Sector is the region

which we identify as our physical universe while the Cosmic Sector is a region just like our half but with the concepts of space and time inverted.

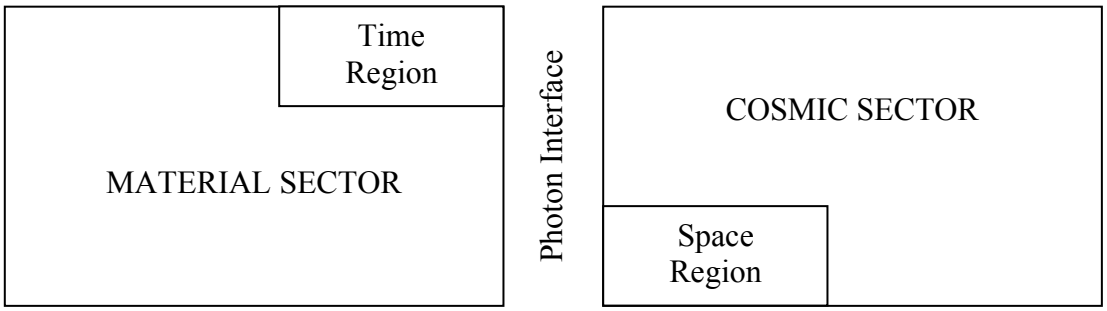


Figure III: A Simplified Diagram to Represent the Physical Universe

Any attempt on our part to represent scalar quantities in either generalized dimensional aspect is only, and can forever be, only a graphical or mathematical tool or device for understanding; the representation is only a model and must be considered as such.

A model depicts a limited number of identified characteristics for the phenomena being modeled. A model is not a picture of reality because a picture is a true and accurate representation within the limitations of the picturing medium of that which is being pictured. Consider a hologram or a photograph as an example of a picturing medium; the observed objects of this three dimensional world are represented by various sizes and positioning of patterns or images in two dimensions. In this sense, physical reality is merely a picture in three dimensions, in the spatial aspect or the temporal aspect, of the true scalar reality of the universe of motion. Mathematical representations of motions may be with respect to three Cartesian coordinates or with respect to a plane and a perpendicular axis as spherical coordinates. In either case, the mathematical representation is only a model used to depict magnitude and directionality for the motions from which an effect is derived. Verbal and mathematical models are NOT the true reality.

CHAPTER IV: DISTRIBUTING REPRESENTABLE MOTIONS

DISTRIBUTED SCALAR MOTION

Consideration of probabilities for deviation from the bias position of unit value in any direction shows that in a generalized three dimensional system, effective deviation cannot exceed unit value. A unit of displacement does one of two things: it offsets the natural progression in both directions in one dimension as previously discussed or in any one direction of one dimension of a more complex Notational Reference Point phenomena. Since the natural progression cannot be observed because it has no effect by itself, offsetting one direction of one dimension of primary motion had absolutely no effect. Therefore, the first effective unit of displacement offset the natural progression completely in one dimension by having a one Dimensional two directional linearly represented displacement in that dimension. That, then, is the mode by which representation is accomplished for the first unit of displacement at each and every representable reference point.

As a direct result of the ambiguity of direction between primary and displacement motion, two identical units of $1D1d_L$ displacement in the same dimension is equivalent to primary motion in the opposite direction. Thereby, the equivalent of two units of $1D1d_L$ displacement in each of the three dimensions of an individual reference point coordinate system is the absolute limit for effective displacement at each reference point. Therefore, additional units of displacement beyond the first unit must be only partially effective toward continued effectiveness for displacement in all other directions due to distribution effects. The use of photon type displacements is the first in a series of steps in obtaining the distribution of displacement representation. The series achieves a set of minimum values of effective deviation from the scalar background of unity in all representable directions. The complex motion structures having net deviation values of motion between offset and effective one unit inward in space at individual reference points constitute atoms or sub-atoms of matter.

Primary motion is representable in a generalized three dimensional reference system only as one directional outward from a reference point. So long as simple outward progression is the only aspect of scalar motion under consideration, the representation in three dimensional space as a linear progression in any direction is the most probable representation. By representing the displacement motion as one Dimensional two directional in one of three dimensions, the progression of primary motion must be represented in a different geometric dimension from that of the displacement motion. The addition of a second unit of displacement must be represented either as being of the same mode in a dimension perpendicular to both the dimension of the first displacement and the primary motion, or as rotational around one dimension or both dimensions perpendicular to the two directional linearly represented displacement motion.

If the second unit of displacement is linearly represented, it must be represented perpendicular to the first displacement and its magnitude must be harmonically related to the first and be in the same displacement direction, either positively or negatively.

Probability considerations indicate that this kind of double photon structural unit has high probability for having associated with it two additional units of displacement having rotational representation in the opposite displacement direction. If it does not spontaneously separate, any subsequent interaction causes separation; therefore, one can say that such structures have a transient existence at best.

Since motion is continuous, a continuity for change must be represented in each individual three dimensional system. In a dimensional system representation of change can be accomplished by either a change of magnitude or a change of direction. A simple continuous change of geometric direction by the mathematical expedient of rotational representation satisfies the requirement of continuity just as well as does a continuous change of magnitude from a given reference point. Continuous change of direction provides continuity of magnitude for any displacement in all directions relative to a specific reference point, but could not have anything other than a scalar effect relative to any other reference point. Thereby, the second step of distribution for a net deviation would most probably be rotationally represented deviation around one or more of the dimensions of the individual three dimensional reference system.

The Laws of Probability demand distribution of all units of displacement motion among the various possible representations in such a manner that for a given total number of units of displacement, minimum effective displacement from unity is represented as a result. A displacement represented as rotational around dimensions of space, or of time, perpendicular to the first displacement is not fully effective in a single linear direction of either aspect. The second displacement unit rotationally represented in the other dimensional aspect from that of the first displacement provides maximum distribution of displacement effect of the net displacement while continuing to represent primary motion in one direction of one of the dimensions of both aspects. Minimum effective magnitude of displacement from unity for all subsequent combinations of motions at each reference point is insured by requiring alternation of scalar direction of displacement for all required changes of mode of representation and occasionally for other reasons.

The various possible combinations of linear and rotational displacement around one set of coordinate axes gets quite complex, but taking them one step at a time simplifies the many possibilities. See Chart 6 page 113 in the Appendix for a quick overview of the sequence for the representation of the modes initially diagrammed on page 28 and discussed in this and subsequent chapters.

Positive rotational progression without an associated negative rotational unit is not observed because chance selection of the directional mode for representing primary motion is strongly biased for one directional linear. A rotational representation requires absolute specification of a particular orientation of a particular reference system having a specific number of available dimensions; too many limitations to make it possible to establish any kind of representation of general curvature for primary motion in either three dimensional aspect. Since primary motion must be represented in both of the three dimensional aspects, rotational directionality of primary motion cannot exist and, therefore, cannot be observed in a generalized three dimensional system devised for multiple reference points. The most direct result of this is that generalized space is geometrically straight. It cannot be curved in any manner and, therefore, effects ascribed to that kind of condition by the previously accepted theoretical systems of the late 20th century are explained in a different manner.

Simplification of description for obtaining a three dimensional distribution of units of displacement motion is accomplished by referring to the presence of rotationally represented displacement motion even though a rotational representation relative to an individual reference point seems like only a direction. Rotational directionality must exist in connection with the representation of displacement motion in an individual reference point system and although actual rotation of the reference point coordinate system is not only not required, its result would be unnecessarily ambiguous. Rotational representation is required as a possibility in an individual reference point system. With ambiguity only for the direction of axial representation, rotational stability in a generalized system of coordinates has high probability for existence; i.e., the limited ambiguity causes the representation possibility in the generalized system for stable unidirectional rotation; i.e., gyroscopic stability.

Probability distributions indicate that $2D1d_R$ displacement achieves greater distribution effect than one $1D1d_R$ representation. Thereby, selection of $2D1d_R$ representation is favored as the means of representation for the second unit of displacement. One unit of oppositely displaced (from that of the photon) $2D1d_R$ displacement motion in an individual three dimensional reference system offsets the effective magnitude of the photon displacement, and more than offsets directionality of effect. This is the first compound motion describable as rotationally distributed motion to have a fully representable effect in either three dimensional aspect. This structure has the effect representable as remaining stationary in one of the three dimensional aspects. It is called a rotational base. Rotational bases do not have effective displacement magnitudinally; all they have is direction in either space or time. All displacements added to a rotational base must have effective displacement in at least one dimension of an individual Notational Reference Point coordinate system in order to have measurable effects in a generalized three dimensional coordinate system.

Thus, a photon having a unit of negative speed displacement compounded by the addition of a unit of $2D1d_R$ positive displacement has no net displacement value, but does have representable directional effect in space. This structural arrangement can have other displacements added to it since it has now been stabilized in three dimensional space. This structure is referred to as the single photon material rotational base, or as the material sub-atomic base.

Because primary motion must always be present, it must be represented relative to each and every individual reference point regardless of the complexity of the compound motion being represented at that point. Even though representation of primary motion at atomic reference points is not a direct representation its effect must be present, and even that may eventually become offset by additional displacements to be discussed later. Primary motion provides an outward progression from all apparently stationary reference points in generalized dimensional space. This representation of primary motion is responsible for the general outward progression of the generalized dimensional aspect; the separation of atoms one from another, the spatial progression observed for distant galaxies, as well as the normal progression of time.

SUB-ATOMIC PARTICLES OF THE MATERIAL SECTOR

There are several theoretically possible ways to sequentially add units of speed displacement as rotational representations; one most probable, others possible in specific situations, some completely unstable and therefore, impossible. Adding a unit of $2D1d_R$ negative displacement to the rotational base is not possible as a stable representation

because such displacement would exactly cancel the positive rotational displacement that formed the rotational base. Adding units of $1D1d_R$ positive displacement or negative displacement are both possible because both results have a spatially inward effect. Net positive displacement magnitude and direction is necessary to maintain stability of compound motions in generalized space.

The displacement rotations may be perpendicular to or around the photon itself as an axis. The one around the photon having positive displacement is called the *positron;* the one having a similarly oriented but negative displacement is called the *electron.* Since formation of the rotational base has already distributed the effects of the compound motion in all directions in space, the dimension of oscillation of the photon merely defines the dimensional position of one of the axes relative to the other two in the individual Notational Reference Point system.

The addition of a unit of $1D1d_R$ positive displacement to the rotational base and limited to one of the perpendicular dimensions has equal probability of being relative to either of those dimensions. It is the equal probabilities of positional representation that causes the indicated notations of ½ unit in each of the possible notational positions (as in the *massless neutron).* Less than whole units of motion cannot actually be present in any representation because motion is unitary.

After the addition of a unit of positive displacement perpendicular to the photon, a unit of $1D1d_R$ negative displacement around the photon axis will reduce the net effective displacement of the compound motion to zero. The combination is not destroyed as may initially be thought because the displacements whose magnitudes are offset are in separate geometric dimensions. The resulting structure progresses with the natural reference system at the speed of light in three dimensional space. Notice that no net effective displacement is present in one of the dimensions perpendicular to the photon displacement, thereby permitting the required, where possible, linear representation of primary motion to be effective. The neutrino remains in that unit of primary motion indefinitely; i.e., until interaction with some other compound motion structure.

Several other compound motion structures are possible. Each specific structure has the effect of its displacements distributed in all directions in three dimensional space. Each new representation of compound displacement motion causes the appearance of some new property or characteristic not observed with each of the other combinations.

In order to decrease the verbiage required to describe the units of speed displacement which are added together to make up the represented compound motions, a shorthand symbology has been developed. For particles constructed on the single photon rotational base, the notation consists of a sign or symbol representing the presence of charge, a letter to designate the kind of rotational base and three numerals to indicate the effective rotationally represented displacements around each axis.

A negative sign (-) indicates a negative electric charge, as it is presently described for the observed isolated electron. A positive sign (+) indicates a positive electric charge as presently described. An asterisk (*) placed first in the notation indicates that which is called a magnetic charge. The letter M in the notation designates the material sector rotational base which consists of a photon having negative $1D2d_L$ displacement in combination with positive $2D1d_R$ displacement for the particular sub-atomic Notational Reference Point. The first digit is for one of the perpendicular axes; the second digit, the other perpendicular axis; the third digit, the third axis, which is the reciprocal of the geometric direction of the dimension of the $1D2d_L$ displacement motion.

The letter C designates a photon having $1D2d_L$ positive displacement with $2D1d_R$ negative displacement distributed in the dimensions of the time aspect of the NRP dimensional system. The C indicates that that rotational base is the base for particles of the cosmic sector of the physical universe.

Particles constructed on the M 0-0-0 rotational base fall into three categories:

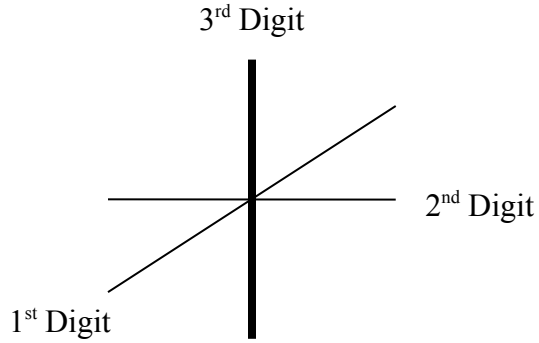
1. Massless sub-atomic particles;
2. Similar particles which have acquired mass; and
3. Particles which are combinations; i.e., compound particles. These have mass but are not sufficiently complex to exhibit full atomic characteristics in ALL possible interactional situations.

The numerical value in each position of the Notational Reference Point sub-atomic notation represents that quantity of effective rotationally represented displacement in the appropriate dimension. The numerals may also be thought of as representing effectively excess units of positively oriented time or space due to positive or negative displacements, respectively. Each such positive unit of time or space is not negating the effect of a corresponding unit of that aspect of the normal progression of primary motion in that dimension because it is perpendicularly oriented and rotationally directed. Parentheses around the numerals indicate units of negative displacement while lack of parentheses indicates units of positive displacement.

Table 1: The Sub-Atomic Particles

The Sub-Atomic Particles[9]	
M 0-0-0	Rotational Base
M 0-0-1	Positron
M 0-0-(1)	Electron
M ½-½-0	Massless neutron (muon neutrino)
M ½-½-(1)	Electron neutrino
*M ½-½-0	Charged electron neutrino
Particles with Acquired Mass	
-M 0-0-(1)	Charged electron
+M 0-0-1	Charged positron
M 1-1-(1)	Proton
+M 1-1-(1)	Charged proton
Compound Particles	
M 1-1-(1) C (½)-(½)-1	Compound neutron
M 1-1-(1) M ½-½-(1)	Mass 1 Hydrogen

Table 2: Identification of Axes with Sub-Atomic Notations



The photon dimension is represented as the Z axis, the 3rd digit of Sub-atomic reference point notations.

By changing M to C (or vice versa) and placing parentheses (or removing them), the exact reciprocal chart for the particles of the cosmic sector is obtained.

As an exercise of and for more complete understanding, the student should construct a model for the single photon rotational base and observe the effect on the model of the various displacement representations for all sub-atomic particle notations.

For the model use the full uncut circle of matte-board supplied with this book. Draw two perpendicular diameters on each face of the circle in such a manner that the opposite faces match each other; the ends of the diameter lines meet at the edge. Insert straight pins or map pins in the edge of the circle at opposite ends of one diameter.

For the different representations given in the chart, one of the diameter lines represents the photon while the other diameter represents one of the perpendicular axes. A wire or long pin through the hole in the center represents the other axis perpendicular to the photon. Rotation of the photon line around this axis alone would generate a disk like

representation; this is the disk of your model. Rotation of the disk around the diameter-end set of pins produces the sphere like appearance of the rotational base and is representational of the other part of the two-dimensional rotation that forms the rotational base of all sub-atomic species representations.

Since the dimensions of time are analogous to the dimensions of space, a rotation of your model in some dimension of space can be thought of as though it were in time without introducing any error other than that which may occur in your keeping things straight in your own mind.

Even though rotation of your model causes the directions of the perpendicular axes to be continually changing, rotational representation as a mathematical tool does not necessarily cause axial rotation. For some interactional processes such rotation may be appropriate, but for most analytical situations, rotation of the entire system in generalized space is not appropriate. The dimensional motions inside the radius of the individual Notational Reference Point coordinate system cause only scalar effects outside of that radius in that which becomes generalized space; the outside region.

In each case in which there is effective displacement the normal outward progression of motion is continually providing the next natural locations for the displaced motions of the compound motion structures. Since the outward scalar progression is randomly oriented in generalized dimensional space, the compound motion moving inward in opposition to randomly oriented primary motion moves in randomly selected directions. The continual inward movement in randomly oriented directions in dimensional space allows all compound Notational Reference Point structures to have reasonable probability for interaction with other similar structural representations, as well as any which progress with the natural reference system; i.e., light speed particles.

In order to extend the magnitude of the rotational displacements beyond one, a second vibrational unit is required. The second vibrational unit may be directly added to the base photon to become part of the photon rotationally represented as the rotational base for the subsequent structure or, as is more probable, the additional vibrational unit may be added as part of a perpendicularly oriented rotational base. This latter case is illustrated by the required units of vibration and rotation being provided by the material neutrino structural notation, which has the appropriate 1D and 2D displacements associated in the neutrino sub-atomic unit. This is the situation encountered in combining the neutrino notation with the proton notation to form the mass one hydrogen isotope notation, as noted in the preceding chart of compound particles. The summation of the two simple particles shows that the mass one Hydrogen notation does not have a full unit of $2D1d_R$ positive displacement in both perpendicular dimensions of its Notational Reference Point configuration. If certain other requirements are met during the combining process, the notational description identified as the mass one isotope of hydrogen becomes stable.

Writing in another half unit of displacement to convert the unit of $1D1d_R$ positive displacement in the Hydrogen mass one notation to a unit of $2D1d_R$ would have the notation M 2-2-(2) which has low probability for stability; obviously a problem in notational representation. An alternate method of description is used for the notational representation for all subsequently represented atoms of matter for which probability calculations indicate high probabilities of stable existence.

A MODEL FOR ATOMS IN THE MATERIAL SECTOR

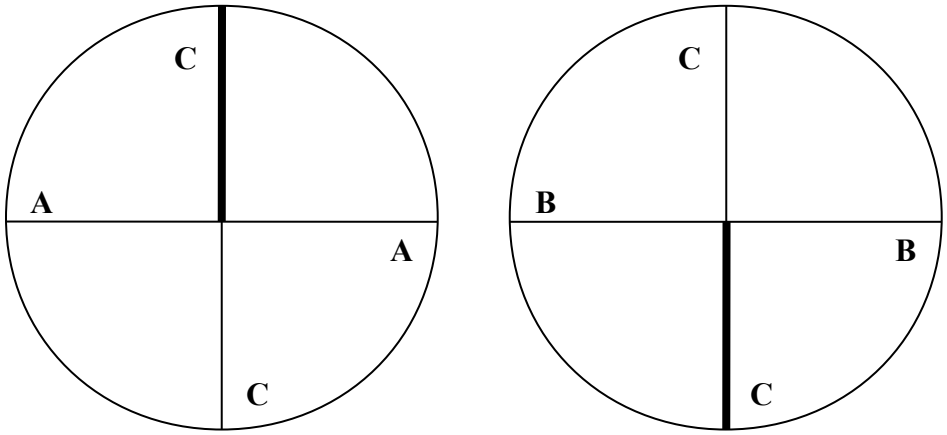
The rotational base for all ground state notational descriptions for atoms of matter start with one unit of negative $1D2d_L$ motion in each of two perpendicular dimensions to which two units of $2D1d_R$ motion, one for each photon, have been added to form the rotational base combination; 1-1-0. Once this compound structure is obtained, additional units of displacement motion cause the appearance of properties or characteristics which allow identification of physical and chemical properties that are different from each of the previous structural notations.

One of the most significant results of the concept of sub-atomic particles and atoms composed of compound motions is that it is no longer necessary to invoke mysterious hypothetical forces to explain how the parts of atoms and particles are held together. There are no parts other than the several distinct representations of the motions of which each is composed. Each kind of particle and each kind of atom has special and distinctive characteristics due to the specific combination of representable displacement motions incorporated in each compound motion. Extended discussions of the various phenomena associated with the interactional characteristics of the compound motions and further combinations of dimensionally representable motion are treated as separate topics; e.g., chemistry, mechanics, thermal properties of matter, light phenomena, electric and magnetic phenomena.

In attempting to describe the representations of displacement motions comprising sub-atoms and atoms of matter, several of the limitations to actually representing those motions in the region of normal experience require the student to exercise thought and imagination in the construction and interpretation of both mathematical and physical models. The probability principles have a preset bias toward the natural progression of unity because of the nature of the basic postulate and the limiting definitions and assumptions about the concept of motion and its mathematically representable behavior. The distributions listed by their NRP symbolic notations give some indication of the relative stability of the ground state configurations. Probability considerations dictate that the distribution of rotational displacement units be limited, usually, to only one stable combination among the various possible ways of distributing a given total number of rotational displacements. Of all of the possible arrangements, the ones with the greatest probability for stability have smaller numbers representing speed displacements rather than larger values and symmetrical distributions rather than asymmetrical distributions.[10]

Consideration of the limited number of ways in which two photons can be combined with additional displacements indicates that the two $1D2d_L$ displacement motions must not only be perpendicular, but that the added rotationally represented displacements must also be interacting dimensionally, as well as, magnitudinally.

Construction of another model will assist in identifying the interactions and the necessary resulting appearances. Supplied with this book are two other disks, each of which has a radius cut approximately the width of the thickness of the disk. Draw diameters on these disks in a manner similar to that used in making your single photon rotational base, except that this time one of the diameters must be coincident with the radius cut. Label each of the disks. The diameter coincident with the radius cut is to be marked with a C at each end; i.e., near the circumference. On disk “a” the other diameter is labeled with an A at the ends near the circumference. On disk “b” the other diameter is labeled with a B at the ends near the circumference.



Intersection of the disks "a" & "b" shows the common axis for rotation to be CC. Disk "a" is formed by rotation of line AA around line BB and disk "b" is formed by rotation of line BB around line AA. For visualization purposes, two dimensionally represented rotations around AA and BB can be accomplished if, and only if, the second part of each 2D rotation is synchronous with the first part of the other 2D rotation around the other axis, AA or BB.

Each subsequently added unit of $2D1d_R$ displacement adds synchronously, thus increasing the rotationally represented displacement in that dimension by one $2D1d_R$ unit for the entire structure. This combination of rotations constitutes the basis for describing a physical model of the $2D1d_R$ displacement motions necessary for the theoretical structures of atoms of matter.

Rotational representation is a mathematical device used to show a difference in a directional property required for representation of scalar motion in a dimensional system of reference. The physical model is an even more limited representation of the mathematical model, and therefore, cannot be considered as anything other than a tool for understanding. The physical model is absolutely NOT a picture of reality. Rationalization of the visualizable physical model and a non-visualizable mathematical description for the required motions in a three dimensional coordinate system leave considerable room for confusion. Thinking about the consequences of various actions and discussions with other students of the Reciprocal System of theory will eventually reduce the confusions to a minimum.

For all atomic structures in the Material Sector, the double photon rotationally represented structure is an interacting system based on negatively displaced photons; thus, the NRP configuration does not require specification of a type of base. Adequate notation requires only a set of numbers which represent the absolute magnitudes of rotationally represented displacement from unity in each of the dimensions of the compound motion structures and a way of depicting those numbers to indicate the direction of displacement, positively or negatively. The first and second digits represent the $2D1d_R$ displacements while the third digit refers to the $1D1d_R$ displacements.

It has been found through numerous correlated calculations that in order for the representation to have characteristics which correspond to, and therefore qualify the notations to be representative of, atoms of matter, the double photon rotationally represented system must have at least one effective positively displaced 2D1dR displacement. One positive $2D1d_R$ displacement is required to offset or neutralize the

magnitude of displacement effect of both of the first two $1D2d_L$ negative displacement units of the NRP base photons. Thus, the first structural representation, which has no displacement around the third dimension that can qualify as being representative of an atom, has the notation 2-1-0 rather than 1-1-0.

A unit of $1D1d_R$ displacement around the third or common axis of the two interacting rotationally represented systems applies to both 2D rotating systems. Each $1D1d_R$ displacement for the entire 2D interacting system is two natural displacement units, one for each part of the interacting rotationally represented structure. For the physical model, a $1D1d_R$ displacement is represented as a rotation around the CC axis; the two parts being represented by the two disks. An atom is NOT two intersecting disks, but is a combination of motions which must be represented in dimensionality by appropriate mathematical expedients.

SIMPLIFYING THE LANGUAGE OF REPRESENTATION

In the initial development of the consequences of the postulates for a universe of motion, there were no guideposts for the identification of the effects of various combinations in which the possible representational modes for displacement motion could be taken, although mathematical probabilities dictated the order in which complexation could occur. After long periods of development, in excess of fifty years, such identifications have been made. Along with these developments, explanations for most observed phenomena and many unobserved phenomena, as well as completely unobservable phenomena, have been obtained. Since correlations for various properties and characteristics of matter have been made for the representational modes and magnitudes of displacement motion, an approach similar to that usually taken in the descriptions for the results of the previous theories of atomic structure is being taken here. The basic concepts are described and explained giving the notation and the meanings attached to the symbology with the expectation that understanding and comprehension will gradually be gained through familiarity.

All atoms having the same NRP structural notation are referred to as atoms of the same element. Elements which have no $1D1d_R$ displacement, and therefore, no deviation from unity in this dimension do not have the ability to orient with a primary valence for a chemical relation to other elements. Thus, these kinds of atoms are referred to as inert elements or the rare gases. Discussion of the mathematics of electric and magnetic phenomena (Chapter 8), and interatomic "force" relations (Chapter 6), as well as, the concepts of valence and chemical orientation (Chapter 5) as used in the Reciprocal System of theory will provide a clearer understanding of $1D2d_R$ and $2D2d_R$ displacements.

The phenomena of static electric effects and electric charges have been found to be associated with $1D2d_R$ displacements in the atomic and sub-atomic NRP structural representations. Therefore, in describing the properties of sub-atoms and atoms of the universe of motion, the one Dimensional axis for rotational representation of the atomic and sub-atomic NRP configurations is called the electric axis. Displacements described as $1Dld_R$ represented around the electric axis are referred to as electric displacements.

Similarly, magnetic effects are found to be associated with displacements described as $2D2d_R$ displacement motion. Therefore, the two Dimensional axes are the magnetic axes and $2D1d_R$ displacements around these axes are referred to as magnetic displacements. Use of the terms electric displacement and magnetic displacement do NOT imply actual

appearance of electric or magnetic effects. Static electric or static magnetic effects are not present until the appropriate $2d_R$ motion is possible and required as a representational mode by the energetics of the process in question.

EXTENDING DISPLACEMENTS BEYOND TWO

At the first or unit level of $1D2d_L$ displacements, $1D1d_R$ and $2D1d_R$ dimensional differences have no numerical effect since $1^3 = 1^2 = 1$. But where the rotational representation must extend to greater displacement values, the numerical effect of a $2D1d_R$ displacement "n" being equivalent to $(n \times n)$ or n^2 $1D1d_R$ displacement units is noticed due to the interactional character of the 2D rotating systems, "n" 2D effects is not just 2n 1D effects, although that relationship must also be considered. Each unit of $1d_R$ displacement around the 2D axes is a unit of natural displacement, but the 1D natural displacement equivalent of "n" 2D displacements is $(2n)^2 = 4n^2$. Because one unit of $1D1d_R$ displacement of the entire structure is two natural $1D1d_R$ displacement units, the number of electric displacement units equivalent to various magnetic displacements "*n*" becomes

Equation 5: Electric Displacement Units

$$\frac{4n^2}{2} = 2n^2 \quad \text{(electric displacement units)}$$

In the notation 2-1-0 only one of the magnetic displacement units is effective, magnitudinally. However, the total positive magnetic displacement represented makes it possible to add one unit of negative electric displacement and still have net positive displacement for the entire structure; the notation for such a structure is 2-1-(1). It can be seen that two negative electric displacements exactly offset the effective magnetic displacement, thus destroying the 2-1-(2) as a valid structural representation. Atomic notation 2-1-(2) is essentially the same as 1-1-0, the atomic rotational base.

The notation 2-1-(1) represents the first in the series of notations for increasingly complex rotationally representable compound motions; atoms of matter. The second member of the series is the 2-1-0 notation followed by additions of positive electric displacement for the third, fourth, fifth, etc. members of the series. It is observed that the members of the series each show an increase in displacement equivalent of one net positive electric displacement unit from that of the previous member.

The effective number of equivalent positive electric displacement units is the same as the atomic number of the elements found in this physical universe. The atomic number is absolutely nothing other than a sequence number from the first kind of structure that has atomic characteristics incrementing some special characteristic of its actual structure so as to cause increments of change measurable by several different resulting properties. Any correlation with a theoretical structure is a characteristic of that theory, not an intrinsic definition of an observed characteristic named by men.

It can be shown mathematically that the inward scalar effect of positive rotational displacement, being opposed to the outward direction of primary motion in all directions of three dimensional space, gives the same response in the theoretical universe of motion that mass gives in the observed physical universe. Applying the relationship between natural units of $1D1d_R$ positive displacement and units of mass indicates that the notation 2-1-(1) should exhibit a mass effect of two natural mass units, which is obviously deuterium. The 2-1-0 notation has the equivalent of two positive electric displacement units and a mass effect equivalent to four natural units. Subsequent addition of the

equivalent of one positive electric displacement unit adds two natural mass units. Resolution of the apparent discrepancy between observed atomic masses on this planet and the theoretical natural mass of each kind of element can be accomplished only after further development of several other aspects of the theory which are somewhat beyond an Introduction.

A Periodic Classification of the Elements

In the first half of each magnetic rotational group, electric displacement is at a minimum for each element if the increase in equivalent positive electric displacement is accomplished by direct addition of positive electric displacement units. In the latter half of each magnetic group the increase in atomic number is normally attained for the ground state configuration by adding the next unit of magnetic displacement and then reducing to the required net equivalent positive electric displacement value by incorporating the appropriate number of negative electric displacement units. Thus the elements halfway between inert gases have, in the absence of atomic environmental influences, equal probabilities of having either Notational Reference Point configuration indicated in the periodic charts.

In the second and third rows of the charts, the required effective magnetic displacements for these groups of elements is 2. The number of elements between inert gases in these rows of the charts is $2n^2 = 2(2)^2 = 8$. If x is the required number of positive electric displacement units, then 8-x is the required number of negative electric displacement units to reduce the net equivalent positive electric displacement total to the required value. Other far reaching implications for the value of 8 are determined in connection with a somewhat different relationship in Chapter Five.

The pattern for calculating the net equivalent positive electric displacement results from the fact that numerical succession for low speed motions proceeds from 1/1 to 1/2 to 1/3, etc. where each sequential value is the next value, not the total of the individual increments up to that point. Thus, to obtain the net equivalent electric displacement, all previous displacements must be retained and counted along with the equivalence of the current level of electric displacements. For the first level which has only one effective magnetic displacement, there are two elements, $2(1)^2 = 2$; for the second and third levels n = 2, $2n^2 = 2(2)^2 = 8$; for the fourth and fifth levels n = 3, $2n^2 = 2(3)^2 = 18$; in the sixth and seventh levels n = 4, $2n^2 = 2(4)^2 = 32$. Thus, the sequence numbers, or atomic numbers, of the inert gases are 2, 10, 18, 36, 54, and 86. Number 118, which should be the next inert gas atomic number, is intrinsically unstable due to zero point equivalence of the required $1D2d_L$, $2D1d_R$, and $1D1d_R$ displacements.

The arrangement of the elements in a periodic table reflects relationships of structural representation, as well as the way in which the various elements enter into chemical combination. It has been found that there are four basic types of orientations possible for interaction among the elements; negative electric, positive electric, positive magnetic, and neutral. The type of associational orientation exhibited by the various elements is confined to the elements having certain structural representations in common and are thus found in the periodic chart in specific common regions. It is convenient to divide the periodic chart into four divisions representing the types of orientational possibilities for atomic interactions involved in the formation of chemical compounds. Other very close interactions, such as those in the elemental forms, in solvate crystals and in solutions, also follow the same pattern.

Grouping of the elements according to magnetic displacements and electric displacements represented in common yields a chart which appears on first glance to be identical to the familiar long form chart. Closer examination shows numerous differences, some of which will be discussed in the sections dealing with chemical orientations and reactions.

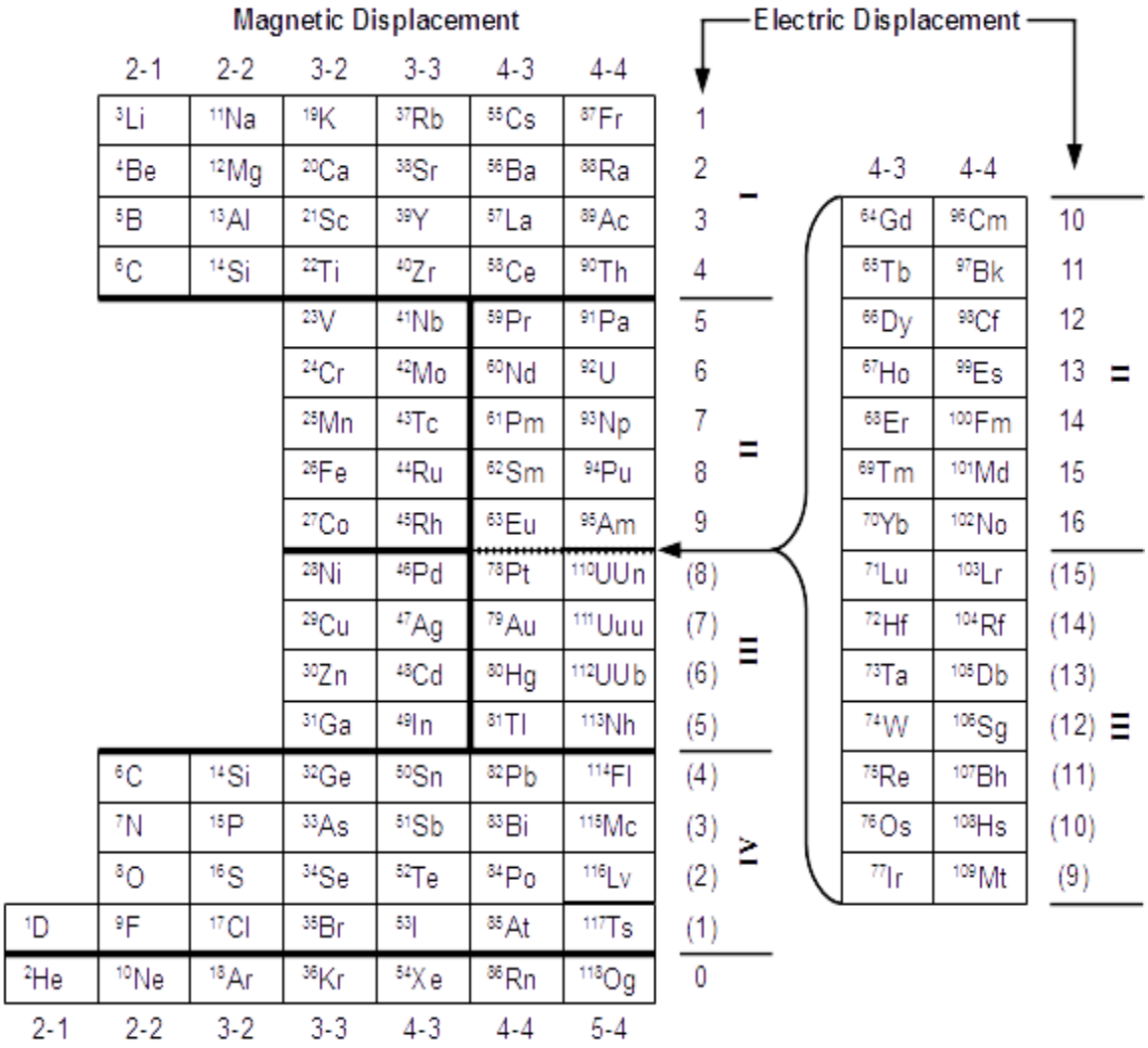
In previous forms of the periodic chart, correlated with an early form of quantum mechanics to arrive at numbers referred to as Quantum Numbers, the horizontal rows and vertical columns grouped chemically similar elements together, as well as provided a mathematical basis for further analyzing the characteristic behaviors of many elements. Even though the previous forms and mathematical analysis provided a seemingly adequate explanation for many characteristics of atoms, those forms and those analyses are built on the premise of a matter based universe, not a Universe of Motion, and therefore, cannot be adopted as adequate; let alone correct, relative to the development of consequences of the postulates for the Reciprocal System of theory. It is fairly safe to expect that much of the mathematics of quantum and wave mechanics will be found to have use in some phase of the development of this theory.

In this theoretical development there are two distinctly different types of rotational displacements, the magnetic or $2D1d_R$ displacements and electric or $1D1d_R$ displacements. The long rows, whether horizontally or vertically placed on the chart, contain those elements which could theoretically have the same magnetic displacements. The shorter rows composed of notations having the same electric displacement, when placed vertically, and thus called columns, results in the elements in each column having similar chemical properties.

THE PERIODIC CHART

Emphasis is on the magnetic displacement in vertical columns, with equal electric displacements in horizontal rows.

Table 3: The Periodic Chart



These charts are based on the requirements of this theoretical development and are for the ground state isolated condition, which may be thought of as the initial structure prior to initial condensation of stellar material.

Table 4 displays electric displacements in a manner similar to the previously accepted long-form format. Various other pictorial charts of the elements have been proposed. It has been found that no one chart form can adequately display all property relations among the elements of matter. Compare the required relative positions for the elements of all Divisions with their positions on the previously proposed forms of the Periodic Charts.

Table 4: Periodic Table of the Elements

hydrogen 1 **H** 1.0079												boron 5 **B** 10.811	carbon 6 **C** 12.011	nitrogen 7 **N** 14.007	oxygen 8 **O** 15.999	fluorine 9 **F** 18.998	helium 2 **He** 4.0026
lithium 3 **Li** 6.941	beryllium 4 **Be** 9.0122											aluminium 13 **Al** 26.982	silicon 14 **Si** 28.086	phosphorus 15 **P** 30.974	sulfur 16 **S** 32.065	chlorine 17 **Cl** 35.453	neon 10 **Ne** 20.180
sodium 11 **Na** 22.990	magnesium 12 **Mg** 24.305																argon 18 **Ar** 39.948
potassium 19 **K** 39.098	calcium 20 **Ca** 40.078	scandium 21 **Sc** 44.956	titanium 22 **Ti** 47.867	vanadium 23 **V** 50.942	chromium 24 **Cr** 51.996	manganese 25 **Mn** 54.938	iron 26 **Fe** 55.845	cobalt 27 **Co** 58.933	nickel 28 **Ni** 58.693	copper 29 **Cu** 63.546	zinc 30 **Zn** 65.39	gallium 31 **Ga** 69.723	germanium 32 **Ge** 72.61	arsenic 33 **As** 74.922	selenium 34 **Se** 78.96	bromine 35 **Br** 79.904	krypton 36 **Kr** 83.80
rubidium 37 **Rb** 85.468	strontium 38 **Sr** 87.62	yttrium 39 **Y** 88.906	zirconium 40 **Zr** 91.224	niobium 41 **Nb** 92.906	molybdenum 42 **Mo** 95.94	technetium 43 **Tc** [98]	ruthenium 44 **Ru** 101.07	rhodium 45 **Rh** 102.91	palladium 46 **Pd** 106.42	silver 47 **Ag** 107.87	cadmium 48 **Cd** 112.41	indium 49 **In** 114.82	tin 50 **Sn** 118.71	antimony 51 **Sb** 121.76	tellurium 52 **Te** 127.60	iodine 53 **I** 126.90	xenon 54 **Xe** 131.29
caesium 55 **Cs** 132.91	barium 56 **Ba** 137.33	lutetium 71 **Lu** 174.97	hafnium 72 **Hf** 178.49	tantalum 73 **Ta** 180.95	tungsten 74 **W** 183.84	rhenium 75 **Re** 186.21	osmium 76 **Os** 190.23	iridium 77 **Ir** 192.22	platinum 78 **Pt** 195.08	gold 79 **Au** 196.97	mercury 80 **Hg** 200.59	thallium 81 **Tl** 204.38	lead 82 **Pb** 207.2	bismuth 83 **Bi** 208.98	polonium 84 **Po** [209]	astatine 85 **At** [210]	radon 86 **Rn** [222]
francium 87 **Fr** [223]	radium 88 **Ra** [226]	lawrencium 103 **Lr** [262]	rutherfordium 104 **Rf** [261]	dubnium 105 **Db** [262]	seaborgium 106 **Sg** [266]	bohrium 107 **Bh** [264]	hassium 108 **Hs** [269]	meitnerium 109 **Mt** [268]	ununnilium 110 **Uun** [271]	unununium 111 **Uuu** [272]	ununbium 112 **Uub** [277]	nihonium 113 **Nh** [284]	flerovium 114 **Fl** [289]	moscovium 115 **Mc** [288]	livermorium 116 **Lv** [293]	tennessine 117 **Ts** [294]	oganesson 118 **Og** [294]

* Lanthanide series	lanthanum 57 **La** 138.91	cerium 58 **Ce** 140.12	praseodymium 59 **Pr** 140.91	neodymium 60 **Nd** 144.24	promethium 61 **Pm** [145]	samarium 62 **Sm** 150.36	europium 63 **Eu** 151.96	gadolinium 64 **Gd** 157.25	terbium 65 **Tb** 158.93	dysprosium 66 **Dy** 162.50	holmium 67 **Ho** 164.93	erbium 68 **Er** 167.26	thulium 69 **Tm** 168.93	ytterbium 70 **Yb** 173.04
* * Actinide series	actinium 89 **Ac** [227]	thorium 90 **Th** 232.04	protactinium 91 **Pa** 231.04	uranium 92 **U** 238.03	neptunium 93 **Np** [237]	plutonium 94 **Pu** [244]	americium 95 **Am** [243]	curium 96 **Cm** [247]	berkelium 97 **Bk** [247]	californium 98 **Cf** [251]	einsteinium 99 **Es** [252]	fermium 100 **Fm** [257]	mendelevium 101 **Md** [258]	nobelium 102 **No** [259]

CHAPTER V: INSIDE UNIT SPACE

WHY ATOMS EVER GET TOGETHER

In answering the question of why the different elements associate in the manner in which they obviously do, the first, and most important factor, is, of course, the incessant progression of motion. The second most important factor is the net effective speed displacement at the individual reference point. The third factor involves the relations among the specific modes of displacement represented at each reference point involved in an association.

The first positive $2D1d_R$ displacement creating the rotational base completely offset the possibility of direct representation of linear outward progression for individual Notational Reference Points. As a result of random orientation of atomic coordinate systems, subsequent rotationally represented positive displacements cause each such compound motion structure to have the scalar effect of progressing inward toward all spatial locations in the natural reference system. The ambiguity of direction for the outward progression of primary motion away from all spatial locations in the fixed spatial reference system makes it seem that all atoms and sub-atoms of matter are moving randomly outward. The consequences of compounding rotationally represented displacements, both one and two dimensional, positively and negatively displaced, along with additional $1D1d_L$ and $1D2d_L$ displacements cause many and varied phenomena.

Every compound motion structure that is identified as an atom or sub-atom of matter is moving inward toward all natural locations, some of which are occupied by other atoms or sub-atoms, most of which are not. We observe the movement of large aggregates of atoms of matter as collectively moving inward toward other aggregates in such a manner that their net inward progression has been identified as gravitation. The motion causing gravitation is inherently present for all atoms of matter. It is the "all directions" characteristic of rotational representation of displacement motion required in the complexation sequence for displacements represented at individual reference points for all atoms and sub-atoms of matter that is the basis for determining that it is this characteristic of the complex motion of atoms that is the cause of gravitational motion. The mathematical analysis of the behavioral characteristics of this type of motion representation supports this conclusion. The force of gravitation is *simultaneously and instantaneously* present with the presence of matter; it is not propagated at a finite velocity; it is either present because matter is present or it is not.

The inward force effect of rotationally represented displacements is of such a nature that the gravitational force effect cannot be screened off in any way. In a universe of motion there is no anti-gravity or artificial gravity of the "Star Trek" variety; that is strictly wishful thinking of "science *fiction"* engendered by the fact that the previously accepted theoretical system has no specific explanation for the cause of a gravitational effect, let alone any indication that an anti-gravity effect should not be observable.

In a universe of motion, a force is necessarily a motion or an effect of motion. We therefore define a "force" as that which will produce motion as perceived in a spatial or temporal reference system (and is thereby perceived as vectorial) if not prevented from

doing so by other "forces". "Force" is merely a special way of looking at motion, at its effect, rather than at its immediate value. It is still convenient to use the concept of force on an "as if real" basis along with the same mathematical relations among "forces" as in current usage, but with the realization that "force" is a derived concept, not something real.

Real is the actual presence of something, the actual movement of the something, or tendency of that something to move, not the derived mathematical relation for any resultant movement or tendency to change location in space. The mathematical "force" is not the reality, material things and the movements which result from the presence of compound representations of motions are the true realities of the physical universe. Lack of apparent movement may be reconciled through the procedure of showing a balance of "force" effects due to the various motions present, similar to the present procedure of balancing forces. Both the first and second conditions for equilibrium in the generalized spatial reference system are still in effect. The only thing changed is an understanding for the causes of various effects.

Since force is defined as an aspect of motion, the inward gravitational motion in three dimensional space is dependent on the geometry of such a reference system. The inward force of gravity diminishes with increasing distance becoming equal in magnitude with the force of the outward progression of the natural reference system of motion at some distance from each unit or aggregate of units of matter. The three dimensional distance away from each particular aggregate, at which the numerical value of its inward gravitational motion is equal to unity, is referred to as the gravitational limit of that aggregate.

An aggregate may be two atoms or thousands of atoms, planetary or stellar quantities; even a globular cluster or a galaxy or a cluster of galaxies constitutes an aggregate for the purpose of defining the gravitational limit for the particular aggregate. Any imbalance of the two opposing force effects near any gravitational limit accentuates the imbalance, and thus, the gravitational limit is not a position of equilibrium, but one of neutral balance.

The behavior of objects significantly outside the gravitational limits of their neighbors is such that an apparent barrier seems to exist between them which can, however, be overcome by sufficient linear movement of either object. Insufficient linear movement between apparently approaching objects results in a slowing of approach and possible deflection from a previous path. Mathematical analysis of such behavior appears as an inverse square law relation for repulsion. For individual atoms and for some small groups of atoms, the normal outer gravitational limit is between one and two units of normal progression of primary motion in the spatial aspect. For large aggregates, the gravitational limit distance is much greater.

The theoretical characteristics of gravitation in the universe of motion as derived from the postulates of the Reciprocal System of theory are in complete agreement with the empirical observations. According to this theoretical approach gravitation is simply the inward scalar effect of the motion of material units, an inherent property of the atoms and particles of matter. The same motion that makes an atom be an atom also causes it to gravitate. In a universe of motion, the only thing that can resist a change of motion is another motion. The particular motion of an atom that can cause resistance to any change of its translational motion in generalized space is the rotational representation of its net effective displacement (that which makes it be an atom). The inherent inward motion of

atoms of matter, effective in all directions in space provides the inertial effect that must be offset by additional linear displacements, $1D1d_L$, to allow vectorial movement.

The true picture of activity in a gravitationally bound system can be understood only when the apparent movement of photons and neutrinos, as well as all forms of matter, is realized to be a result of the frame of reference by which their movement is interpreted. Photons have displacement in only one reference point dimension and have no independent motion in the two remaining dimensions. Other light-speed particles have no effective displacement in at least one dimension. This lack of effective displacement in one dimension of the individual coordinate system implies that primary motion is effective in that dimension; thus, the particle remains in the same natural location and progresses outward at the speed of light in a randomly selected direction from its point of origin in the gravitationally bound fixed reference system. Effective displacement motion is an inward motion which may have both translationally and/or rotationally distributed effects in a dimensional system. The magnitude and specific representation of the effective displacement motion stabilizes the compound motion in individual Notational Reference Point systems dispersed in a generalized three dimensional system, which gives the resulting structure its measurable properties in the generalized system. Remember, motion is a concept and our interpretation of its appearance as phenomena is a result of experience.

The natural progression of motion is outward from unity, 1/1. When one of the aspects of motion is confined to one unit, the progression must necessarily continue outward from that value. The outward progression from unit value may be toward larger values of separation in generalized space and time, OR as measured in a three dimensional aspect, it may be inward toward smaller values of apparent separation. If the space quantity involved in the motion is confined to one unit, the progression toward smaller values of motion is toward the mathematical zero of coordinate space.

Atoms are effectively at rest or are moving at relatively low speeds in the conventional spatial reference system because they possess inherent motions at high displacement speeds which oppose the normal outward progression of the natural reference system of motion. Because of the inward motion of each atom it becomes highly probable that some atoms will approach the same natural location and collide. The minimum amount of space is one unit, but if two atoms having momentum in generalized dimensional space approach and collide, the inability to directly represent less than one unit of space does not preclude the continuation of inward motion.

Continued apparent movement results from motion taking a random direction in three dimensional time at the unit boundary and continuing onward to establish an equilibrium position in the conventional spatial reference system that is apparently less than one unit of spatial progression. Movement to an expression of net motion as one space unit and n time units establishes the motion at 1/n net representable units of motion in the spatial aspect. Such relationship when measured in the conventional manner that uses the natural progression of time, one unit at a time, to measure distance, gives the equilibrium position an apparent distance in generalized three dimensional space related to the 1/n value of motion at equilibrium.

For a representable motion involving an effective s = 1 and t = n, the observable equivalent space is s = 1/n. The expression for speed in the normal terms of the region outside unit extension space for motion inside unit space is $s/t = 1/n\ /n = 1/n^2$. Thus, the expression in the outside region for speeds in the region inside unit space is the square of the appropriate expression for the outside region; thus, inside region speed = $1/t^2$.[13]

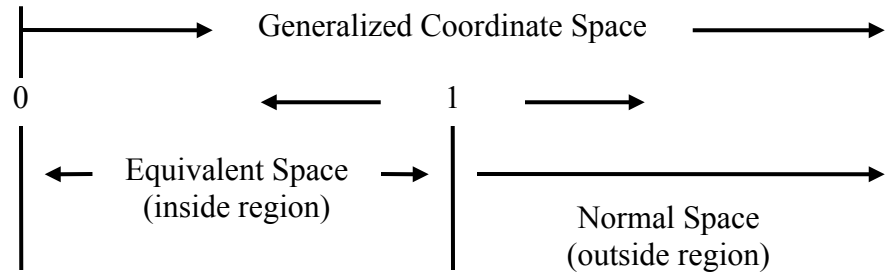


Figure IV: Generalized Coordinate Space

WHAT HOLDS ATOMS TOGETHER

Nothing more complicated than the natural progression of scalar motion! Restating that which has been said concerning progressions and displacements for the concept of motion so as to avoid any possible ambiguity: The direction of the natural progression in coordinate space, which is always outward from unity, appears to be reversed inside unit distance in generalized space. The reversal is only an apparent one since the progression of the natural reference system is always constant in a direction outward from unit space or unit time or both unit space and unit time. Actual movement in a three dimensional reference system is due to the inward motion of the atoms of matter, and any additional linear speed displacement associated with the particles, which is always in opposition to the direction of primary motion, the motion of the natural reference system.

The "force" of gravity is defined in a three dimensional system that recognizes the mathematical zero as its reference point for numerical values. Because of the nature of a three dimensional reference system and the force of gravity always being defined as inward toward the zero of that reference system, the direction of the natural reference system inside unit space and the direction of the force of gravity are the same, toward less equivalent space.

The magnitude of the force effect of the natural progression is always everywhere, in all directions, equal to unit value. At some distance from the center of rotational displacement, the force effect of the inwardly directed displacements has a magnitude of unity; equal and oppositely directed from that of the natural progression. Thinking from inside unit space, the direction of speed displacement is still toward unity, although this is now outward from zero. Since the three dimensional direction of the force effect of a speed displacement is oppositely directed inside unit space from that outside unit distance, there comes into existence an equilibrium position between any two atoms that come within unit distance of each other. They may or may not stay at that distance; that is a different question. The value of the equilibrium distance is a function of the net displacement of the individual atom; it is not caused by an interaction between atoms or an atomic size.

The scalar magnitude of the inwardly directed force due to the rotationally represented displacements varies directly with the magnitude of the specific rotational values of the atom and inversely as the square of the distance from the center of rotational action, the center of the atom. For an atom with small total displacement, the distance is very small at which the magnitude of the inwardly directed effect of the rotational displacement is equal to unity; thus, the equilibrium distance is closer to the center of the small displacement atom than for greater rotational displacement atoms. A point of equilibrium closer to the atomic center means shorter interatomic distances in generalized space.

A compressional force is inward toward zero distance of separation in generalized space, and is therefore, in the same direction inside unit space as the natural progression and thus adds to the magnitude of that force. Since the scalar magnitude of the forces due to the rotational displacements remains constant at specific distances for a given atom in a given associational relation, the force effect of compression acting together with the force effect of primary motion against the rotational forces of an atom places the point of equilibrium at shorter interatomic distance.

A force of tension in the same direction as the rotational forces, outward from zero, inward toward unit value, which adds to the rotational force or subtracts from the force effect of the natural progression of primary motion, thus requiring a greater interatomic distance for equilibrium to be established. It must be remembered that the positioning of atoms closer together than one natural unit of spatial progression is NOT a function of the other atom in the association; it is an effect of the motion that is the individual atom acting in opposition to the ever-present outward progression. The distance and direction taken by these force effects with respect to the presence of another atom is the result of the two associated atoms approaching and occupying the same natural unit of primary space and continuing their motion in dimensional time. The interatomic distance results from the interactional probability; i.e., the product of forces. The equivalent space required by each of the seemingly interacting atoms is a function of the force effect of the primary progression plus the magnitude of any externally applied compressional force or minus whatever tension force is externally applied and the effective *internal pressure am*ong the interacting atoms. Since the force due to the primary progression and a force of compression, an external pressure, act in the same direction, the equivalent of an *internal pressure* is present due to the primary progression acting alone against the rotational force effect. This is the cause of the so-called "chemical bonds" in molecules, crystals, glasses and true solutions.[14]

The *zero external force* equilibrium distance corresponds to the normal inter-atomic distance which is calculated from the magnitude of the effective displacements in each of the atomic dimensions for each of the associated atoms. Individual magnetic and electric displacements are actions inside unit space, and are therefore, in dimensional time. The force effect of each displacement unit is transmitted across the unit boundary in a manner dictated by the number of possible orientations for the axes of the rotational system of the atom in the time region. This is a function of the number of rotational units required for equivalency to linear units in the three dimensions required for representation and the maximum magnitude of the possible displacements in each of those dimensions.

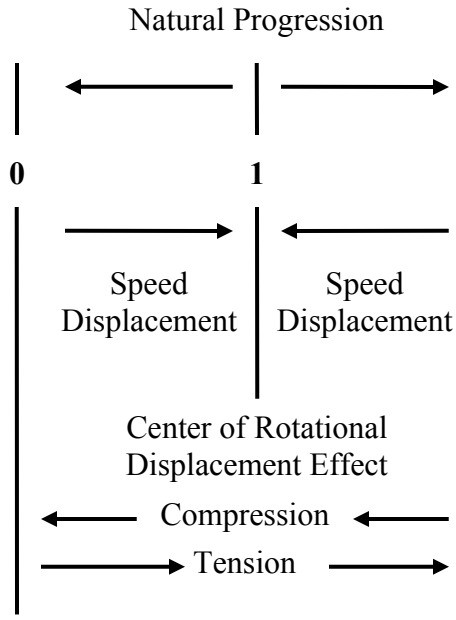


Figure V: Natural Progression

ORIENTATION REQUIREMENTS AMONG ATOMS FOR BONDING

The question concerning how many atoms of this element associate with how many atoms of that element is a function only of the effective displacements exhibited by each atom and what kind of displacement each has. The overall effect in three dimensional space is determined by the effective net displacement of each atom.

A smaller negative displacement has a more negative effect than a greater negative electric displacement because the smaller negative electric displacement in the ground state configuration is farther from the midpoint where positive and negative electric displacements have equal probability. A single negative electric displacement is far more probable than the necessary corresponding positive displacement on the preceding magnetic base. Within any one long row of the periodic charts, negativities increase in the same order as the increase in net equivalent positive electric displacement; atomic number.

In a vertical column where the electric displacements are equal, the element with the smaller magnetic displacement is the more negative because the effect of a greater magnetic displacement is to distribute the negative electric rotation over a larger total positive displacement. The magnitude of the variation in negativity due to magnetic displacement differences with the same electric displacement is less than the effect of differences in electric displacements on the same magnetic displacement. In other words, there is a greater negativity difference between adjacent elements in a given magnetic row than for adjacent elements in a given electric row.

Apparent atomic interactions place the atoms within unit primary distance in space, which we have called equivalent space. In equivalent space the dimensions of time are independent separate dimensions and thus require the displacements, in both the magnetic and the electric dimensions, to act independently.

The effective rotational displacement in the dimension of interaction determines the combining power or valence of each atom of an element. The negative valence of any

atom of an element is the number of units of negative electric displacement which that atom possesses or is exhibiting in that orientation. The positive valence of an atom in a particular orientation is the number of units of negative displacement which it is able to neutralize with that orientation. The orientation determines the valence which then may result in establishment of an equilibrium distance and, thus, an association geometry in space.

Each specific structure has its maximum probability for stability in accord with the total amount of displacement motion being exhibited in the nearby environment; i.e., within one unit of space as defined by the primary progression of motion in three dimensional space.

The natural progression cannot be observed independently. Any observed phenomena must involve displacement motion whether as some form of radiation transferring rapidly by emission and absorption among material structures, actually remaining as an integral part of a specific material structure, or by the phenomena of positional relationships of material structures.

In any true chemical compound, one component must have a negative displacement, or the equivalent of a negative displacement, of four or less. A component in a compound may be a single atom or a small group of atoms which, because of their individual displacements, can collectively exhibit an appropriate negative or positive displacement. The most probable orientation in an electric or magnetic dimension, considered independently, is that orientation which causes a minimum effective displacement, zero or a value equivalent to zero, in the dimension of interaction between the atoms of the resulting structure. It is the presence of negative electric displacement available in certain elements that makes it possible to place quantitative limits on the establishment of equilibria with other atoms, and thereby, create molecules, whether with atoms of the same element or among atoms of different elements.

An equilibrium distance can be established between atoms or groups of atoms if both of the interacting atoms or groups are specifically oriented along a line of interaction. The line of interaction is in equivalent space not dimensional space, even though a line can be defined by the subsequent spatial geometry established. The equilibrium is established only when the magnitude of the resulting relative motion in the orientation dimension is unity, zero with respect to the natural datum.[15] The relative motion within unit space along the lines of interaction must be reduced to zero in the natural system by the negative displacement of one atom being counterbalanced or offset by an equal positive displacement of some other atom or at least reduced to an equivalent of zero displacement in the temporal dimensions involved.

Another way of saying this is that, for formation of a molecule or radical structure, equilibrium can be established only when the net total of positive and negative displacements is zero, or the equivalent of zero, in the line or lines of interaction. This may be along the electric axis of each of the interacting atoms or an electric axis of one atom oriented with the magnetic axis of another atom. We are reserving the terms “bond” and “bonding” to that aspect of the atomic associations in which the force aspect of the progression is actually involved.

FORMULAS AND VALENCE

In this approach there is no need to memorize valences, although later on it may seem as though you have learned them by memorizing. It will have been done by sufficient use of

a specific technique and the normal function of the mind to remember those things it does repeatedly. Valences are what they are, and thereby, remain essentially the same as those which you may already know. The reasons for being those values will obviously change since we are no longer dealing with the idea of a nuclear atom or the concomitant ideas of electron sharing or transfer.

Valence, the chemical combining power of an atom, is determined by either the electric displacement or one of the magnetic displacements of each individual atom. Interatomic distance is affected by both the electric and magnetic displacements because distance is an effect measured from outside unit distance for an inside unit value phenomena. Molecular geometry and the geometry of crystal structures are also a function of both electric and magnetic displacements, although the manner in which each kind of displacement is involved in geometry determination is dependent on the utilized valence, the resulting interatomic distances and in some cases other atomic orientation effects. Each factor contributes to the probability function of each of the other factors, which makes the geometry situation very complex.

FORMULAS OF NORMAL ORIENTATION COMPOUNDS

That which is referred to as first order normal valence is merely the electric displacement of each element. To make them easier to use, a periodic chart should always be available. The chart form between pages 50 and 51 is most similar to the long form currently in use and incorporates the observed atomic masses based on $_{12}C$ rather than the natural atomic masses. The $_{12}C$ system of atomic weights is retained in order to provide a greater degree of familiarity to ease the transition to complete acceptance of the Reciprocal System at all levels of scientific study. For comparison purposes, the atomic weights of the elements are listed in the Appendix using the $_{16}O$ system of atomic weights which is the natural system on this planet in our galaxy.

Elements of Division One all have positive electric displacements of four or less; the values of electric displacement are the first order positive valences of these elements, x. Similarly, all elements of Division Four have negative electric displacement, the values of which are the first order negative valences of those elements, (x).

In order to form a stable relationship between any two atoms or among several atoms, the net motion between pairs of atoms must be offset or neutralized in one dimension for each atom. This neutralization does not affect the net displacement effects that extend beyond the equivalent space of the involved atomic combination; mass, electric, and magnetic effects. For normal binary compounds this requires only the presence of one kind of element with a normal positive valence and one kind of element with a normal negative valence; for example, between elements involving Divisions I and IV. In order to write the formula of the resulting binary compound, the reasons for the orientation or even what is meant by the word *orientation* is not necessary to be known, nor is it necessary to know what the resulting interatomic distances will be, to say nothing about what the geometry of the arrangement will be. Only the values of the positive and negative electric displacements of the elements need be used. The general procedures for obtaining chemical formulas for compounds with many elements is not changed other than an understanding of what is theoretically taking place in obtaining the association of the atoms in the various possible arrangements.

QUESTION SET 1

For those who may not be totally familiar with writing formulas of chemical compounds the following exercises are suggested; use the Periodic Chart from page 50 or 51:

1. Using the symbols for the elements of the electric **groups 1** and **(1),** write the formulas for each of the possible compounds by placing the symbol for the electric **group 1** element first, followed by the electric **group (1)** element. For example, LiH, LiCl, KBr, etc.
2. Using the symbols for the electric **group 2** elements and the electric **group (1)** elements, write the formulas for all possible normal valence compounds. Examples: MgF_2 , $CaCl_2$.
3. Using the symbols for the electric **group 1** elements and the electric **group (2)** elements, write the formulas for all possible normal valence compounds. For example: Na_2S . K_2Se, etc.
4. Using the symbols for the electric **group 2** elements and the electric **group (2)** elements, write the formulas for all possible normal valence compounds. For example: MgO, BaS, etc.
5. Using the symbols for the electric **group 2** elements and the electric **group (3)** elements, write the formulas for all possible normal valence compounds. For example: Mg_3N_2 , Ca_3P_2
6. Using the symbols for **scandium** and **titanium** with the appropriate symbols for **oxygen** and **sulfur,** write the most probable formulas for the binary compounds formed using only normal electric valences. (four formulas)

OTHER POSSIBLE ORIENTATIONS

The next step in developing the ideas of atomic orientation for chemical compound formation involves differences in the ways in which certain elements may enter orientation; i.e., differences of valence. *Relative negativity* determines which element is exhibiting which type of valence.

Stating the results of theoretical work, going back over the basics, and giving examples, usually explains the ideas of the different association possibilities for a given representation better than trying to redevelop the thinking from basics to final results.

Representation of the effects of displacement motion in a fixed reference system requires the use of reference points, thereby two linear units of inwardly directed space or time can exist in any given dimension between the +1 of the natural progression in one direction and the +1 of the natural progression in the opposite direction of the same dimension. In a three dimensional reference system in which there can be two linear displacement units between datum points for the outward progression in each of the three dimensions, the number of three dimensionally distributed unidirectional displacement units is $2^3 = 8$, whether those units are represented linearly, 2 units, or rotationally, 8 units.

There are several consequences of the value eight and its representation in a three dimensional Notational Reference Point system. The first is almost obvious; it takes a total of eight (8) electric displacement units to reach an equivalent of zero rotational displacement. A model may help to visualize this situation; consider a circle equally divided into eight segments with edges numbered from the top at zero, clockwise through

seven, eight falling on top of the zero.[16] Outside of this set of numbers place another set, numbered sequentially in the counter-clockwise direction, again the eight falls on top of the zero. See Appendix Figure VI. To use this device, consider the numbers in one direction around the circle as being positive electric displacements while the numbers in the opposite direction around the circle represent negative electric displacements. There are two 2D axes, and therefore, one magnetic displacement position is worth two electric displacement positions around the circle, but only in the direction chosen as positive displacement. This means that there are only four magnetic displacement units around the valence circle. Magnetic valences are limited to positive numbers with a maximum value of four.

Eight electric displacement units constitute an equivalent zero point or neutral point with respect to balancing the magnitudes of positive and negative displacements against each other to achieve the equivalent of the natural progression in a temporal dimension shared between two atoms. If an atomic component is orienting with a displacement that is displaced from the unit reference, it is using normal valence; if the component is using a displacement from an equivalent zero point, it is said to be using *neutral* valence.

Another consequence of the equivalence between two linear and eight three dimensionally distributed $1D1d_R$ displacement units is found in the multiple valences exhibited by members of Division IV of the periodic charts. As pointed out in a previous paragraph, one direction around the valence circle model can be thought of as positive displacements while the opposite direction can be thought of as negative displacements. This can be used to determine the exact equivalent positive displacement that an element of Division IV can most readily assume in polyatomic groups with other elements of Division IV which are orienting with normal negative valence. Examples of orientation to an equivalent zero point are found in many compounds such as Cl_2O_7, SO_3, and P_4O_{10}. Other examples are also observed in polyatomic radical groups such as sulfate, perchlorate, and nitrate. Division III elements **almost** exclusively form their binary compounds with Division IV elements by use of the neutral or enhanced neutral orientation although some Division III elements can use magnetic valence in binary compound formation.

Another consequence of this 8R = 2L equivalence can be seen in the shifting to another equivalent zero point two units clock-wise or counter-clockwise around the circle model by either the normal orientation valence or the neutral orientation valence. In order to differentiate, for communication purposes, among the various possible orientations which some atoms can take, *valences shifted in the same direction as the normal valence around the circle are referred to as* ***enhanced*** *valences. Valences shifted in the opposite direction of counting on the circle are referred to as* ***diminished*** *valences.*

As an example of shifted neutral valence: consider a normal valence of (2) on the valence circle model, shift two more electric positions to (4), then choose the other number, a 4, as the enhanced neutral valence for the element. This is the situation for sulfur in the sulfite radical. Use of enhanced or diminished valence always increases the reactivity of the element or grouping containing such orientations.

Usually valences shifted to a lower positive valence is observed in only one member or atom type in a polyatomic grouping in which the orientation used is neutral or magnetic. Seldom do two atoms of the same element in the same molecule or radical use the same shifted valence, and never to orient toward each other in that structure. One of the atoms

in a shifted valence orientation between atoms of the same element must use normal valence; e.g., the thiosulfate radical.

Occasionally, lower negative valence leads to a more symmetrical arrangement of the atoms of the molecule and thus, if the other factors allow for increased probability for stability by such arrangement, it is observed. All elements exhibiting valences greater than two can theoretically engage in the use of diminished valences; however, most shifts lead to decreased probability for stability of the possible resulting compounds as compared to the normal or neutral valences.

Another interesting sidelight on this situation of multiplicity of valence can be seen with respect to the building up sequence of atomic numbers. Disregarding the higher probability for representing nitrogen as 2-2-(3) rather than 2-1-5, this latter representation exhibiting a positive electric displacement of 5 would be expected to show an electric normal positive valence of five. Similarly, sulfur could be written as 2-2-6 rather than the ground state representation of 3-2-(2). We are not in a position by which to state on theoretical grounds which situation actually exists in nature. The possibility exists for an atom to realign the displacements to a less probable "ground state" atomic arrangement to achieve a more probable associational arrangement.

The theoretical possibility of variability of valence for a given element, as shown to exist in the experimentally observed law of multiple proportions, gives further evidence for theoretical validity to the postulates and consequences of the Reciprocal System of theory.

In order to change a particular orientation to a different orientation, sufficient energy must be supplied to separate the atoms in the first orientation and then have the new orientation established which subsequently establishes the new equilibrium distance, force, and geometry. Examples of the application of this may be seen in the oxidation of the sulfide radical to the sulfate radical or in the reduction of the chlorate radical to the chloride radical. Being the equivalent of some opposite orientation does not imply equal energy because the different orientations produce different equilibrium distances between atoms because of the different *specific rotations* being exhibited and utilized for the different orientations.

In Question Set 2, as pointed out in the column labeled "Type of Orientation" for the example numbered 0, IF_5 has enhanced neutral >< normal. This may be symbolized "e.neut. >< n." and should be read "an enhanced neutral orientation of iodine is oriented in a line with a normal orientation of an atom of fluorine". Either named element, the central or the peripheral, may be exhibiting the positive orientation and either may be named first. The symbol combination "><" is used to represent the phrase "is oriented in a line with". An "e." in combination with "n." or "m." is representative of the word "enhanced" and "d." is for the word "diminished". Neutral orientations are always from an electric valence and, therefore, the word "electric" is not necessary in that combination. The word "normal" or the abbreviation "n." by itself may be used to refer to either a negative electric valence, a positive electric valence, or a magnetic valence; the other stated valence indicates the meaning of "n.". If there could be confusion, an ambiguity can be resolved simply be spelling out the appropriate word. Obviously, a shorthand notation reduces what should be written and said from what is thought.

The word "radical" is used with both monatomic and polyatomic groups to indicate that the atoms involved are not in the elemental form (crystal matrix or molecule), but are associated with some other type of atom or a molecule. Each atom may or may not have

an electric charge associated in its structure. Notice that in naming radicals the -ide ending implies only that the named radical is orienting with a negative valence; it is coincidental that most -ide endings are for atomic radicals. The -ate and -ite endings are used with polyatomic groups orienting with net negative valence which have central atoms orienting with valence greater than four, usually some form of neutral valence.

Orientation of atoms and groups of atoms involving hydrogen or elements of the first series of eight elements are somewhat more complex, due to inactive dimensions, than the relatively simple electric and magnetic orientations discussed in this chapter. Organic compounds obviously are in that category and will be discussed later along with some of the interactive characteristics which are dependent on the same factors.

QUESTION SET 2

Will give opportunity for you to test yourself on your understanding of the principles outlined here for possible orientations in a few simple binary compounds. Fill in the requested information:

	Example	Valence of Peripheral atoms	Valence of Central atom	Type of Valence of Central atom	Type of Orientation
	IF_5	(1)	5	enhanced neutral shift 2(8-x)	enhanced neutral >< normal
7.	VCl_3				
8.	$ZnCl_2$				
9.	Ag_2O				
10.	NH_3				
11.	$LaCl_3$				
12.	$BeCl_2$				
13.	BeH_2				

These exercises should have given some experience with writing formulas for the normal electric, neutral, and enhanced neutral orientations for binary compounds involving the Division IV elements with the other Divisions. These exercises have also involved some discussion of other factors in the formation of chemical compounds. Next, we shall consider some binary compounds formed between Division IV elements and Division II elements using magnetic orientation and then extend the discussion to include orientations among polyatomic groups.

Recall the statements in the section on the requirements of atomic orientation that electric and magnetic dimensions are considered separately in the alignment of the dimensions involved in the orientation. For purposes of orientation, the dimensional axes for magnetic displacement are exactly equivalent to the axis of an electric displacement, because orientation is an interaction in dimensional time, not an outside region equivalent of rotational displacement. Whatever the magnetic displacement of a given atom is, that is also a possible positive valence. Thus, the value of the magnetic displacement in each magnetic dimension of an atoms interacting displacement systems may provide the possibility of increasing the probability of having those displacements neutralize an opposite displacement with a smaller number of atoms required in the formula and a more symmetrical spatial arrangement. An XY result is more probable than X_2Y or XY_2

which is more probable than X_2Y_3 or X_3Y_2 and much more probable than larger subnumbers resulting in more complex geometries.

The magnetic displacement represented by the first number of the notation is referred to as the primary magnetic valence, the second number, if different from the first number, is referred to as the secondary magnetic valence. Neither primary nor secondary magnetic valence is more probable than the other, but simplicity and symmetry of spatial geometry for the possible resulting compounds does contribute to the abundance of observed results.

If compounds formed between elements by normal, neutral, "enhanced" normal, or "enhanced neutral" orientations are less probable than the use of magnetic >< normal orientation, then m >< n orientation is what is observed. Magnetic valences can also be enhanced or diminished by the 2L equivalence shift. On the valence circle two electric units equal one magnetic unit when shifting equivalence point. Occasionally, normal magnetic orientation is less probable than a "diminished magnetic" >< normal orientation, in which case the "d.m." >< n. orientation is observed. A "diminished magnetic" valence is one numerical unit less than the normally observed "magnetic" valence, while an "enhanced magnetic" valence is one numerical unit greater than the highest normal magnetic valence. These variations result from dimensional contributions to probability calculations. A positive "diminished electric" valence is highly improbable due to the availability of the magnetic valences.

There are some examples of situations in which a diminished valence has very low probability for stability when considered alone, but when combined with a normal, either magnetic or electric, orientation molecule formed by the same elements, geometric considerations provide the diminished valence orientation sufficient stability for a combined existence with the normal orientation molecule.

QUESTION SET 3

Use the previously given column heading set-up for exercises in Question Set 2. Continue that exercise incorporating the use of magnetic valences along with the others while completing the requested information about each of these compounds:

14.	SO_3				
15.	SO_2				
16.	As_2O_5				
17.	As_2O_3				
18.	IF_7				
19.	$MnCl_3$				
20.	Mn_2O_7				
21.	VF_3				
22.	VF_4				
23.	VF_5				
24.	$FeBr_2$				
25.	C_3O_2				
		(Hint – combine two possible valences)			
26.	$KClO_3$				
27.	K_2SO_4				

A negative valence hydrogen atom is referred to as the normal electric valence. Hydrogen exhibiting a positive valence is using a magnetic valence since there is no positive electric displacement that can be used for a normal positive electric orientation. Hydrogen is always positive to the other non-metals and negative to any element using positive electric or magnetic orientations.

Intermixed solvent molecules and radicals from crystal structures form solutions by orienting their constituents based strictly on the same rules of orientation used for the pure substances. Consider the representation of the substance water; H_2O. The oxygen is obviously the central atom, and being the more electronegative of the two elements present, must exhibit and orient for molecule formation with its normal valence of (2), electric negative two. The hydrogen must therefore orient its magnetic displacement in a temporal line so as to counterbalance one of the negative electric displacements of the oxygen. Notice that each hydrogen atom has only one effective magnetic displacement and, thereby, one of its magnetic dimensions is ineffective, leading to inactive dimensions in its compounds. These inactive dimensions respond to externally applied magnetic fields in a different manner from that of merely unequal magnetic displacements in the magnetic dimensions of other elements. In water each hydrogen atom has its negative electric displacement directed in three dimensional time such that it can orient with any atom or radical orienting with positive valence, whether as an electric, magnetic, or neutral orientation. Of the subsequent solvent-solute orientations, electric to electric orientation leads to interatomic forces that are somewhat more mobile with respect to thermal considerations than corresponding electric to magnetic orientations. Magnetic orientations always leave positive electric displacements unneutralized leading to solvate formation. Valence Group I chlorides do not crystalize from water solution incorporating the water in the crystal structure. Most Division II chlorides do, while only some of the Division III chlorides do; for example, Iron II chloride does, as does zinc chloride and copper II chloride, but not copper I chloride, to name just four examples. Hydrate formation is not strictly a dipole effect, although polarization effects for molecules is related to the types of orientation present in the molecules.

The orientations involved in the elemental forms, both metallic and non-metallic, is similar, but with significant differences that involve extended geometric relationships not bounded by the limitations imposed by negative electric displacement.

WHAT ABOUT ELECTRIC CHARGES?

Notice that electric charges have not been mentioned in describing the orientation of atoms in any compounds thus far considered. The examples used range through the various types of compounds as classified according to their behavior in water solutions, along with some thermal behavior. The question of whether the substance acts as an electrolyte in water solution has nothing to do with the way in which the atoms are oriented in the pure forms of the substances, whether solid, liquid, or gas. The presence of charged radicals, which are referred to as ions, is often questionable, although in some situations ions are definitely present, particularly in gas phase situations.

Relative conductivity of solutions is a matter of whether the resulting structures can be caused to take on an electric charge, and if so which structures can be most readily caused to do so, with the applied source (E.M.F.) of available motion (charged or uncharged electrons). Reorientation effects may result from the relative magnitudes of

charge effects, thermal effects, and the various possible orientations. The source of the electromotive force and its magnitude determines the nature of the resultant effect. Which structural representations in dimensional space can be caused to take on an electric charge, to what magnitude, and what different orientations are stable under the new conditions are the principal observed results.

The initial orientation of the atoms and groups in the pure substances has nothing to do with any subsequently caused reorientation within those structural groups other than what is available and contributing to the total energy situation. Conducting the electric current always causes a series of motion interchanges which may or may not result in a net orientational change for the atoms of the initial substances.

In the liquid and solid phases of matter the association of solvent molecules with solute radical atoms or polyatomic groups is within unit space, and therefore, any electric charge present causes the grouping in the contiguous space units to exhibit an induced opposite charge which cancels the measurability of the presence of electric charge in any given sample of solid or liquid, whether of a pure substance or a mixture of different molecular and radical species.

Most phases of Physics and all areas of Chemistry involve atoms in some kind of associational pattern. Thus, it is reasonable to consider the concepts of atomic orientation as basic information appropriate for all other specific topics. Other concepts and relationships of atomic structure appropriate to other specific topics of discussion are addressed in the appropriate context. Results found in one area of investigation apply directly in all other areas with assurance of complete compatibility for results of investigations within this theoretical system because of deduction from a single premise. Extensive detailed explanations are often omitted in one area of discussion since at some other point a complete and detailed development of the phenomena is given.

CHAPTER VI: QUANTITATIVE RELATIONS

FUNDAMENTAL UNITS

When all quantities are expressed using the natural units of space and time, of which the universe of motion is constructed, the values of all the "fundamental constants" reduce to unity and effectively vanish in the various equations in which they are used. Since our conventional units are in essence quite arbitrary due to the environment of our local planet, the conversion factors between conventional units and natural units are also arbitrary and can be calculated only from specific measurements made of simple basic phenomena. The speed of light is definitely identified as unit velocity and as the natural rate of the progression of space in the spatial aspect of motion. To the extent that theoretical factors have been adequately considered and the experimental determinations accurately made, other fundamental quantities and constants have been determined.

To provide the conditions from which consequences for the postulates of the Reciprocal System could be derived, a progression of one unit of primary motion in one representable dimension must be exactly equivalent to a unit of motion representable in any manner in any direction. Once the quantity of spatial progression involved in one unit of primary motion in a representable dimension is determined, that is the quantity of space represented in a dimension of motion whether that unit of motion is directly representable as primary motion in a specific spatial dimension or as a distributed effect in all directions of dimensional space, including rotational representation. This quantity of space in the arbitrarily selected units of this planet for the amount of spatial progression per natural unit of time is equivalent to any and every unit of scalar space. A similar argument is used for units of time.

The value of unit frequency obtained from an atom of unit magnitude is more consistent with the Reciprocal System theoretical viewpoint and with the general pattern of measured values than that calculated from previously accepted theoretical considerations and infinite mass. The Rydberg constant is a primary multiplier by which energies and velocities of matter in the spatial aspect interact and is, thereby, the value of motion equivalent to one unit of oscillation.[17]

The fundamental frequency of one transverse vibration is by definition represented as the effect of one unit in one direction and one unit in the opposite direction in a dimension other than that represented as the dimension of progression in generalized dimensional space. The previously discussed theoretical description of radiation requires a photon of frequency "one" to be one cycle of oscillation and involve a minimum of two units of primary motion in the dimension of normal progression because two units are required to give equal probability of representation for the effect of the $1D2d_L$ displacement/s of any photon regardless of its frequency, but especially for the photons having only one unit of displacement from unity.

$R_H = 109677.6 \ \text{cm}^{-1}$

$$\frac{1}{R_H} = \frac{1\,cm}{109677.6} = 9.117632 \times 10^{-6}\,cm/cycle$$

$$s_n = \frac{1}{R_H}\frac{\mathring{A}}{cycle} \times \frac{1}{2}\frac{cycle}{halfcycle} = 455.8816 \quad \text{Ångstroms / half-cycle}$$

Frequency is the rate of presentation of an oscillatory effect at a location in dimensional space. Since primary motion is outward from any spatial location, both the change of natural location of the oscillation being measured and the frequency of the oscillation effect are motion, a speed, a quantity of space progressed and have the units: distance / time; s/t.

$$v_n(natural\ velocity) = \frac{s_n\ natural\ unit\ of\ space}{t_n\ natural\ unit\ of\ time}$$

$$t_n = \frac{s_n}{v_n} = \frac{4.558816 \times 10^{-6}\ cm}{2.99793 \times 10^{10}\ cm/sec} = 1.520655 \times 10^{-16}\ sec$$

One Dimensional motion is s/t whether vectorial or scalar, thus a two Dimensional speed would be s^2/t^2 and a three dimensionally distributed speed would be s^3/t^3. Since rotational representation distributes the directionality of a displacement motion in all directions of space, it is a three dimensional speed, a motion that is capable of offering effective resistance to any change of translational motion in any direction. Otherwise, translational motion at light speed could and would be taking place in any vacant dimension; for example, photons and light speed sub-atoms. The concept of resistance to change of motion in all directions of a three dimensional system is referred to as inertia. The magnitude of the effect of resistance to any change of vectorial motion in any direction in space is called inertial mass. The required mathematical representation for the inertial mass effect caused by the rotationally represented displacement of each atom is formulated in general as the reciprocal of three dimensional motion, t^3/s^3. If this formulation were not correct, inconsistencies would appear very quickly.[18]

The Avogadro number is commonly given the units of atoms or molecules per gram-mol. When considered as the number of complex motion structural units equivalent to one natural unit of mass per gram of molecular or atomic mass, the reciprocal of that unit gives the value of mass effect (in grams per unit of structure) equivalent to one natural mass unit. The value of the Avogadro number has been determined by several methods, some of which have been adjusted according to a theoretical interpretation which is questionable in the light of the basic assumptions upon which the Reciprocal System of theory is built. The value 6.0248×610^{23} units per g-mol is more consistent with the subsequent derivation of various mass dependent constants. Pending further study, 1.65979×10^{-24} grams per atomic mass unit is taken in this work as the unit of inertial mass.

$$M = mv = \frac{t^3}{s^3} \times \frac{s}{t} = \frac{t^2}{s^2}$$

[momentum is the two dimensional analog of mass]

In the definition for kinetic energy K.E. = $\frac{1}{2}mv^2$; Energy has the units of $mv^2 = t^3/s^3 \times (s/t)^2 = t/s$ [energy is the one dimensional analog of mass]

Since v = s/t ; and a = v/t = s/t /t = s/t^2:

$$F = ma = \frac{t^3}{s^3} \times \frac{s}{t^2} = \frac{t}{s^2}$$

Thus, force and acceleration are seen to be the dimensional inverses of each other. From the basic units of mass, length of space, and quantity of time the other units of mechanics are derived. All physically meaningful relations are shown to be motion or a relation of motions in which the relative factor dimensions of the numerator are always the same or less than the factor dimensions of the denominator. For example, pressure is defined as the force per unit area;

$$P=\frac{F}{A}=\frac{t}{s^2}\times\frac{1}{s^2}=\frac{t}{s^4}$$

which can also be shown to be energy per unit volume; t/s / s^3 . Using the conventional units of centimeters and seconds, the values in Table 5 reflect the natural units and their equivalent conventionally named basic units in mechanics.

Table 5: Space-Time Units

s	space	4.558816×10^{-6} cm	4.558816×10^{-6} cm
t	time	1.520655×10^{-16} sec	1.520655×10^{-16} sec
s/t	speed	2.997930×10^{10} cm/sec	2.997930×10^{10} cm/sec
s/t^2	acceleration	1.971473×10^{26} cm/sec^2	1.971473×10^{26} cm/sec^2
t/s	energy	3.335635×10^{-11} sec/cm	1.49175×10^{-3} ergs
t/s^2	force	7.316889×10^{-6} sec/cm^2	3.27223×10^{2} dynes
t/s^4	pressure	3.520646×10^{5} sec/cm^4	1.57449×10^{13} dynes/cm^2
t^2/s^2	momentum	1.112646×10^{-21} sec^2/cm^2	4.97593×10^{-14} g-cm/sec
t^3/s^3	inertial mass	3.711381×10^{-32} sec^3/cm^3	1.65979×10^{-24} g

Relations Unique to the Universe of Motion

The limitation in three dimensional space to unidirectional motion results in the inability to exceed the speed of light, unit velocity, as effective movement in any direction of three dimensional space. A type of physical relation peculiar to the universe of motion which is not encountered in conventional physics, besides the ability to reduce all quantities to motion terms, is found in a lack of limitation to unidimensional and unidirectional motion.

Translational movement of massive particles at light speed in one dimension is the result of unit effective displacement in one dimension and has been referred to as equivalent primary speed. The postulates of the Reciprocal System of theory require the existence of effective speeds up to and including unit velocity in all three dimensions whether as primary motion, photons and light speed sub-atoms, or as equivalent primary motion. Therefore, the representation of some kind of effect relative to the one dimension of space that is usable for direct representation must be available on which to build toward the effects of equivalent primary motions that are not directly representable in the two perpendicular dimensions.

We have considered one method of representing an effect of displacement motions in more than one dimension by the directional characteristic of rotational representation. One of the results of that representation, quantified by an inter-regional ratio, causes atoms to be effectively much smaller than one natural unit of linear spatial progression. A similar effect is observed for translational velocities that cause equivalent primary motion to exist in one or two of the perpendicular dimensions whose effects are otherwise not

directly representable. This is observed also as an apparent reduction in size for the stars classified as white dwarfs.

A factor that has been given only passing attention is that of boundaries between different regions in the universe of motion. The boundaries of the regions are all locations in either three dimensional aspect at which the value of either or both of the aspects of motion are at unity in any one dimension. If only one aspect remains at unity all variability of motion beyond that boundary results from changes in the effective quantity of the other aspect.

The ordinary region of everyday experience involves quantities of motion having net value less than one, but the effective values of both aspects are greater than one in the mathematical relation that is the effective measurable motion between reference points. This is the region of linear movement in extension space at speeds less than that of light. A similar region extends beyond the three dimensional speed of light boundary in which the total quantity of the aspect we call space exceeds the quantity of time involved in the motions; that is to say, at speeds greater than the speed of light in all three dimensions of space.

Since the normal time progression is a constant which determines the relative magnitudes of spatial and temporal effects, increased total time resulting from positive displacements is reflected as less equivalent space. While effective displacement speeds greater than unit speed in one dimension can not be directly represented in generalized three dimensional space, additional motion in a second dimension causes the appearance of an equivalence effect; i.e., equivalent space; in the mathematical expressions for and appearance of appropriate phenomena. The present interpretation of the effects of total displacement motion in excess of unity (i.e., unit motion in a second or third dimension in addition to the dimension of line of sight) is that of being a reduction of size rather than an extension into other dimensions of motion. Thereby, measurements which involve quantities of distributed displacement motion in excess of unity at a reference point have been interpreted as anomalies of size. Equivalent space effects and equivalent time effects are observed in the regions called the time region and the space region, respectively. Similar effects on a very large scale are observed in the regions immediately adjacent to the photon interface region; white dwarfs, pulsars and quasars.

The key factor in the relations between motion in dimensional space and motions in the time region is that in the context of the three dimensional spatial reference system, all motion in the time region is scalar with respect to generalized space even though dimensional in time. Inside unit space the dimensions of all Notational Reference Points are dimensions of time, therefore, motions in dimensional space and motions in dimensional time meet essentially in point contact at the regional boundaries.

Table 6 depicts the physical universe in five principle regions in three sectors: the Material Sector, the Cosmic Sector, and the Photon Interface Sector. The question of the number of regions has only to do with recognition of what constitutes a boundary, not with whether boundaries actually exist. Phenomena of the Photon Interface Sector have displacement in only one dimension, the photons, or no effective displacement in at least one NRP geometric dimension, the result of which is translational velocity at the speed of light; these are light speed sub-atoms of both the Cosmic and Material Sectors. For values of motion for which the quantity of representable space remains constant at one unit in the time region of the material sector, variability of speed is obtained from changes in the effective quantity of positively directed time incorporated from the net quantity of rotationally represented positive displacement motion. Similarly, in the space region of

the cosmic sector, the quantity of representable time remains constant at one unit and all variability of speed results from changes in the net quantity of positively directed space incorporated from the required units of rotationally represented negative displacement.

Two additional sub-regions which are being tentatively referred to as Secondary Astronomical regions may be thought of as parts of the Material and Cosmic Sectors or, possibly, as parts of the Photon Interface Sector. In these regions the phenomena involve displacement quantities of equivalent primary motion in one or two dimensions which are not directly representable in the line of sight dimension. Thus, the anomaly of measurement and the error of interpretation of effective sizes of the objects and distances to the objects; to say nothing about theoretical interpretations concerning composition and location of the objects. They are normal matter with more than the normal progression of the temporal aspect of motion between atoms and aggregates, thereby causing them to appear somewhat smaller in three dimensional space than normal.

Cosmic matter aggregates would appear in the Cosmic Sector in the same forms exactly the same as Material matter appears in the Material Sector, as stellar systems organized in galactic systems. It is the ejection of atoms of Cosmic matter into the Material Sector that causes their mass effects in this Sector to be less than unit value, and thereby, apparently sub-atomic from a Material Sector mass standpoint. They are not sub-atomic material structures; cosmic ray particles are Cosmic atoms in the Material Sector.

Table 6: The Physical Universe[20]

The Material Sector		The Physical Universe		The Cosmic Sector	
s/t < 1	s/t=1 ,>1		t/s=1	s/t > 1	
Displaced Motion less than unity		Motion extends into additional Classical mechanics Gas Phase of matter most Planetary, Stellar, and Galactic phenomena White Dwarfs Pulsars & Quasars	Photon Interface Sector: Photons, E.M. radiation	Displaced Motion greater than unity	
Time Region	Normal Time Progression			Normal Space Progression	Space Region
Atoms Atomic interaction phenomena Chemical orientation and bonding Solid and Liquid phases of matter Sub-atomic phenomena					(Cosmic atoms) etc. (Cosmic ray phenomena involve the behavior of cosmic atoms in the Normal Time Progression Region)
s = 1 unit t > 1 unit	1 < s < t		unobservable cosmic W. D's P's & Q's	s > t > 1	t = 1 unit s > 1 unit

THE INTER-REGIONAL RATIO

Of all the directions time can take in the time region, only one can transmit its effect across the regional boundary to any given dimension in space. In the absence of factors which might establish a preference, the ratio of the effect transmitted across the boundary

to the total magnitude of the displacements in the time region is numerically equal to one out of the total number of possible directions. The transmission ratio thus depends on the mode of representation for the specific displacement motion and particularly on the number of geometric dimensions involved.

The factors involved in the inter-regional ratio are the number of three dimensionally distributed unidirectional rotationally represented displacement units equivalent to one unit of effective linear displacement in one dimension: $2^3 = 8$ units. This is the # of linear displacements between linear datum points raised to the power of the # of dimensions over which the rotational representation extends or is distributed. Due to the limitations by which motion can be directly represented in a three dimensional reference system, the directional vectors for three dimensionally distributed motions can best be visualized by considering a two-unit cube as being an assemblage of eight one-unit cubes. The larger cube being two units by two units by two units to provide the two units of linear displacement in each of the dimensions of space. The eight directions in three dimensional space corresponding to the directions of the diagonals from the center of the assemblage of the eight one-unit cubes represent the most probable directional relationships for the eight displacement units in the temporal dimensions. See Appendix Figure VII.

These eight possible orientations for the one Dimensional rotations along with four possible orientations for each of the two Dimensional rotations make up the atomic orientational system inside unit space. Each of the rotating systems (one for the simple sub-atomic particles and two for the atoms of matter) has an initial unit of vibrational displacement (one for each photon) with three possible orientations, one in each dimension. For the basic two Dimensional rotation of atoms this means $3^2 = 9$ possible positions for the two vibrational units, of which two positions are occupied. This is the number of dimensions that are to be used raised to the power of the number of dimensions that must be taken together. Thus, there is an additional 2/9 direction, due to the vibrational positioning, that can be taken by each rotational displacement unit of an atom.[21]

The number of possible dimensional directions, which can be taken by primary translational motion, or any displacement in that dimension, or the effect of any one one-Dimensional displacement in each Notational Reference Point compound motion construct, is

Equation 6: Inter-regional Ratio

$$\frac{2^3}{2}\times\frac{2^3}{2}\times\frac{2^3}{1}\left(1+\frac{2}{9}\right)=4\times4\times8\left(1+\frac{2}{9}\right)=156.444\overline{4}$$

Transmission of effects depend upon, the continuity of motion; as well as the contiguity of position. Therefore, it is the randomizing effect of displacement positioning due to point contact at regional boundaries that causes the measurement of effects of motions in the time region to be reduced in what we have previously considered ordinary space. The fact that we actually measure motions and effects of motions, and interpret the measurements in terms of either space or time, means that our measurements of the motion that is the interatomic distances has been reduced by the inter-regional ratio. Thus, interatomic distances are measured to be in the neighborhood of 10^{-8} cm even though there is no actual measureable spatial distance less than one natural unit of space.

The concepts of scalar motion, randomly oriented dimensional systems at multiple reference points, and their effects due to representation in a generalized three dimensional coordinate system should eliminate philosophical problems. The idea of more than one unit of displacement motion exhibiting an effect within one unit of extension space, whether thought of as linear or as volume, becomes commonplace.

THE INTER-ATOMIC FORCE

An important consequence of motion in time, which takes place inside one space unit, is its equivalence to motion in space. A change in the time aspect of this motion from 1 to t is equivalent to a decrease in the space aspect from 1 to 1/t. Speeds in the time region, when considered from outside of that region, are formulated as equivalent space, 1/t, divided by total time, t, which is equal to $1/t^2$ in outside region terms. Since space remains constant at one unit for values of motion in the inside region and the velocity in that region is $1/t^2$ in outside region terms, quantities derived from such velocities exhibit the second power expression for the velocity in the corresponding relations of the outside region.[13]

This relationship must be taken into account in any relation involving both regions, such as our taking measurements in outside region terms of inside region phenomena. The joint activity of the displacement rotations that constitute an atom is caused by the magnitude of representable space being held at unit value. The joint activity of the rotational representation of motion in an individual Notational Reference Point system exhibits inertial and gravitational mass effects in the outside region. The three dimensions of rotational representation are separate within the region inside unit space, therefore, the one dimensional analog of mass must be used to obtain the equivalent expressions for time region effects in each of the three dimensions of time.

Scalar effects in the generalized dimensional system often appear to be dimensional because of the system in which they are being represented. The interactional force is a function of displacements in all dimensions rather than being limited to the one that happens to be oriented in the association between atomic systems because the individual Notational Reference Point systems are randomly oriented in space. The displacement in the dimension of orientation controls the valence. The effective contribution from displacements in each dimension must be determined separately and then combined.

In evaluating the individual contribution, the outside region expression F = ma becomes:

Equation 7: Force Inside Time Region

$$F = Ea = \frac{t}{s} \times \frac{v_i}{t} = \frac{t}{\frac{1}{t}} \times \frac{\frac{1}{t^2}}{t} = t^2 \times \frac{1}{t^3} = \frac{1}{t}$$

in each temporal dimension of the structure under consideration. To obtain the total force that corresponds to t displacement units, it becomes necessary to integrate the quantity 1/t from 1 to t rather than doing a simple summation.[22] This is caused by the continuity of motion between and within the units of motion, rather than their simply existing as separate units. The force effect of a one dimensional rotationally represented motion exerted against the unit force of the natural progression in one dimension of an atom is

Equation 8: Force of 1-dimensional rotation

$$F_1 = \int_1^t \frac{1}{t}\, dt = \ln(t)$$

If the force were strictly one dimensional, the one dimensional force that two apparently interacting atoms exert toward each other would be

Equation 9: Force of Attraction (1d)

$$F_1 = \ln(t_A)\ln(t_B)$$

Since every atom exhibits two dimensional displacement, the expression for the one dimensional force must be squared to obtain the two dimensional force exerted by the magnetic displacements.

Equation 10: Force of Attraction (2d)

$$F_m = \ln^2(t_A)\ln^2(t_B)$$

Even though the scalar motion represented as an electric displacement is a distinctly different unit of scalar motion, the fact of its representation as rotational around the common axis of the double photon system causes the effect of the electric displacements to modify the effects of the magnetic displacements in a manner different from that of a direct product of the one dimensional force effect factor. The force modification is caused by the electric rotation being a displacement of a displacement and is obtained by the relation:

Equation 11: Electric Force

$$F_E = \frac{1}{\ln(t'_A)\ln(t'_B)}$$

In this analytical situation we are not concerned with the translational motions that various atomic structures may have as a result of thermal motions or $1D1d_L$ displacements. We are evaluating scalar motion structures which are displaced from the normal progression of the natural reference system that have a contiguous nature when in apparent interaction. The rotational representation of displacement is the source of the gravitational force effect which brought them into contiguity in space. The net force effect of the rotationally represented motion is inversely proportional to the square of the apparent distance of separation of the apparently interacting bodies and is in opposition to the natural progression (which in the region inside unit space is inward toward the zero of the generalized three dimensional reference system of space). The distance of separation in outside region terms is an equivalent space distance between the two apparently interacting atoms and thus a distance s measured in outside region terms becomes s^2 for the inside region equivalent distance. The square of the equivalent distance of separation becomes $(s^2)^2 = s^4$ in outside region evaluations.

The total force equation is the product of all of the factors: F_M, F_E, the inter-regional ratio and the inverse proportionality of the square of the distance of separation.

$$F_T = \frac{(1)^4}{(156.44\overline{4})^4}\frac{1}{s^4}\frac{\ln^2(t_A)\ln^2(t_B)}{\ln(t'_A)\ln(t'_B)}$$

Equation 12

$$F_T = \frac{1}{(156.4\overline{4})^4}\frac{1}{s^4}\frac{\ln^2(t_A)\ln^2(t_B)}{\ln(t'_A)\ln(t'_B)}$$

Since this force is acting against the force of the natural reference system which is unity, substituting this value for F:

$$1=\frac{(1)^4}{(156.4\,\bar{4})^4}\frac{1}{s_o^4}\frac{\ln^2(t_A)\ln^2(t_B)}{\ln(t'_A)\ln(t'_B)}$$

and solving for s_o yields the equilibrium distance:

Equation 13: Equilibrium Distance

$$s_o=\frac{1}{156.4\,\bar{4}}\frac{\ln^{1/2}(t_A)\ln^{1/2}(t_B)}{\ln^{1/4}(t'_A)\ln^{1/4}(t'_B)}$$

Sub-notations A and B refer to different kinds of atoms or to different orientations of the same kind of atom. For application to elements in which A is the same as B, the expression simplifies to

Equation 14: Equilibrium Distance (simplified)

$$s_o=\frac{1}{156.4\,\bar{4}}\frac{\ln(t)}{\ln^{1/2}(t')}$$

Multiplying by the conventional reference system equivalent of one natural space unit gives

Equation 15: Inter-atomic Distance

$$s_o=\frac{455.8816\,\mathring{A}}{156.444\,\bar{4}}\frac{\ln(t)}{\ln^{1/2}(t')}$$

$$=2.914\frac{\ln(t)}{\ln^{1/2}(t')}\quad\text{Angstrom units}$$

The numerical value of t must reflect the fact that from the natural standpoint *zero* net rotational displacement is unit rotation from the fixed spatial viewpoint even though such rotation cannot be directly represented. The t value obtained is called the *specific rotation*. The necessity of using specific rotation values also reevaluates all t values to positive rotational displacement equivalencies.[23]

The initial unit of normal progression from which the displacements must extend, must be added to the displacement values of the notation for atoms in vibration one status. Vibration two status changes the effect of one or more rotational units to half unit values for each displacement unit of the compound motion structure that is rotating on vibration two status. This is primarily due to separate system action in the basic two dimensional rotational structure of atoms.[24]

CHAPTER VII: INTERACTIVE PHENOMENA

SPECIFIC ROTATION OF DISPLACEMENTS

It has been shown that it is the presence of negative electric displacement that makes it possible to form, and thus develop representations for, individual molecules or structural units composed of a specific number of atoms of certain elements; formulas for compounds and radicals. Now that some of the possible orientations required by atoms of matter for compound formation are at least more familiar and the mathematical expressions representative of the interactive forces are recognized, the "how" of obtaining the values for the principal variable in those expressions must be considered.

The initial displacements of each type, linear and rotational, extend from unit primary motion to give rise to effects in either dimensional aspect. The direction in the generalized dimensional aspect of the effect of displacement is outward for several reasons: a displacement motion is dimensional only within the individual reference point system; clockwise vs. counter-clockwise is a matter of viewpoint; inside unit space, time is dimensional, because the spatial quantity cannot be less than unit value. Any effect in generalized space for both primary and displacement motions can be represented only in an outward direction from each reference point.

A background unit of primary motion cannot be given rotational representation, although it is the primary motion in each dimension by which to begin the sequence of counting to determine the specific rotation involved in any given orientational relationship. Orientations for subsequent "bonding" extend from the natural datum, unity, as does the gravitational force effect of the rotations, mass. Specific rotations are a consequence of requiring atoms and all interactional effects related to their presence to be relative to the stationary reference system. They are not additional motions or parts of atomic structure; they are merely ways of accounting for our stationary reference system.

It is only in interactions among atoms and between atoms and sub-atoms along with the need to calculate an observable result in a fixed reference system that the presence of units of photon vibration become required in the expression. Representation of extra units of vibration for a given ground state rotational displacement notation requires an adjustment in appropriate dimensions for the specific rotational displacement values.

From the viewpoint of the generalized three dimensional reference system of space, *zero* rotational displacement must be represented as unit rotation. As a result, the initial unit of speed in each rotational dimension must be counted when determining the quantitative effects of all rotational representations relative to the stationary reference frame. The *specific rotation* of every atom is at least one unit greater in each dimension than the displacement represented by the notation given in the periodic charts for the ground state elemental configuration. This is part of the reason for choosing this type of structural notation for atomic structures in developing the consequences of the postulates for the Reciprocal System of theory.

From the initial comments in Chapter Three in the section on Representable Motions, positively displaced rotationally represented displacements added to negatively displaced $1D2d_L$ displacements may be represented in different dimensions as well as in different

modes. Since all displacement representations at individual Notational Reference Points have a scalar effect relative to the motions at other reference points, the magnitude of the net effect for each atomic system is maintained by a very specific minimum effective displacement from unity. This minimum is obtained by geometric summations of all effective displacements considering dimensional and directional characteristics, as well as direction of displacement from unity.

Additional units of negatively displaced $1D2d_L$ motion are always added during the atom building process. Some photons are emitted during the process but the high energy $1D2d_L$ units of displacement remaining with the new atomic structure cause the total rotationally represented displacement to have their interactional effects countable in partials of positively displaced units of $1D1d_R$ or $2D1d_R$ motion.

Each unit of motion of a multi-unit photon is a contiguous but separate unit represented in the same dimension; otherwise, photons could not exhibit the photoelectric effect or fluorescence effect. There seems to be no logical requirement for all units of negative $1D2d_L$ motion, which are part of the base photons, to maintain the same identical geometric dimensional probability positioning. That is to say; the following requirement does not necessarily follow, that all unitary parts of a given frequency $1D2d_L$ displacement rotate together with all rotationally represented units of displacement motion required for the particular atomic representation.

In the basic structure of atoms each linear unit equivalent of rotationally represented positively displaced motion is directly associated with a negatively displaced vibrational unit, but not vice versa. This is caused by the sequential ordering of representation. The vibrational frequency of the photons being combinationally represented in the representation as atoms of matter is specific but all factors related to their precise relation to required rotational displacements and specific rotations is not yet clear. At the present stage of development of the theory, the required number of vibrational units involved with required rotational representations does not extend beyond *vibration two* requirements for atomic structures. There seems to be a lack of anything other than continuity (representation in the same dimension) required of the units of vibration of the basic frequencies of the photons. Determination of specific presence of non-rotating units of vibration for potential association with the required rotating units has yet to be confirmed and shown to be a requirement.

In order to extend rotation beyond unit equivalence with the oppositely directed $1D2d_L$ displacement of one unit, and maintain minimum net displacement from unity, additional units of vibration must be brought into effective presence. Until extension is required the system is said to be rotating on a *vibration one* status. Immediately upon requiring rotational representation equivalent to two linear units around any dimension, another unit of vibration must be present to prevent equivalence destruction of the photonic vibration. This is the reason the M 2-2-(2) notation was unstable. The atomic interacting system avoids this unstable situation by increasing the vibrational frequency of one or both photons being rotated.

The force effect of one unit of rotationally represented displacement, having specific rotation $t = 2$, is less than unit value, $\ln t = 0.693$. Rotational notation value 2 having specific rotation $t = 3$; $\ln t = 1.0986$; is effective. Thus, the first series of eight elements is seen to have inactive force dimensions until additional vibrational units are brought into rotation.

The symbol t used in the force equations is called the *specific rotation* because it reflects the required number of units of rotational motion effective in the three dimensionality of space with respect to each atomic Notational Reference Point. The value of t is obtained directly or indirectly from the notation for each kind of atom. Because extension to *vibration two* status in the photon vibrations is required for certain orientational associations, as well as, at certain positions in the building process of atomic structures, conversion of the rotational representation to other values for *vibration two* conditions may occur for any atom beyond atomic number one.

Extension of rotation to a second unit of vibration is a function of the total displacement being represented for a given atom, rotational and linear equivalencies, approaching the absolute limit of one effective linear displacement from unity in each dimension. Offsetting rotations in a specific temporal dimension for chemical association between atoms often requires other shifts of rotational representation, as a result of positional relationships and environmental factors. These shifts are part of what effectively causes the requirement of recognizing the rotation of the extra units of negative $1D2d_L$ displacement. As a result of the probability positioning of the units required for a second vibration unit to become effective, the specific rotation values shift in the appropriate dimensions to half units of specific rotation. The primary controlling factors for determining the specific rotation in each dimension of each atom are seen to be the identity of the atom and the orientational associations required; i.e., normal electric, neutral, or magnetic. The next most important factors are probability functions. These factors are part of what makes the calculation of all atomic interactional, as well as, absorption and emission phenomena difficult.

The electric dimension of rotational representation for the double photon doubly rotating system is the axis for rotational representation of the entire magnetically rotating structure. Electric displacement values may extend by whole units or half units because an electric unit is a rotational representation for both photonic bases. Half units of specific rotation are not necessarily required in the electric dimension although they may be present without overt evidence of their presence. Specific electric rotation values may follow the sequence 2, 2½, 3, 3½, 4, 4½, 5, 5½, 6, 6½ , 7, 7½, etc. or any intermediate sequence up to the other extreme of 2, 3, 4, 5, 6, 7, 8, 8½, 9, 9½, 10, etc., up to 16.

The sequence of specific magnetic rotations for the different elements may follow the pattern 2, 2½, 3, 3½, 4, 4½, and 5 in either, but not the same in both, magnetic dimensions for corresponding elements from one magnetic row to the next. The sequence of specific magnetic rotations may be at the other extreme 2, 3, 4, 4½, 5. The shift to the vibration two status may be at any intermediate position of the sequence.

In Equation 8 of Chapter 6 [page 75], t is evaluated on the basis of a one dimensional force effect. Equation 10 may appear to assume that the displacement in each of the magnetic dimensions of the atom in question is the same. Squaring a function has exactly the same meaning as obtaining the product of similar functions because the direction in space of any time dimension is completely indeterminate. For an atom exhibiting different displacement values, such as those of the 3-2 and 4-3 magnetic rotational groups, the effective distribution is that of a spheroid having an effective t value determined from the relation[25]

$$\left(t_p^2 \times t_s\right)^{1/3} = t_{eff}$$

t_p is the specific rotation effective in the two equal dimensions of the spheroid and is associated with the principal magnetic rotation which is sometimes the larger value and

sometimes the smaller value. t_s is the specific rotation effective in the single dimension and similarly can be either the smaller or the larger value. Of course t' is the specific rotation effective in the electric dimension which may or may not be correlated with the spheroidal distribution of the magnetic dimensions.
Net positive rotational displacement is absolutely required for stability in the material sector of the universe, and in an environment of atomic orientations a totally positive rotational displacement is more probable than any combination of positive and negative displacements where the negative displacements are not definitely required for orientational association, and even then, the effective specific rotation of the negative speed displacement must be determined from the equivalent positive displacement.

Remember, positive or negative displacement, inward or outward, is all the same in either generalized dimensional aspect relative to the atom as a scalar reference point. *Specific rotation* is like the absolute value of a signed number, it has no sign, it is a value. Neutral orientations for normally first order negative valence elements are considered to be the result of totally positive displacement combinations, as well as, for determining the specific rotations involved. When magnetic orientation, enhanced orientation, or neutral orientation is involved, vibration two status for several rotational displacements is automatically demanded. The corresponding specific rotation of an atom in associational relation whether with other atoms of the same kind (the elemental form) or with atoms of a different kind is determined by the orientation required or possible for the atoms involved.

Interatomic distances must be calculated between each pair of atoms in chemical formula units and subsequently arranged relative to geometric probabilities for determination of crystal geometries and molecular or radical shapes, all in accord with relative negativities. The t value entered into the final force equation used to determine the interatomic distance in a specific spatial direction is t_{eff}. For metallic elements and alloys of Division I elements, t_{eff} is the geometric mean of the specific rotations of adjacent atoms. For elements of Division IV and for normal compounds, negative displacements are balanced or offset by positive displacements resulting in the effective displacement between any two atoms being the sum of the displacements of those atoms in the line of orientation. Elements of Divisions II and III may utilize the 8-x neutral orientations thereby creating a pseudo-balancing of displacements for their interatomic orientations. Neutral orientations are almost always interspersed among positive orientations and positive-neutral orientations causing quite complex interatomic situations. Negative to negative orientations seldom have sufficiently high probabilities for existence .to require consideration at this stage of the development of the theory.

A little study of the Charts 1, 2, 3, and 4, in the Appendix will show the positions at which shifts to vibration two status has occurred for one or more of the required rotationally represented displacements in the elemental forms. Where vibration two status is required for binary compounds of the NaCl type arrangement, the specific rotations are also listed.

Vibration two status may result from maximum distribution effects. The fact that a maximum distribution from minimum displacement prevents equivalence alignment of rotational components with linear vibrational components is fortuitous from our point of view of analysis and correlation with the observed material sector of the physical universe. Equivalence alignments result in reduction to and separation of one or more rotationally represented displacement units to linear vibrational form. In many cases a

simple sub-atomic compound motion is separated (either an electron, a positron, or a neutron) while in other cases the simplest of atomic compound motion structures having zero electric rotational displacement (a helium atom) is separated. These separations are identified as radioactive decay. Radioactive decay is only one type of decay mechanism by which spontaneous destruction or decay of a specific compound motion could occur.

Quite often a required shift to vibration two status contributes to the cause of a chemical process being endothermic, rather than a heat balance being totally a chemical reorientation effect. The opposite effect may also be true. Photochemical reactions are often initiated on this basis, also.

The actual atomic environment dictates the extent of the shift to vibration two status for the rotational displacement units of the individual atoms. This means that the question of the identity of adjacent atoms is very important, as is the temperature of the system and the flux density of other frequencies of radiation. The applicable probability functions for the possible geometric arrangements of the atoms involved are also affected by these factors. Do not expect the specific rotation of any given element to be the same throughout a given complex molecule or in all possible atomic arrangements: i.e., in all compounds, as well as the elemental form, or to remain constant in a specific chemical reaction.

Since the specific rotations of all atoms of a given Division I element are equal and the magnitude of the "forces" in an isometric crystalline form is equal in all directions in space, it is to be expected that each should have an isometric crystal form. Elements of the other Divisions are not quite so simple, especially those with high probability for negative electric rotations. Even though all Division II elements do have an isometric form, the higher values of the specific electric rotations and the possibility of the opposite neutral orientation of alternating atoms in a given array in the three dimensionality of space require a certain probability for additional geometries.

The solid phase of matter results from the orientation of the motions of the atoms which allows the atoms to move to equivalent space positions inside one natural unit of extension space. Variation in the magnitude of the specific rotations from one orientation to another in complex compounds causes the apparent magnitude of the forces and, therefore, the distances between each pair of atoms in the array to be the same in two dimensions or no two of the dimensions; i.e., different in one or all three dimensions, respectively. The actual magnitude of the specific rotation in each dimension of each atom involved in the overall array determines the required interatomic distance for each pair of atoms and thus, the resulting geometry in space.

PHOTON INTERACTIONS

Photons of radiation consist of either positive or negative $1D2d_L$ displacements which are representable only as an effect of interaction in the generality of space; i.e., the displacement has no directly discernible effect in and of itself in the unit of primary motion of which it is a part; it cannot be perceived without interaction. Photons of all frequencies are interface phenomena because they have displacement in only one dimension, and thereby, become effective and identifiable in either of the three dimensional aspects of motion, when, and only when, they interact with other photons or with atoms or sub-atoms of matter, either material or cosmic. It is the addition of rotationally represented displacement motion to oppositely displaced $1D2d_L$ motion that gives rise to the effects identified as atoms and sub-atoms of matter of either the material or the cosmic sector.

The overall displacement motion represented within the NRP is responsible for these effects: atomic mass, vectorial motion, heat, electric charge, and magnetic charge. In the normal region outside unit distance the net rotational displacements that constitute the atoms of matter have the effect of mass, something entirely separate from the quantities of energy which may be absorbed by or emitted from atoms. Components representable as opposition to the outward linear motion of the natural progression may be represented within the same unit space in two different ways. The one dimensional application of energy, as $1D1d_L$ displacement, to a material structure is represented with the other displacement motions in such a manner as to give the effects we presently identify as vectorial motion. Lack of relative motion, other than thermal motion, among atoms and molecules in the solid phase allow contiguous structures to share $1D1d_L$ displacement motion. The other way of representing opposition to the normal outward progression is by the addition of low frequency $1D2d_L$ displacement in that dimension.

Photons of radiation either do or do not have resonance with the various atoms or atomic groupings in such a way as to give rise to the phenomena of absorption, reflection, and transmission. The large scale effects of each of these phenomena are thoroughly discussed in available conventional physics texts. Refraction effects, absorption effects, and reflection effects are sufficiently different so as to require different treatment both conceptually and mathematically. The phenomenological descriptions of the interactions of photons with atoms of matter are still in the process of being investigated in terms of the Reciprocal System of theory, as are most other phenomena. However, the phenomena which result from absorption to any degree have been studied in sufficient detail to provide calculations of some spectral effects, heat effects, and electrical and magnetic effects. Threshold effects are often part of absorption phenomena, thus giving clues to the specific identification of some required scalar motion interactions.

HEAT AS A DISTRIBUTED MOTION

The mathematics and useable behavioral characteristics of heat processes are thoroughly discussed from the viewpoint of experimental analysis in most elementary physics and chemistry courses while more technical details and practical applications of heat processes are presented in thermodynamics courses. The theoretical aspects of thermal energies are seldom attempted even at advanced levels. The mathematics of the theoretical description of heat with respect to the Reciprocal System of theory have yet to be completed, although the qualitative aspects are fully in accord with experimental observation.

To effectively remain as a temporary part of atoms or groups of atoms for any reasonable period of time, an added motion must be associated with the units of the background primary motion and with the atoms, jointly, or with the atoms, only. In order to not be incorporated as permanent constituents in the motion of atoms or groups of atoms the added motion must have a displacement represented in a different mode from that which defines the identity of the atoms. The added motion may be represented in the same dimension as that of primary motion, but is not necessarily required. One directional rotationally distributed positive or negative displacements are the kind of displacements that are permanent parts of atoms, and therefore, cannot be the kind of motion that has only temporary association with identifiably specific atoms. The only types of displacement motion that can satisfy the requirements of direction and mode are positive $1D1d_L$, $1D2d_L$, and positive or negative $1D2d_R$, and only negative $2D2d_R$ displacement motion.

Since the direction of the normal progression in equivalent space is inward toward the zero of generalized dimensional space, the inward direction of representation of a positive $1D2d_L$ displacement motion is not effective. The representation of $1D2d_L$ motion in the outward direction from zero is inward toward unity and is effective. The outward direction from zero toward unity is coincident with the effective direction of the force effect of the rotational displacements that make up the atoms of the group. Adding the outward effect of the positive displacement $1D2d_L$ motion to the effect of the rotationally represented displacements of the atoms or groups of atoms causes an outward shift in the point of equilibrium between the force effect of the primary progression and the net force effect of displacement motion represented in that direction in generalized space. The net effect is similar to that of a force of tension among the atoms or groups of atoms. This shift increases the equivalent distance of separation in direct proportion to the distributed magnitude of the $1D2d_L$ motion added on a temporary basis. Thus, positive $1D2d_L$ displacement having only temporary association with a group of atoms or a single atom in the dimension of the primary progression is identified as the motion responsible for the phenomena of heat. As implied by referring to groups of atoms, the average distance of separation can be modified between individual atoms or specific polyatomic groupings of atoms in polyatomic groups. Each atom or group of atoms is referred to as a *thermal unit* or *thermal group.*

Thermal $1D2d_L$ displacement motion is distributed among all possible directions of the time region dimensions specified by the inter-regional ratio, not ALL directions as rotationally represented motions are. For solid to liquid phase change to occur, the distributed magnitude of the $1D2d_L$ displacement component must be sufficient, not only to bring the net motion to unit value in one reference point dimension of a sufficiently large number of thermal groups, but it must be capable of maintaining that value for a specific proportion of the sample in question. The sample in question refers to the specific physical size of the microcrystal, not to the overall sample. The specific ratio of solid to liquid phase thermal units is determined for each substance by geometric considerations for the structure of the microcrystals.

Of course, for reorientations among the atoms of polyatomic groupings to occur conditions must exist for a specific orientation of the atoms present in the polyatomic group. The number of orientations of each type and the mass effect of the displacements represented within a polyatomic grouping determine the magnitude of $1D2d_L$ displacement motion required before reorientation of the atoms within the polyatomic group can occur. Reorientation of atoms may change which atoms are grouped together in the subsequent thermal groups, thereby causing changes in the formulas of the resulting compounds. If atomic reorientations can supply the required energy and if the necessary activation energy is available, then a change of composition of the solid phase is observed, sometimes with concomitant formation of either a liquid or gas phase component which is, of course, dependent on the total energy available at the energy state at which transition occurs.

If atomic reorientation energy is not available, the molecules or other crystal structure components acquire net translationa1 motion in one dimension. Freedom from the restrictions of an orientation position in one of the time dimensions (which is randomly oriented in generalized space) including distance of separation in space, may increase for a large enough number of the individual components of a crystal structure for total collapse of the spatial arrangement. This is the process of melting which shows that each

thermal unit and individual combination of thermal units has its own melting point or decomposition point.

To be sure, statistical analysis for critical size and configuration for geometrical components in a crystal structure play an important part in the determination of melting points. It is the distribution of thermal energy throughout the geometric structures under consideration that determines the temperature range for an observed melting process. This is why powdered samples give more precise results in melting point determinations; small crystals provide greater surface area which provides a much larger surface area to volume ratio and smaller physical volumes over which the thermal motions must be distributed. At the temperature of collapse for the crystal structure, the identifiable melting point, added heat energy is channeled as a result of probability distribution into continuing the thermal destruction of the crystalline form. For the liquid phase to persist, the net thermal force effect must be maintained at unit value or greater in one dimension of the individual coordinate system without any contribution from rotationally represented components in that dimension.

If freedom from restriction of orientation position in the time region and geometric position in space do not occur simultaneously, then a gradual change in the geometry occurs as observed in the spatial aspect. Gradual changes of this sort are classified as softening, as in glasses. Regular geometric positioning, whether in the spatial aspect as for the recognized crystal structures or with part of the order in the temporal aspect as for substances classified as glasses, thereby lacking apparent regularity of geometric positioning of atoms in space, is a result of the types of orientations involved among the atomic constituents and thus whether the particular interatomic distance taken between each pair of atoms in the overall array is specific or merely an average. In substances like silicon dioxide, the inclusion of very small amounts of other atomic components disrupts the spatial regularity although a crystal like regularity continues to exist by considering the three dimensionality of time.

Thermal motion is continually being redistributed within each sample of matter and with its environment. Each quantity of $1D2d_L$ motion added to the system under consideration causes further distribution of the units of thermal energy available. Redistribution changes the number of thermal units having sufficient thermal energy exceeding unit value distributed in all three dimensions of generalized space, thereby making possible the transition to three dimensions of freedom representative of the gas phase. From this concept the *critical temperature* of many substances has been calculated.

Since pressure is a measure of the total thermal energy per unit volume in the gas phase, the vapor pressure of a liquid depends on the distribution of the available thermal energy among the thermal units, which controls the number of thermal units in the gas phase. Each thermal unit must have sufficient thermal energy to continue in the gas phase or it will degrade back to the liquid or solid phase on an individual unit basis by collision or statistical distribution by condensation with cooler thermal units. In the redistribution process some of the $1D2d_L$ motion is redistributed by contacts among the groups of molecules in the expanded phase or by collisions of gas phase molecules with either of the condensed phases. Evidence of this transition is observed for collision of low energy thermal units with other compound motion structures with which they can orient, dew formation, or as a result of higher energy collisions by which transfer of some of the positive $1D2d_L$ motion can be accomplished, cloud formation. It is the $1D1d_L$ spatial velocity equivalent of the $1D2d_L$ motion of the individual molecule that changes to some

value less than the *critical* energy in all three dimension for that type of thermal unit that allows condensation to form the liquid or solid phase. A dynamic equilibrium of phases is established at any set of temperature-pressure conditions below that of the *critical* conditions.

Remembering that all of the heat energy of the system is displacement motion in the equivalent space of the molecules, and that contact between motions in that region with the outside region or the next contiguous equivalent space region are point contacts, and that all motions (even the imputed vectorial motions that bring displaced units of motion together) are continuous at points of contiguity, transfer of motion is one dimensional upon contact between compound motion structures. Radiation of thermal vibration energy is a different dimensional matter entirely.

Collisions among thermal units having critical energy or greater result in pure elastic collisions minus whatever thermal energy transfer can and does occur for equilibration purposes. Thus, not only specific heats, but melting points, vapor pressures at specific temperatures (and thus, boiling points), and critical temperatures and pressures are calculable directly from this theory. Vander Waals constants, London forces, and many other constants are purely empirical "fudge factors" and have no significance relative to any specific representable scalar motion.

ABSORPTION AND EMISSION OF PHOTONS

Other than heat transfer interactions, the most obvious and fundamental phenomena in which photons interact directly with atoms and molecules of matter are absorption and emission spectra. The interaction upon which many other phenomena owe their interpretation is the presently accepted interpretation for emission spectra of hydrogen. The presently accepted theoretical interpretation of spectra depends on complete acceptance of the nuclear model of atoms. Considering the fact that the Reciprocal System of theory starts with the idea of motion and constructs all entities and phenomena from the representation of scalar motion in dimensional systems, the analysis of atomic spectra must be in terms of motion.

From the previous discussions in which speed displacements have been in terms of full units of motion, it may seem that gaps must exist in the availability of intermediate values of total motion to be represented in either of the three dimensional aspects. The specific quantities of rotationally represented displacement motion have determined the identities for the atoms of matter. The inter-regional ratio indicates the scalar relationship of the alignment relations among the dimensions of equivalent space and generalized space. The requirement for primary motion to be represented in one of those directions provides the basis for the representation of $1D1d_L$ and/or $1D2d_L$ displacements leading to the phenomena of translational movement and thermal movement, respectively. BUT, because these displacements are concurrent with complex motion structures having effects distributed in all directions in the time region, equivalent space, as well as in generalized space, the linearly represented displacements cannot be mathematically represented in the same way as the rotationally represented displacements, either magnitudinally or directionally.

It is because of the reciprocal relation of space and time that the equivalence of the formulation of that relationship as motion, s/t, or as energy, t/s, becomes understandable. A specific total motion or speed of n/1 is equivalent to an energy of 1/n, as also a speed of 1/n is equivalent to an energy of n/1, but each is not equal to the other even though each can be added to the other as long as the net total motion represented in all three

geometric dimensions of a given compound representable motion in the material sector has a net value less than unity. The displaced motion that is being rotationally represented causes the mass effect. It is a three dimensionally distributed motion. The displaced motion that is being co-represented at the same Notational Reference Point in a linear manner is not a three dimensionally distributed motion although it is distributed three dimensionally by the generalization of the spatial reference system of normal experience. Because of this difference of representation of the displacements, the effect of the distributed linear displacements is instantaneously in one direction with an inherently one dimensional effect; energy instead of mass.

In the generalized spatial system the zero starting point of energy has been considered to be some value close to, but not equal to, zero space velocity. From the previous conceptual viewpoint, units of motion and units of energy were treated as being of similar magnitude in the same manner as were the magnitudes of space and time units. For continuity of the everyday conceptual view of this world it is normally assumed that space and time have a limited relationship and that they are of the same order of magnitude. The magnitude of one second of time is usually treated as though conceptually equivalent to about one centimeter of space, and that both space and time are infinitely divisible, while in the development of the Reciprocal System of theory both are quantized and one second of time is equivalent to over one hundred eighty six thousand miles of space. Increments of energy having been viewed strictly from the naive position of being an effect having the same zero reference as vectorial motion, rather than as the reciprocal of displacement motion, as it theoretically exists in the natural reference system of the universe of motion, has caused the normally accepted view of this world and universe to be very skewed.

If a scale is set up with low speed, 1/n, near one end and high speed, n/1, near the other with unit speed in the middle, we find that high energy is at the same end as low speed and low energy at the end with high speed. From our position near zero of a three dimensional reference system, either zero speed or zero energy as the reference level for a summation of speed and energy seems to show that the scalar directions of deviations in speed and energy are oppositely directed. BUT, the energy under consideration is a

	← Primary →			
Displacement s/t speed	0 1/n	eq. prim. 1	n/1	
t/s energy	n/1	1	1/n	0

displacement motion, not primary motion. In the natural reference system outward from unity is the same scalar direction regardless of its specific direction or magnitude in a three dimensional reference system.[26]

Adding more increments of one Dimensional linearly represented displacement motion, whether they cause a change of thermal energy or of translational movement, brings the total displacement closer to the equivalent of primary motion; NOT toward primary motion.

All added motions are to individual Notational Reference Point systems and are, thereby, inside unit space which requires the squaring of that quantity of motion for measurement in the outside region. A positive displacement being inward in the spatial aspect and outward in the temporal aspect has the effect of adding directly to the time aspect of the compound motion in a specific spatially linear direction. Considering the energy representation at a Notational Reference Point, this additional unit of displacement moves the total motion of the NRP closer to the equivalent of primary motion in one direction. Thus, the starting value is represented as $1 - 1/n^2$. The added, motion, energy, is $1/m^2$. The net displacement motion of the individual system would be represented by the relation:

$$\frac{s}{t}=\left(1-\frac{1}{n^2}\right)+\frac{1}{m^2}=1+\frac{1}{m^2}-\frac{1}{n^2}$$

but since ordinary motions are so close to zero relative to equivalent primary motion, that value must be subtracted out for ordinary work in a stationary spatial reference system. Thus, the energy equivalent for the increment becomes:

Equation 16

$$\frac{t}{s}=\frac{1}{m^2}-\frac{1}{n^2}+1-1=\frac{1}{m^2}-\frac{1}{n^2}$$

$n < m$, where n and m represent some number of units of deviation from the natural datum. For $n < m$, the net energy represented for the final state from zero space is farther from zero, but is actually a greater deviation from unit t/s. n & m are the number of effective units of displacement from primary unity, not equivalent primary motion. From the zero reference of the spatial reference system n and m appear to be in the opposite order. Don't get confused by trying to stick with interpreting values of displacement as being from the zero of spatial velocity. Reiterating from Chapter Two in the section on Essential Considerations: "One of the first essentials for an understanding of the system of motions that constitutes the theoretical universe of motion defined by the Reciprocal System is to relate all motions to the natural reference system."

Since energy is normally formulated as t/s and is, therefore, a one dimensional relation, the expression or effect in dimensional space is a change of one dimensional speed which is recognized as a linear velocity. The added energy causes the net deviation from equivalent unity to be less in one dimension of space and, thereby, seems to be moving in a particular direction rather than remaining stationary. The emission of photons causes the net deviation from unity of the emitting structure to be farther from equivalent unity and nearer to the equilibrium condition of its surroundings in dimensional space because absorption of energy caused greater deviation from those equilibrium conditions. Since the actual displaced motion of photons of radiation can be expressed as energy, t/s, the emitted radiation from excited (having greater than the ambient or average energy as measured from the zero of space) atoms of an element can be represented mathematically by the change in total energy of the atom from before emission, $(1 - 1/m^2)$, to that after emission $(1 - 1/n^2)$, of the radiation. Thus, $\Delta E = 1/n^2 - 1/m^2$. $1/n^2$ represents the state farthest from equivalent unity or the nearest to primary motion; i.e., the least displacement possible from the environment and, thereby, from primary unity.

If the radiation is emitted by an atom having equivalent positive electric displacement of one unit, the smallest numerical values consistent with units of energy which that kind of atom can absorb or emit would be in small whole number multiples of unit motion or unit energy. Thus, in an arbitrary system of measure such as that which we use on this planet, the numerical value found to be consistent with the units of measure of that system is

representative of unit speed in that system. The quantity identified as the Rydberg constant for mass one hydrogen is thus the magnitude of unit motion, unit frequency, or unit energy, depending on how we wish to express the value.

It is noted that the inefficient method of increasing net speed from the zero of space by adding displacement units of energy has a limiting value of unity in that dimension, equivalent primary motion. Thus, the speed of light is a very real barrier to one dimensional translational motion in space for any compound displacement motion structure. One dimensional movement is the only kind of motion directly representable in three dimensional space; therefore, that must be our reference for observation and analysis.

CHAPTER VIII: REFERENCE PHENOMENA

REFERENCE POINTS

In the universe of motion derived from the postulates for the Reciprocal System of theory, a generalized three dimensional reference system is deficient in its ability to correctly represent the nature of the scalarized (dimensionally randomized) motion causing any given effect. Without this deficiency none of the observed effects or behaviors of matter could be observed, nor would there even be such a thing as matter. Designation of reference points serves the dual purpose of facilitating mathematical description of the motion causing the phenomena and providing a conceptual base from which verbal description of the phenomena becomes simplified.

The designation of different types of reference points is merely an auxiliary device to compensate for the deficiencies and limitations of the spatial and temporal reference systems. Reference points constitute the zero point in generalized space from which a motion or an effect of motion can be measured. The specific effect represented in the dimensions of a generalized three dimensional system is determined by the nature of the motion or motions present and/or newly added for representation at a specific Notational Reference Point. One dimensional effects are always represented radially outward from a reference point. Two dimensional effects are two dimensional loops through the reference point; one such reference point would be randomly directed in space and would seem to be spherical, but a string of such points would have limited randomness of arrangement in space and appear to be a toroidally shaped effect.

The unavoidable nature of conventional language and usage by which things and concepts are identified, requires that the name given to a type of reference point should also describe something about the reference point in question. The directionality and dimensionality of the scalarized motion causing the phenomena determines how each reference point is to be designated: high, low, positive, negative, north, south, or in some other manner.

It is the ambiguity of positive and negative direction and the fact that there are always representations of scalar motions at individual reference points that are unrepresentable as other than an effect that causes the necessity for designating some reference points as positive and others as negative. The effects caused by scalar motions represented in one dimension of a reference point system must be different from the effects caused by scalar motions requiring representation in two dimensions. The question of how one determines whether the reference point in use is to be designated as a positive reference point or a negative reference point or in some other manner is simply how the motion unit responsible for the effect is represented: 1D or 2D, $2d_L$, $1d_R$ or $2d_R$; as well as whether a change in scalar directionality is required, and in which generalized aspect of motion the effect is being represented.

In the natural reference system there is only motion; no mass and no gravity; there is only the concept of change; motion, but no actual change of location because location is a dimensional concept; there is no tendency to move as we normally think of “move”; there are no forces in the natural reference system of scalar motion. Inward, outward, and

around are only orientational directions relative to some specific reference point coordinate system. Primary motion and linear vectorial movement, an effect having as a limit the equivalent of primary motion, are the only motions that can be directly represented in the generalized three dimensional reference system. It becomes obvious that every phenomenal thing or effect other than the movement of photons is an effect of, rather than a direct representation of, displacement motion.

The limitations of a generalized three dimensional reference system cause the effects of all displacement motions to be distributed in a manner that may subsequently require an object to have vectorial movement in a specific spatial direction. The particular representation of scalar motion that involves all directions of all three dimensions of an individual reference point system is the $2D1d_R$ displacement motion that is fundamental for the effects identified as atoms of matter; the $1D1d_R$ atomic motion modifies the effect of the $2D1d_R$ motion. The two Dimensional rotationally represented motion of atoms is fundamentally distributed in all directions of the individual reference point system with equal probability for effect. As a result the magnitude of the effect can only be related to how much displacement motion is being represented at the Notational Reference Point and how far away from the NRP a measurement is being made; i.e., mass and gravitation effects. The gravitational effect is radially outward from the reference point for mass; i.e., effectively one dimensional because of the limitation of the generalized system in which to represent the effect.

If different types of reference point effects originate at the same physical location the physical movements caused by the respective effects may be in the exact same spatial direction or the opposite spatial direction because representation in space for the effects of all reference points is outward from each reference point. That is why they are called reference point effects.[27] Displacement motions having representational complexity greater than the unidirectional rotational representation for the mass effect of atoms merely modify and/or add to the mass (and gravitational) effects already present.

Some effects actually seem to separate from an origin and proceed through three dimensional space; for example, photons originate at negative reference points and proceed outward in randomly selected directions at the speed of light. Photons are themselves either high or low energy reference points. The photon representation involves alternating directional representation in the generalized dimensional system for the effect of the $1D2d_L$ displacement motion to achieve the effect of equal probability distribution for the $2d_L$ motion. The photon $1D2d_L$ displacement motion is represented perpendicular to the primary progression which must be represented as outward in the three dimensionality of the aspect in which the interaction responsible for the identification of the presence of the photon occurs. Since the primary motion unit is represented as outward toward more positive values of space and time, *the reference point from which each photon is emitted is referred to as a negative reference point*. The observation of effects for all light speed particles is made only upon interaction in the spatial aspect; therefore, the type of reference point required by all light speed "particles" is negative because they all move outward toward more positive values in both the spatial and the temporal reference systems from an apparent condition of non-existence that is similar to the origin for photons of radiation.

Gravitational reference points are designated as positive because the effect is in the negative direction toward the reference datum of unity of space. Gravitation results from the continuous motion identified as displacement oriented negatively in the spatial aspect

and positively oriented in the temporal aspect of each individual Notational Reference Point in the material sector. For most reference point effects the direction, either positive or negative, of the temporal aspect of a specific displacement motion is responsible for the negative or positive designation for the reference point. The normal flow of time is always positively outward from now. Directionality of the time aspect of the displacement in question does not enter into the question of type of reference point for either photons or gravity because the effect of the causative motions does not modify the normal outward flow of time with respect to the NRP.

ROTATIONAL OSCILLATIONS: ONE-DIMENSIONAL

The use of a different representation mode for a next displacement motion always gives rise to a different phenomena not previously observed. At a specific temperature which is unique for each kind of *thermal unit,* the thermal $1D2d_R$ displacement motion distributed with the thermal unit becomes sufficient for a portion to become equally representable as a $1D2d_R$ motion. This representation is within the thermal unit and extends from a particular $1D1d_R$ displacement. For the condition at which the total thermal oscillation can be consistent with environmental conditions and a portion of the distributed positive displacement $1D2d_L$ thermal motion to become represented as $1D2d_R$ displacement motion of an individual NRP atom or an associated electron, a conversion occurs. The change of mode of representation is accomplished by a **zero energy** conversion process whereby one kind of two directionally represented motion appears as another kind of two directionally represented motion. This type of motion conversion always occurs at threshold conditions and results from a probability distribution for conservation of motion units identified by D.B. Larson.[28]

All units of $1D2d_L$ thermal displacement motion are distributed among all possible directions designated by the inter-regional ratio and as dictated by the complexity of structure of each thermal unit. The change of representation is not a direct unit for unit conversion as measured from the three dimensional reference system view point, particularly with respect to the 2L = 8R equivalence. This new motion of atoms and other thermal groups is identified with electric charge effects and is a motion that is inherently distributed within the individual NRP. Thermal motion is distributed in generalized space by random orientation generalization, whereas the electric charge is distributed within the individual reference point by rotational representation prior to random orientation of the reference point coordinate system.

If the conversion is to the charge effect on an electron, the electron can have effective motion distributed in the dimensions of space. Recall the notation for an electron, M 0-0-(1). Offsetting the negative displacement of the photon by positive rotation to form the material sub-atomic rotational base causes zero net displacement. The (1) indicates a negative displacement in the electric dimension. This $1D1d_R$ unit of motion is inward in the temporal aspect and outward in the spatial aspect. The outward progression of either aspect, particularly time, cannot be nullified. The normal progression of primary motion is always represented in one direction in a linear manner and, thereby, is being represented along one of the axes perpendicular to the photon oscillation effect of the electron NRP. Neither the space aspect nor the time aspect of primary motion may be associated with the other aspect of a displacement motion in a different mode of representation in an attempt to constitute effective motion; thus, neither the uncharged electron configuration nor the uncharged positron configuration has effective motion. The electron can have existence in the uncharged condition while associated with normal atoms of matter, which have excess positively oriented rotationally represented time

beyond the normal progression. By taking on a unit of $1D2d_R$ positive displacement, the charged electron is capable of independent existence as effective motion separate from atoms of matter. That is why electrons are identified only as separate entities having electric charge and never in the uncharged condition. Uncharged positrons are capable of direct association with atoms of matter because they are the same type structures; rotationally represented positive displacement motion. Both charged electrons and charged positrons may remain with atoms of matter causing the specific atom to exhibit appropriate charge.

By the conversion of thermal $1D2d_L$ motion to electric charge, $1D2d_R$ motion, along with transfer of $1D1d_L$ translational motion, electrons can be given translational movement and charge. This process is referred to as thermionic emission of electrons. As a threshold effect, other sources of $1D2d_L$ energy can also be used to accomplish the same effect, so long as the source is of sufficient magnitude to meet the threshold requirements for conversion of representational mode and any other orientational requirements, including translational velocity effect for the emitted electron, as in the photoelectric effect.

It takes a large, but calculable, number of units of thermal motion to cause equivalency for a specifically associated unit of $1D2d_R$ displacement. The distribution of motion at the designated reference point in generalized space may be the same, but the effective equivalent magnitude of displacement motion is different. Therefore, the effect expressed in generalized space must be different; in effect, as well as in magnitude. The number of distributed units of displacement must equal or exceed the representational equivalency of thermal motion in a specific thermal unit to be represented as $1D2d_R$ rather than $1D2d_L$; thereby, achieving the threshold for the charge effect for that kind of thermal unit. In other words, while participating in the total thermal motion of the emitter, the change of mode of representation allows one or more associated electrons to become represented as having effective displacement motion, individually, and have translational displacement motion separate from that of the emitter. Environmental conditions include normal electron densities for different materials. Electrons are present with all atoms of matter; they are just not required constituents of atoms.

As with other one dimensional effects, the electric charge effect is radially outward in three dimensional space from the source, in a manner more like that of the mass effect than like that of the other one dimensional effect, heat, previously considered. However, in like manner with thermal effects, the charge effect is confined within the specific thermal unit of which it is a member. Heat effects merely modify the point of equilibrium with the normal outward progression from unity and, thereby, interatomic distances. Charge effects are described mathematically in a manner similar to gravitational effects which are referred to generally as field effects. Photon emission is a separation of the photon from the emission reference point and subsequently becomes its own reference point, high or low energy, for a dimensional effect perpendicular to its direction of natural progression.

The electric charge effect is radially outward from the reference point, individual atom or group of atoms, and the magnitude of the effect is, therefore, inversely proportional to the square of the distance in generalized three dimensional space from the center of the Notational Reference Point carrying the charge and is directly proportional to the magnitude of the displacement motion causing the effect. In the case of photons, random directionality taken upon separation of each photon and the geometry of space is responsible for the inverse square law relation for intensity of radiation. Polarization of

photons is a function of the emitter. In the case of the electric charge effect being discussed, the diminution of magnitude of the effect is caused strictly by the geometry of the mathematical dimensionality of space. The presence of the motion causing an effect causes the effect to be instantaneously present, the electric charge effect is not propagated through space.

A positive electric displacement (inward in the spatial aspect) can support, with high probability for anything other than transient stability, only a negative $1D2d_R$ displacement, while a negative electric displacement (inward in the time aspect) can support only a positive $1D2d_R$ displacement. Since positive $1D2d_R$ units of displacement can be added only to negative electric displacements, with other than transient stability, they should be named as a positive charge. Historical precedent overrides this naming by referring to such charges, added to atoms identified as having the requisite negative displacements, as the negative (-) electric charge.

By similar arguments, the negative $1D2d_R$ displacement motion added to atoms or thermal units having only positive rotational displacements is called the positive (+) electric charge.

Any atom normally represented with negative electric displacement can also support negative $1D2d_R$ displacement units by reorientation of the negative electric displacements to a totally positive representation, because an atomic representation involving negative electric displacement can be represented using totally positive displacements. Since the atomic number is the same as the number of equivalent positive electric displacements for atoms of a given element the maximum number of positive[1] (+) electric charge units which an atom of an element can support is its atomic number. Because the electric displacements are rotational representations of the entire magnetically rotating structure, the differences of ionization potential required to add charges to the equivalent electric displacement units obtained from magnetic displacement equivalencies is greater than that required to add charges to pre-existing positive electric rotational displacement units.

The positive or negative character of each reference point is based on both the displacement direction and the mode of representation that causes the requirement for designating the reference point. A question of importance is "does the displacement causing the reference point requirement extends from primary motion or from a previous displacement?" From primary motion the displacement must be $1D1d_L$ or $1D2d_L$. From a $1D1d_R$ displacement the added displacement will be $1D2d_R$. From a $2D1d_R$ displacement the added displacement will be $2D2d_R$. The displacement direction of the motion requiring reference point designation is always opposite to that of the direction of displacement of the motion unit from which it extends. *The direction in time, positively or negatively, from which the newly added reference point displacement extends defines whether the effect generated by the new displacement unit is referred to as a positive or negative reference phenomena.*

[1] As presently named. "From a logical standpoint, a rotational vibration with a space displacement should be called a negative charge, since it opposes a positive rotation, while a rotational vibration with a time displacement should be called a positive charge. On this basis, the term "positive" would always refer to to a time displacement (low speed), and the term "negative" would always refer to a space displacement (high speed). Use of the terms in this manner would have some advantages, but so far as the present work is concerned, it does not seem advisable to run the risk of adding further confusion to explanations that are already somewhat handicapped by the unavoidable use of unfamiliar terminology to express relationships not previously recognized. For present purposes, therefore, current usage will be followed, and the charges on positive elements will be designated as positive. This means that the significance of the terms "positive" and "negative" with respect to rotation is reversed in application to charge." (*Basic Properties of Matter*, p. 151)

Table 7: Reference Points

type of motion unit requiring reference point designation	effect identified as	direction of motion unit from which reference point motion extends		type of reference point
		in space	in time	
$1D2d_L$ + primary	emission of photon	primary positive	primary positive	negative
positive $1D1d_R$ displacement	increase mass	negative	positive	positive
negative $1D1d_R$ displacement	decrease mass	negative	positive	
positive $1D2d_L$ extends from primary	heat	positive	negative	negative
positive $1D2d_R$ displacement	negative electric charge	positive	negative	negative
positive $1D2d_R$ displacement	positive electric charge	negative	positive	positive

The positive $1D2d_R$ displacement unit of motion extends from a negative electric displacement, $1D1d_R$. The positive $1D2d_R$ displacement unit has its spatial aspect extending in the positive rotational direction in space and its time aspect extending in the negative temporal rotational direction. Since the time aspect of the new unit of displacement is now extending from the negative datum of time toward more positive values, *the negative* charge*, a positive $1D2d_R$ displacement, *causes the atom, to which it is attached, to act as a negative reference point for the electrostatic charge effect.*

A positive electric displacement, or the electric equivalent of a magnetic displacement, from which the positive* charge motion extends, is a unit of motion in which the space aspect is negatively oriented with its time aspect positively oriented. The negative $1D2d_R$ displacement unit responsible for the positive* charge requires a change of time direction from positive to negative toward less positive values. It is this change from the normal positive direction of the time aspect of a positive electric displacement to negative in a negative $1D2d_R$ displacement that causes this motion to be designated a positive reference point for electric field effects in addition to designation of the atom as a positive gravitational reference point.

The effect of the displacement motion causing either electric charge is outward from the atomic reference point. Common electric charge reference points will move outward from each other while opposite charge reference points will move toward each other because each effect is toward the starting point of the opposite charge reference point effect. The movement of the reference points carries the charged atoms or groups of atoms toward or away from each other in generalized dimensional space according to the character of the reference points from which the charge effects extend. Like charges repel, move apart, while unlike charges attract, move toward each other in space.[29]

The outward movement of like charges, repulsion, is reduced to a negligible, or at least immeasurable, amount within a relatively short distance. The situation between unlike reference points is very much different from that of like charges because the movement toward each other in space brings the charge carriers into contiguity. Oppositely oriented atomic rotations, continuous along the same time line between contiguous structural units, will offset, completely or partially, the effect of the other for a potentially stable chemical orientation. These may be either $1D1d_R >< 1D1d_R$ or $2D1d_R >< 1D1d_R$.

Subsequent separation of the atomic or molecular units may result because of unbalanced orientations; that is a different matter, entirely, from the required orientation for charge approach.

Contact between oppositely charged atomic structures brings the oppositely oriented $1D2d_R$ displacements into contiguity because of the alignment of electric displacements of the atoms carrying the charges. Immediately upon passing the outer gravitational limit and achieving unit distance separation, the continuation of motion causes the atoms or polyatomic groups to take equilibrium distance positions in equivalent space corresponding to appropriate orientation relations. Atomic orientations being in the same temporal dimension causes the oppositely directed $1D2d_R$ motions to be in the same temporal dimension. The presence of oppositely directed $1D2d_R$ displacement motions in the same temporal dimension of a unit of motion is an unstable situation.

Even though the $2d_R$ motions are displaced from unity in opposite scalar directions, they are not opposites in the same sense that $1d_R$ motions are oppositely oriented. The effect of a $1d_R$ motion is a mass effect, while that of a $2d_R$ motion is a charge effect. A $2d_L$ displacement can be associated with primary motion whether that primary unit is associated with an atomic coordinate system or not, whereas, a $1d_R$ displacement is stable only in an atomic or sub-atomic coordinate system, thereby, a $2d_R$ motion is stable only in association with an atomic reference point. Since oppositely directed $1D2d_R$ displacements are not stable in the same dimension of primary motion, the $2d_R$ motions transfer to and stay with successive units of primary motion as $1D2d_L$ effects. This effectively separates the charges from the displacement motion of the atoms to become observable as the emission of the simplest of oscillational units, photons of both high frequency and low frequency. Any discrepancy between symmetrical displacements from unity of these photons is retained with the thermal unit as thermal oscillation of some amount or separated as charged electrons, thereby accounting for any temperature change of the matter portion of the system occurring during discharge, as well as other extreme heat effects.

Scintillation experiments confirm the emission of photons upon annihilation of electric charges. The emitted photons may be at any angular relation to each other due to randomness of direction for representation of primary motion in space, with simultaneous or very nearly sequential emission: i.e., no more than a few natural time units apart. Simultaneity experiments have not to my knowledge been conducted up to the present time. Such experiments would have to show both the temporal and frequency relation between the low and high frequency emissions, not an easy task with present technology.

Although quite an important agent for both chemical and physical change in the low temperature environments of planetary surfaces, the electric charge is a temporary appendage because of the relative ease of attaching and detaching $1D2d_R$ units of motion to material particles by an appropriate force couple, including the photoelectric effect. The outcome of many physical events is often influenced more by the temporary presence of electric charges than by the basic motions of atoms and the movements and orientations resulting therefrom. It should still be recognized that electric charges are transient appendages very much like thermal oscillations and kinetic motions of atoms of matter.[30]

ELECTRONS AND ELECTRIC CHARGE

A difference of considerable importance is that of the addition of electric displacement to the single photon rotational base and the addition of a unit of electric rotation, $1D1d_R$, to

an atom which has effective magnetic displacement. Electric displacement added to an atom, which is already an effective speed less than unity, modifies the total effective displacement, whereas an electric displacement added to the single photon rotational base modifies non-effective speed displacement. This resultant motion is from zero displacement, rather than from an effective displacement reference.[31]

Recall the descriptions for a negative displacement; a unit of motion composed of a unit of space in the normal positive direction and a unit of time in the negative direction. In a scalar magnitudinal sense the inward time aspect of the negative electric displacement unit of motion can be thought of as offsetting the effect of the unit of positively oriented time of the unit of positive displacement used to form the material sector rotational base. Adding a unit of negative electric displacement motion to the single photon rotational base creates a structure that is effectively a unit of negatively oriented space having rotational directionality.

The net positive displacement of atoms is oriented negatively in space and positively in time; thus, atoms are effectively excess rotationally represented time structures. As rotationally represented units of space, electrons may form relations with the rotationally directed time aspects of the positive displacements of atoms, and thereby, move from atom to atom as effective motion. The specific directionality of the displacements of each kind of atom determines not only the orientations of which each is capable and their effective chemistry and interatomic distance characteristics, but also their electron carrying capacities and the freedom with which those electrons can be transferred at various temperatures.

The negative $1D1d_R$ displacements of the non-metals effectively reduce the available excess time both dimensionally and quantitatively. The excess time of the magnetic displacements of atoms is of sufficiently greater energy than that of the electric displacements as to reduce the freedom of the rotationally represented space units for maintaining motion with positive magnetic displacement time. Thus, the elements of Divisions I, II, and III provide greater freedom of movement for the rotating space units than do the elements of Division IV in their ground states. Electric displacements involved in orienting atoms for compound formation are not available for relating to the rotating space units. Most normal valence compounds in pure solid form are poor conductors because they provide inadequate dimensionality for the rotating space units. The presence of only Division IV elements in complex polyatomic structures usually reduces the freedom of movement of the rotating space units to such a level that the substances are referred to as insulators. Elements that are borderline between Divisions III and IV provide degrees of freedom that are environmentally, including temperature, dependent for movement of the uncharged electrons, and are referred to as semi-conductors. The rotating space units may not have $1D2d_R$ displacement units associated therewith, and therefore, not exhibit charge effects. The presence of uncharged electrons with the atoms of a substance makes it easier for the compound structures (atoms plus extra rotational space units) to accept a charge by formation of charge couples.

Within the gravitational limits of any galaxy, uncharged free electrons, rotating space units without charge can exist only in association with atoms of matter. Outside the gravitational limits of a galaxy is often referred to as free space. The rotating space units without charge cannot move freely within galactic space because the relation of space to space is not motion. The presence of electric charge makes it possible for these units of rotating space to become free from atoms of matter because the $1D2d_R$ displacement unit

is a positive displacement which provides extra positively oriented rotationally represented time, thus the charged electron is effective motion and can exist on its own and be identified as a separate physical entity.

ROTATIONAL OSCILLATIONS: TWO-DIMENSIONAL

Atoms of the theoretical universe of motion are basically composed of displacement motions represented as $2D1d_R$, two dimensional unidirectional rotationally represented displacement motion structures, most of which also have $1D1d_R$, one dimensional unidirectional rotationally represented displacements. For certain kinds of atoms a condition exists in which a quantity of $1D2d_L$ motion is sufficient for some of the total two directional motion to be converted by a zero energy conversion process to $2D2d_R$ displacement motion.

Even though the $2D2d_R$ displacement motion is being described subsequent to the discussion of $1D2d_R$ displacements, the $2D2d_R$ displacement actually has a higher probability of being represented than does the $1D2d_R$ displacement. The reason for there being a lower incidence of the appearance of $2D2d_R$ effects is caused by the inability of most atomic structures to support that type of displacement. All atomic structures are able to support $1D2d_R$ displacement motions. For those structural representations having high probability for supporting $2D2d_R$ displacements, the effects of the $2D2d_R$ displacements may always be present at temperatures far below the threshold for zero energy conversion of heat effects to electric charge effects, $1D2d_L$ to $1D2d_R$.

Since magnetic displacements of the atoms are positive $2D1d_R$ displacements, the added magnetic charge $2D2d_R$ displacement motion is a negative displacement and must appear as a property extending from a positive displacement. Because each magnetic displacement is oriented negatively in space and positively in time, both magnetic field directions are outward from positive reference points toward more negative values. Since there is no pre-existing terminology which can dictate the nomenclature, the material sector magnetic charge is called a negative magnetic charge because it is a negative $2D2d_R$ displacement, positively directed in space and negatively directed in time. Positively displaced $2D2d_R$ units of motion cannot be supported directly by atoms of material sector matter and, therefore, are not observed under normal material sector planetary surface conditions in three dimensional space.

Magnetic displacements apply to both rotating systems of an atom, and therefore, atoms that can support magnetic charges will carry increments of two magnetic charges. Magnetic charges exist only in pairs.[32] The combination of magnetic and electric displacements of iron provides the clue to understanding the structural representations that are capable of supporting magnetic charges. The magnetic displacements must be asymmetrical and an electric 8R must be complete relative to the individual reference system.[33]

Larson's description for the division of the magnetic effect between the two units of magnetic charge carried by a magnetically charged atom as modified by the terminology that is adopted in this introduction is as follows: Each of the two $2D2d_R$ displacements has in common the dimension of normal progression represented in three dimensional space, the electric dimension, and have the other effects of the $2D2d_R$ motions distributed around the other two dimensions of the individual three dimensional system. This is tantamount to saying that together the $2D2d_R$ displacements define the positive or negative character of the reference point and the other dimensions determine the manner of distributing the effect in generalized space. The distributed motion effectively divides the magnetically charged atom perpendicular to the dimension of progression in space so that each such atom presents a distributed two dimensional inverse square law effect in its environment.

From one side, the rotation appears to be clockwise while from the other side it appears to be counterclockwise. The scalar direction outward from a clockwise rotation is the opposite of the outward direction from a counter-clockwise rotation, and therefore, the magnetically charged atom presents both a north reference pole and a south reference pole. The interactions of magnetic poles is understood in terms similar to those used in conjunction with electric charge effects, making appropriate changes of wording as needed. Separation of magnetic charges from oppositely oriented interacting magnetically charged atoms does not occur for two reasons: the opposite orientations are not intrinsically oppositely directed scalar motions and the magnetic charges must remain in pairs.

Magnetic reference points (two dimensional) have no effect on electric reference points (one dimensional) that are stationary relative to them because they are different type reference points, not merely opposite as are positive and negative electric reference points. The fields are not interacting because the "fields" are merely the mathematical descriptions for the directionalized magnitudes of effects. The electric charge is one dimensional, and thus, scalar effects for electric reference points are radially outward from their spatially defined locations. Magnetic charges are two dimensional, and therefore, north seeking and south seeking effects are displayed as two dimensional effects. Linear movement of an electric charge in generalized space adds a second dimension to the electric charge effect, thereby creating a two dimensional effect and allowing interaction of the previously inherent one dimensional effect with the two dimensional magnetic field effect. Charged or uncharged electrons interact with the two dimensionality of the magnetic field effect when moving at less than light speed relative to the magnetic field. The resultant direction of movement in generalized space is perpendicular to both the vectorial direction of movement of the electric charge effect and the directions defined for the magnetic reference point field effects.

As magnetically charged atoms interact the line of atoms grows so that one end of the line is a north reference pole while the opposite end is a south reference pole and the intervening atoms offset each other in neutral combinations similar to orientations of neutral groups in chemical combinations. A magnetically oriented line of atoms has a toroidally shaped field effect. Any physical separation of the line of magnetically oriented atoms always leaves north and south reference points un-neutralized and the material still magnetically charged.

Summarizing the foregoing comments, we find that in a universe of motion gravitation is the effect of inward progression toward all natural locations of all atoms of Material Sector matter. Since the three dimensional reference system of space cannot distinguish between positive and negative scalar directions, all directions are outward from the source of an effect. The concept of reference points must be used to distinguish among the effects distributed by the required directional characteristic of each unit of displacement and the random orientation of reference point coordinate systems in space.

AN ELECTRIC CURRENT

The question naturally arises about an effect that initially seems to be a simple extension of the ideas of electric charge effects, "What is an electric current?" Correlation of experimentally observed facts with the development of the consequences of the postulates for a universe of motion show that static electric effects are the result of $1D2d_R$ motion while current electric effects are the result of continuous direction movement of

sub-atomic particles, particularly electrons. It is immaterial whether the moving sub-atomic particles are electrically charged or not.

Since the electric current is defined as a quantity (q) per unit time (t) and described as a number of electrons per unit time, the identification of the electric current as a speed, s/t, gives further evidence that the unit of quantity in electrical phenomena is equivalent to a unit of space.

A unit of energy has the same status in all phenomena and has been shown to have the dimensions t/s, the electromotive force, V, is also shown to have the dimensions of force, in general.[34]

Energy per unit time = power; t/s / t = 1/s

power = current × volts;

volts = power / current;

Equation 17: Voltage as Force

$$\frac{\frac{1}{s}}{\frac{s}{t}} = \frac{1}{s} \times \frac{t}{s} = \frac{t}{s^2}$$

Equation 18: V = IR

$$V = IR;\ R = \frac{V}{I} = \frac{\frac{t}{s^2}}{\frac{s}{t}} = \frac{t}{s^2} \times \frac{t}{s} = \frac{t^2}{s^3}$$

$$P = I^2 R;\ R = \frac{P}{I^2} = \frac{\frac{1}{s}}{\left(\frac{s}{t}\right)^2} = \frac{1}{s} \times \frac{t^2}{s^2} = \frac{t^2}{s^3}$$

E and V are sometimes used interchangeably for volts and electromotive force. E is used here to symbolize energy.

Equation 19: $E = mv^2$

$$E = Pt;\ E = I^2 Rt = RtI^2 = \left(\frac{t^2}{s^3} \times t\right) \times \left(\frac{s}{t}\right)^2 = \frac{t^3}{s^3} \times \left(\frac{s}{t}\right)^2 = mv^2$$

Kinetic energy is defined as the energy of movement in one direction of one dimension: in one of two possible directions.

Equation 20: Kinetic Energy

$$K.E. = \frac{1}{2} mv^2$$

Using the various relations of electrical phenomena, natural unit equivalent values are derived.[35]

$$q = \frac{2.89366 \times 10^{14}\ esu/g_{eq}}{6.02486 \times 10^{23}\ nat.u./g_{eq}}$$

$= 4.80287 \times 10^{-10}\ esu/nat.u.$ of electric quantity.

$$\frac{s}{t}=\frac{q}{t}=\frac{4.80287\times10^{-10}\,esu/nat.u.}{1.520655\times10^{-16}\,sec/nat.u.}=3.15842\times10^{6}\,esu/sec$$

The Faraday constant, 9.648456×10^{4} c/g-eq, relates the quantity of electricity and the mass involved in electrolytic action. Since one (1) ampere equals one coulomb per second, c/sec can be rewritten as

$$1\,Ampere=\frac{\frac{9.648456\times10^{4}\,c/g_{eq}}{6.02486\times10^{23}\,nat.u./g_{eq}}}{1.520655\times10^{-16}\,sec/nat.u.}=1.05313\times10^{-3}\,c/sec/nat.u.$$

= 1.05313 milliamp per natural unit

Using the natural unit of current which is equivalent to the natural unit of speed, the speed of light 2.99793×10^{10} cm/sec.

$$\frac{\frac{c}{sec}}{\frac{cm}{sec}}\times\frac{cm}{nat.u.}=\frac{c}{nat.u.}=1.60145\times10^{-19}\,coulomb$$

is recognized as the elementary unit of charge, which has been assumed to be the unit magnitude for all electrical phenomena.
The discussion in Chapter 4 and on page 98 concerning the structure of electrons and atoms of matter showed that uncharged electrons can exist only in association with atoms of matter. Addition of $1D2d_R$ motion to each by appropriate force couples can cause the separation of the electrons from the atoms by creation of the negative charges on electrons and positive charges on atoms resulting in ion-electron pair formation.

An electric current has been shown to consist of the movement from atom to atom in a specific direction of a sufficient quantity of electrons for a sufficient amount of progressive time to have an identifiable effect. For long periods of time the current is referred to as direct, but if the direction periodically changes the current is said to be alternating with a definable frequency.

As stated on page 86, thermal motion is continually being redistributed within each sample of matter and with its environment. Thermal motions also cause a redistribution of electrons among atoms, as well as, a redistribution of the thermal oscillations among atoms in all phases of matter. Thus, thermal motions may be thought of as micro currents at random frequencies. Forced redistribution of thermal energies by the application of a source of heat energy to a sample of matter would thereby cause movement of electrons among the thermally stable structural units composing the sample. The specific rate at which the thermal energies are transferred within the sample is normally referred to as the rate of thermal conductivity, which is also a measure of the electron density within the sample and the rate at which redistribution of electron densities is achieved at specific temperatures.

The system of units used in electrical phenomena was developed along lines which failed to recognize the true character of the entities involved. Thereby, the relationship of the electrical and mechanical units of measure to the natural system has required the identification of the physical quantity relating the electrical and mechanical units of measure. From a mathematical viewpoint it makes no difference whether mass moves through space or space moves through the mass. The result is still momentum, a quantity

of velocity, quantity of space per quantity of time by which to define the motion in two dimensions. Uncharged electrons moving through matter as an electric current is the effective source of current phenomena, as well as being responsible, at least in part, for thermal conductivity of matter. Changes in the equilibrium concentrations of electrons in matter constitutes a pressure resulting in a force due to the pressure gradient; a voltage difference.

Any apparent error in the numerical values are a direct result of the values of the Rydberg constant and the Avogadro number chosen as being more consistent throughout all chemical and physical correlations made with original data, not subsequently modified for infinite mass interpretations resulting from the nuclear atom concept.

LIMITS OF EXISTENCE: COMBINATIONS OF MODES OF MOTION

It is the combination that exists before a transition that is stable and represents the limit of stability with respect to that particular type of transition involving that particular combination, whereas the combination results in instability. The first limit for combining displaced motions is observed in our gravitationally bound environment among photons. Low, moderate and even high energy photons are not observed to directly interact until the energy requirement is met to form the electron-positron pair. This does not mean that other photon combinations do not occur in some part of the universe. It is just that our definition of evidence requires the presence of matter.

The next kind of limit observed is between atoms of matter and thermal frequency photons in which the arrangement, which the atoms or molecules take at very low temperatures, the solid phase, becomes modified to appear as the liquid phase of matter. This is the process of melting and the temperature at which the transition occurs for each substance is its melting point. A second limit of the same type is the *critical temperature* required of an individual molecule to leave the surface of either condensed phase; i.e., solid or liquid; to enter the gas phase. It is the probability distribution of thermal photons among the atoms and molecules of a given substance and the orientation required of the individual atoms in the substance that causes the appearance of specific melting points and boiling points.

The photoelectric effect and the specific energy requirements of the different kinds of materials for the initiation of the effect is the next observed example of a limit for the existence of stable combinations of different modes of motion. Notice that in each and every case, the modifications that occur exhibit either simpler rotational combinations; i.e., fewer atoms per molecule or radical, whether electrically charged or not; and/or the rate of temperature change experienced per thermal photon added; i.e., the specific heat of the material changes. The process involving collision of high energy electrons with various materials for the purpose of obtaining photons of specific frequencies; e.g., x-rays; is, of course, utilizing this same effect in the opposite direction relative to unity.

DISPLACEMENT LIMITS

The first kind of displacement limit is almost obvious; it takes a total of eight (8) electric displacement units to reach an equivalent of zero rotational displacement. Valences for orientation of atoms result from this relationship, as well as for electric and magnetic displacements.

The length of each row of the periodic chart of the elements is limited by the $2n^2$ relationship, as also is the maximum number of elements which can be constructed by

compounding rotationally directed displaced motion with linear vibrational units of displacement motion. The sequence numbers or atomic numbers of the inert gases—2, 10, 18, 36, 54, and 86—result from the relationship of the number of electric displacements equivalent to a given minimum effective magnetic displacement. Number 118 is unstable due to zero point equivalence of the required vibrational and rotational displacements. Thus the maximum number of possible elements is 117.

Because the natural atomic mass of an atom is twice its atomic number, the maximum value or limit for stable atomic mass is one mass unit more than twice 117 or 235. As soon as that total effective displacement mass is exceeded by the summation of positive displacements of any sort, the resulting structure is unstable and some of the mass effect must be ejected by either rotational or vibrational displacement being converted to linear vibrational displacement, photon emission, or the equivalent of some stable rotational structure being removed, alpha emission, beta emission, or fission. Thus, destructive radioactivity of various isotopes is easily explained. Equivalent positive electric displacement of any specific atomic structure may include: magnetically charged neutrinos which when captured cause the atom to exhibit higher than natural atomic mass; electric charges, magnetic charges, and distributed thermal vibrations. Thus, each element has a limiting total displacement of all kinds for which it is stable. All displacements have their limit in the equivalence of two linear units to eight one Dimensional one direction rotationally represented units and the equivalence of primary motion and equivalent primary motion in all three dimensions of either space or time. Positive displacements and negative displacements, both linearly and rotationally represented, are only means of achieving the conditions of primary motion through reaching equivalent primary motion.

THERMAL LIMITS

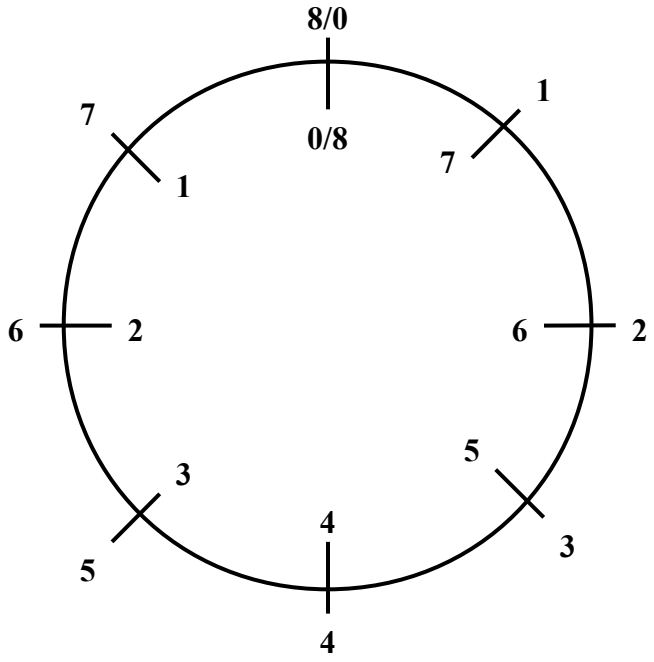
We have observed the development of the ideas of solid phase limits and liquid phase limits resulting from the presence of thermal motion. We have also found that thermal motion can be converted to electric charge, and to magnetic charge in some elements, and eventually that the combination of all of these motions can bring about a conversion of some of the rotational motion of an atom to other modes of representation and frequencies of radiation. In all atoms the geometric summation of electric charge motions and thermal motions with the unidirectional rotationally represented displacements of the basic structure of atoms may reach the limit for the 8R, 2L equivalence at the same value of displacement as the negative displacement of the photons being rotated. At the specific temperature at which the equivalent positive electric displacement of the normal magnetic and electric rotations for atoms of a given element is reached by equivalence of the rotational vibrations (electric charges, magnetic charges, charged neutrinos) combined with distributed thermal vibrations, a point of mass instability occurs which causes spontaneous conversion of an appropriate amount of the net motion, both positively and negatively displaced, to be separated and emitted as photons, atoms, or sub-atom structures along with an appropriate change of the net total equivalent positive electric displacement of the atoms in question. This is called the *thermal destructive limit* for that kind of atom.[36] At this destructive temperature limit, all atoms exhibiting the mass equivalent of 236 undergo a spontaneous conversion of some of their mass, t^3/s^3, to an equivalent energy, t/s, which is emitted as radiation.

There are other limits which are dependent on aspects of the theory not yet discussed, but which require considerable discussion beyond the fundamental concepts of scalar motion. Even though no attempt has been made to create a definitive description of all of the

phenomena related to thermal effects, electric charges, electric currents, magnetic effects, or any other specific phenomena, it is hoped that the relations discussed will serve to illustrate the validity of the basic postulates for the Reciprocal System of theory and serve as an impetus for further exploration of the conceptual revolution brought about by these new ideas.

APPENDIX

Figure VI: Valence Circle



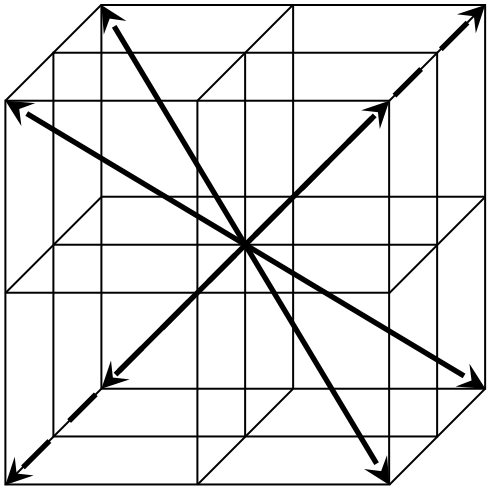


Figure VII: Directional Vectors: $2^3 = 8$

SPECIFIC NOTATIONS, DIVISION I

Chart 1: Electric Groups

1	2	3	4	
^{3}Li 2-1-1 3- in-d	^{4}Be 2-1-2 3- in-d	^{5}B 2-1-3 3- in-d	^{6}C 2-1-4 3- in-d	a
^{11}Na 2-2-1 3-2½-2	^{12}Mg 2-2-2 3-2½-2½ 3-3-3	^{13}Al 2-2-3 3-2½-3 3-4-4	^{14}Si 2-2-4 3-3-5 3-4-5	a e b
^{19}K 3-2-1 4-3-2	^{20}Ca 3-2-2 4-3-2½ eb	^{21}Si 3-2-3 4-3-4 eb	^{22}Ti 3-2-4 4-3-5 e	a
^{37}Rb 3-3-1 4-4-2	^{38}Sr 3-3-2 4-4-2½ eb	^{39}Y 3-3-3 4-4-3½ eb	^{40}Zr 3-3-4 4-4-5 e	a
^{55}Cs 4-3-1 4½-4½-2 e	^{56}Ba 4-3-2 5-4½-3 eb	^{57}La 4-3-3 4½-4½-4 5-4-4	^{58}Ce 4-3-4 5-4½-5 e	a

a = atomic notation
e = specific rotation in isometric form of element
b = specific rotation in simplest geometry form of binary compounds
in-d = inactive dimensions; see Chapter 3, *Basic Properties of Matter* for explanations and discussion.

SPECIFIC NOTATIONS, DIVISION II

Chart 2: Division II Electric Groups

Lower Division II Electric Groups					
5	6	7	8	9	
^{23}V 3-2-5 4-3-6 10	^{24}Cr 3-2-6 4-3-7 10	^{25}Mn 3-2-7 4-3-8	^{26}Fe 3-2-8 4-3-8½ 10	^{27}Co 3-2-9 4-3-9	a e
^{41}Nb 4-3-5 4-4-6 10	^{42}Mo 3-3-6 4-4½-10	^{43}Tc 3-3-7 4-4½-10	^{44}Ru 3-3-8 4-4½-10	^{45}Rh 3-3-9 4-4-10 4-4½-10	a e
Higher Division II Electric Groups					
^{59}Pr 4-3-5 5-4½-5	^{60}Nd 4-3-6 5-4½-	^{61}Pm 4-3-7 5-4½-	^{62}Sm 4-3-8 5-4½-5	^{63}Eu 4-3-9 4½-5-1 5	a e
^{91}Pa 4-4-5 4½-5-5 10	^{92}U 4-4-6 4½-4½-10	^{93}Np 4-4-7 4½-4½-5	^{94}Pu 4-4-8 4½-4½-5 10	^{95}Am 4-4-9 4½-4½-5	a e e

	^{64}Gd	^{65}Tb	^{66}Dy	^{67}Ho	^{68}Er	^{69}Tm	^{70}Yb
a	4-3-10	4-3-11	4-3-12	4-3-13	4-3-14	4-3-15	4-3-16
e	5-4½-5	5-4½-5	5-4½-5	4½-5-5	4½-5-5	4½-5-5	4½-4½-1
e							5
	^{96}Cm	^{97}Bk	^{98}Cf	^{99}Es	^{100}Fm	^{101}Md	^{102}No
a	4-4-10	4-4-11	4-4-12	4-4-13	4-4-14	4-4-15	4-4-16
e	4½-4½-5	4½-4½-5					
e	10						

SPECIFIC NOTATIONS, DIVISION III

Chart 3: Division III Electric Groups

Lower Division III Electric Groups					
(9)	(8)	(7)	(6)	(5)	
^{27}Co 3-2-9 3-3-(9) 4-3-9	^{28}Ni 3-2-10 3-3-(8) 4-3-9½	^{29}Cu 3-3-(7) 4-3-8, 10	^{30}Zn 3-3-(6) 4-4-7 4-4-10	^{31}Ga 3-3-(5) 4-3-6 4-3-10	 a e e
^{45}Rh 3-3-9 4-3-(9) 4-4-10 4-4½-10	^{46}Pd 3-3-10 4-3-(8) 4-4½-10	^{47}Ag 4-3-(7) 4-5-8, 10	^{48}Cd 4-3-(6) 5-4-7 5-4-10	^{49}In 4-3-(5) 5-4-6 5-4-6, 10	 a e e e
Higher Division III Electric Groups					
^{77}Ir 4-4-(9) 4-4½-10	^{78}Pt 4-4-(8) 4-4½-10	^{79}Au 4-4-(7) 4½-4½-10	^{80}Hg 4-4-(6) 4-4½-5, 10 4½-4½-5	^{81}Tl 4-4-(5) 4½-4½-5	 a e e e

(15)	(14)	(13)	(12)	(11)	(10)	
^{71}Lu 4-4-(15) 4½-5-5	^{72}Hf 4-4-(14) 4-4½-5	^{73}Ta 4-4-(13) 4½-4½-10	^{74}W 4-4-(12) 4-4½-10	^{75}Re 4-4-(11) 4-4½-10	^{76}Os 4-4-(10) 4-4½-10	 a e

SPECIFIC NOTATIONS, DIVISION IV

Chart 4: Division IV Electric Groups

			(1)	
			^{1}H 1½-1½-(2)	a
(4)	(3)	(2)	3{1}-{(1)}	e
^{6}C 2-2-(4)	^{7}N 2-2-(3)	^{8}O 2-2-(2)	^{9}F 2-2-(1)	a
3{2}-5,10 d 3{2}-1 g 3-3-1 g	3{1½}-10 ia 3-3-1 im	3{1½}-10 ia 3-3-1 im	3{2}-10 ia	e e e
^{14}Si 3-2-(4)	^{15}P 3-2-(3)	^{16}S 3-2-(2)	^{17}Cl 3-2-(1)	a
3-3-5, 10	3-3-10 3-4-1	3.3.10 ia 3-3-1 im	3-3-16 ia 3-3-1, im 16	e e e
^{32}Ge 3-3-(4)	^{33}As 3-3-(3)	^{34}Se 3-3-(2)	^{35}Br 3-3-(1)	a
4-3-10	4-3-12 ia 4-3-10 im	4-3-14 ia 3-4-1 im	4-3-16 ia 3-4-1 im	e e
^{50}Sn 4-3-(4)	^{51}Sb 4-3-(3)	^{52}Te 4-3-(2)	^{53}I 4-3-(1)	a
4½-4-10 5-4-5, 10 5-4-10	5-4-12 ia 5-4-4, 10	5-4½-14 ia 5-4-1, 10	5-4-16 ia 5-4-1, 16 5-4-1 im	e e e

a = atomic notation
e = elemental form, sp.rt. may be same in compounds
ia = specific rotation e><e in solid form of element
im = specific rotation between molecules in solid form of element
d = diamond form of carbon
g = graphite form of carbon

THE PHYSICAL UNIVERSE

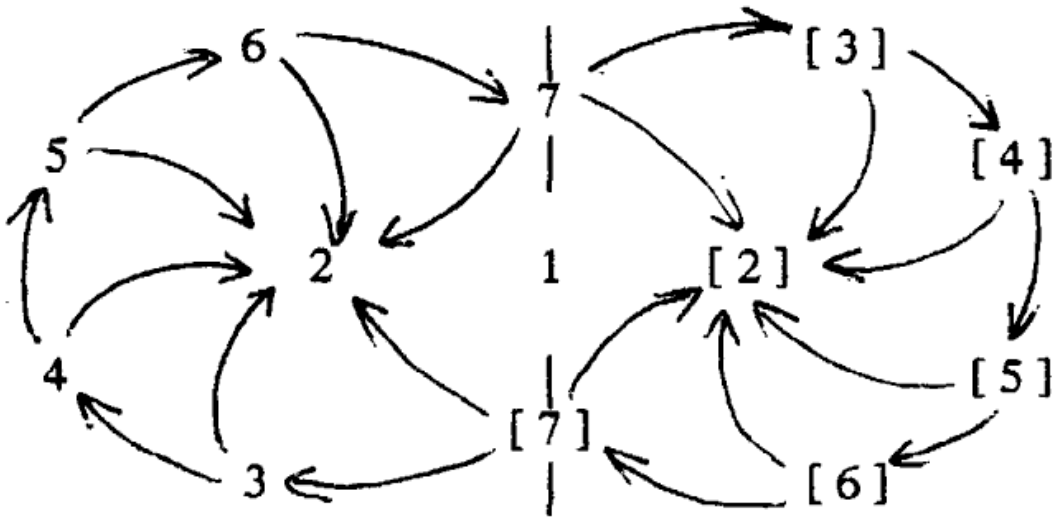
Chart 5: The Physical Universe

The Material Sector		The Photon Interface		The Cosmic Sector	
s/t < 1		s/t=1 ,>1		t/s=1	s/t > 1
Displaced Motion less than unity		Motion extends into a dissipative medium, i.e. most Planetary, Stellar, and Galactic phenomena	photon radiation	unobserv able cosmic radiation W. D's P's & Q's	Displaced Motion greater than unity
Time Region	Normal Time Progression				Normal Space Progression / Space Region
Atoms Atomic interaction phenomena Chemical orientation and bonding Solid and Liquid phases of matter Sub-atomic phenomena	Classical mechanics Gas Phase of matter	White Dwarfs Pulsars & Quasars			(Cosmic atoms) etc. (Cosmic ray phenomena involve the behavior of cosmic atoms in the Normal Time Progression Region)
s = 1 unit t > 1 unit	1 < s < t				s > t > 1 / t = 1 unit s > 1 unit

ORDER OF COMPLEXITY OF PHENOMENA AS SEQUENCED BY ADDING NEXT MOTION REPRESENTATION

Chart 6: Order of Complexity of Phenomena

	Equivalent Background Progression Photon Interface
- - 7 - -	**Explosion phenomena** Galactic (pulsars and quasars) and Stellar (novae and white dwarfs)
- - 6 - -	**Stellar interior phenomena** Sunspots and prominences;[37]
→	thermal, electrostatic and gravitational charges exceed mass limit causing Radioactivity of unstable atomic structures
- - 5 - -	**Rotational Oscillational Phenomena**
→	$2D2d_R$ to specific atoms; magnetostatic effects
→	$1D2d_R$ to any kind of atom; electrostatic effects
- - 4 - -	**Complex Linear and Oscillational Phenomenon**
→	$1D1d_L$ to atoms; vectorial movement
→	$1D2d_L$ to atoms; thermal phenomena and heat effects
- - 3 - -	**Atoms and Atomic Interactional Phenomena** $2D1d_R$ & $1D1d_R$; atoms >< atoms to form molecules and crystals
- - 2 - -	**Simple Oscillational Phenomena** $1D2d_L$; Photons of radiation
- - 1 - -	**The background Natural Reference System** That which precedes all representations of motion in a dimensional system



THE SUB-ATOMIC PARTICLES

Table 8: The Sub-Atomic Particles

Massless Particles

M 0-0-0	Rotational base
M 0-0-1	Positron
M 0-0-(1)	Electron
M ½-½-0	Massless neutron (muon neutrino)
M ½-½-(1)	Electron neutrino
*M ½-½-(1)	Charged electron neutrino

Particles with Mass

-M 0-0-(1)	Charged electron
+M 0-0-1	Charged positron
M 1-1-(1)	Proton
+M 1-1-(1)	Charged proton

Compound Particles

M 1-1-(1) || C (½)-(½)-1
= M ½-½-0 Compound neutron

M 1-1-(1) ⊥ M ½-½-(1)
= M 1½-1½-(2) Mass 1 Hydrogen

|| (add this, placing photons in the same direction, creating new frequency).

⊥ (add this, placing photons perpendicular)

PHYSICAL CONSTANTS OF MECHANICS

Table 9: Physical Constants of Mechanics

symbol	unit	natural unit space-time equivalent	conventional units equivalent to 1 natural unit
s	space	4.558816×10^{-6} cm	4.558816×10^{-6} cm
t	time	1.520655×10^{-16} sec	1.520655×10^{-16} sec
s/t	speed	2.997930×10^{10} cm/sec	2.997930×10^{10} cm/sec
s/t^2	acceleration	1.971473×10^{26} cm/sec^2	1.971473×10^{26} cm/sec^2
t/s	energy	3.335635×10^{-11} sec/cm	1.49175×10^{-3} ergs
t/s^2	force	7.316889×10^{-6} sec/cm^2	3.27223×10^{2} dynes
t/s^4	pressure	3.520646×10^{5} sec/cm^4	1.57449×10^{13} dynes/cm^2
t^2/s^2	momentum	1.112646×10^{-21} sec^2/cm^2	4.97593×10^{-14} g-cm/sec
t^3/s^3	inertial mass	3.711381×10^{-32} sec^3/cm^3	1.65979×10^{-24} g

ATOMIC WEIGHTS, ^{16}O

Table 10: Atomic Weights

#	Element	Atomic Weight	#	Element	Atomic Weight
1	Hydrogen	1.00826	51	Antimony	121.79
2	Helium	4.00388	52	Tellurium	127.64
3	Lithium	6.9432	53	Iodine	126.9451
4	Beryllium	9.01507	54	Xenon	131.332
5	Boron	10.81446	55	Cesium	132.9480
6	Carbon	12.01500	56	Barium	137.37
7	Nitrogen	14.0112	57	Lanthanum	138.9500
8	Oxygen	16.0045	58	Cerium	140.16
9	Fluorine	19.0045	59	Praseodymium	140.9528
10	Neon	20.1855	60	Neodymium	144.286
11	Sodium	22.99713	61	Promethium	(145)
12	Magnesium	24.3128	62	Samarium	150.408
13	Aluminum	26.9901	63	Europium	152.009
14	Silicon	28.0950	64	Gadolinium	152.300
15	Phosphorus	30.98368	65	Terbium	158.9763
16	Sulfur	32.074	66	Dysprosium	162.550
17	Chlorine	35.464	67	Holmium	164.9832
18	Argon	39.961	68	Erbium	167.310
19	Potassium	39.1108	69	Thulium	168.9883
20	Calcium	40.093	70	Ytterbium	173.095
21	Scandium	44.9703	71	Lutetium	175.023
22	Titanium	47.895	72	Hafnium	178.550
23	Vanadium	50.9578	73	Tantalum	181.0058
24	Chromium	52.013	74	Wolfram	183.909
25	Manganese	54.9556	75	Rhenium	186.267
26	Iron	55.865	76	Osmium	190.26

#	Element	Atomic Weight	#	Element	Atomic Weight
27	Cobalt	58.9521	77	Iridium	192.282
28	Nickel	58.709	78	Platinum	195.15
29	Copper	63.566	79	Gold	197.0296
30	Zinc	65.401	80	Mercury	200.65
31	Gallium	69.740	81	Thallium	204.448
32	Germanium	72.613	82	Lead	207.27
33	Arsenic	74.9456	83	Bismuth	209.0473
34	Selenium	78.990	84	Polonium	(209)
35	Bromine	79.9296	85	Astatine	(210)
36	Krypton	83.830	86	Radon	(222)
37	Rubidium	85.4952	87	Francium	(223)
38	Strontium	87.65	88	Radium	226.0977
39	Yttrium	88.9344	89	Actinium	227.1005
40	Zirconium	91.250	90	Thorium	232.1124
41	Niobium	92.9362	91	Protactinium	231.1099
42	Molybdenum	95.970	92	Uranium	238.1051
43	Technetium	(99)	93	Neptunium	237.1241
44	Ruthenium	101.102	94	Plutonium	(244)
45	Rhodium	102.9385	95	Americium	(243)
46	Palladium	106.454	96	Curium	(247)
47	Silver	107.903	97	Berkelium	(247)
48	Cadmium	112.446	98	Californium	(215)
49	Indium	114.86	99	Einsteinium	(252)
50	Tin	118.73	100	Fermium	(257)

ANSWERS TO QUESTION SETS

1. Using the symbols for the elements of the electric **groups** 1 and **(1),** write the formulas for each of the possible compounds by placing the symbol for the electric **group 1** element first, followed by the electric **group (1)** element:

   LiH, LiF, LiCl, LiBr, LiI: NaH, NaF, NaCl, NaBr, NaI,
   KH, KF, KCl, KBr, KI: RbH, RbF, RbCl, RbBr, RbI,
   CsH, CsF, CsCl, CsBr, CsI; FrH, FrF, FrCl, FrBr, FrI

2. Using the symbols for the electric **group 2** elements and the electric **group (1)** elements, write the formulas for all possible normal valence compounds.

   BeH_2, BeF_2, $BeCl_2$, $BeBr_2$, BeI_2 MgH_2, MgFl, $MgCl_2$, $MgBr_2$, MgI_2,
   CaH_2, CaF_2, $CaCl_2$, $CaBr_2$, CaI_2; SrH_2, SrF_2, $SrCl_2$, $SrBr_2$, SrI_2,
   BaH_2, BaF_2, $BaCl_2$, $BaBr_2$, BaI_2 RaH_2, RaF_2, $RaCl_2$, $RaBr_2$, RaI_2

3. Using the symbols for the electric **group 1** elements and the electric **group (2)** elements, write the formulas for all possible normal valence compounds.

   Li_2O, Li_2S, Li_2Se, Li_2Te, Li_2Po: Na_2O. Na_2S, Na_2Se, Na_2Te, Na_2Po,
   K_2O, K_2S, K_2Se, K_2Te, K_2Po: Rb_2O, Rb_2S, Rb_2Se, Rb_2Te, Rb_2Po,
   Cs_2O, Cs_2S, Cs_2Se, Cs_2Te, Cs_2Po; Fr_2O, Fr_2S, Fr_2Se, Fr_2Te, Fr_2Po

4. Using the symbols for the electric **group 2** elements and the electric **group (2)** elements, write the formulas for all possible normal valence compounds.

   BeO, BeS, BeSe, BeTe, BePo; MgO, MgS, MgSe, MgTe, MgPo,
   CaO, CaS, CaSe, CaTe, CaPo; SrO, SrS, SrSe, SrTe, SrPo,
   BaO, BaS, BaSe, BaTe, BaPo; RaO, RaS, RaSe, RaTe, RaPo

5. Using the symbols for the electric **group 2** elements and the electric **group (3)** elements, write the formulas for all possible normal valence compounds.

   Be_3Na, Mg_3N_2, Ca_3N_2, Sr_3N_2, Ba_3N_2, Ra_3N_2,
   Be_3P_2, Mg_3P_2, Ca_3P_2, Sr_3P_2, Ba_3P_2 , Ra_3P_2,
   Be_3As_2, Mg_3As_2, Ca_3As_2, Sr_3As_2, Ba_3As_2, Ra_3As_2,
   Be_3Sb_2, Mg_3Sb_2, Ca_3Sb_2, Sr_3Sb_2, Ba_3Sb_2, Ra_3Sb_2,
   Be_3Bi_2, Mg_3Bi_2, Ca_3Bi_2, Sr_3Bi_2, Ba_3Bi_2, Ra_3Bi_2

6. Using the symbols for **scandium** and **titanium** with the appropriate symbols for **oxygen** and **sulfur,** write the most probable formulas for the compounds formed using only normal electric valences. (four formulas)

   Sc_2O_3, Sc_2S_3, Ti_2O, Ti_2S (X_4Y_2 reduces to X_2Y)

All compounds indicated by formula may not actually be observed due to other probability conditions.

"><" is to be read: "is oriented in a line with"

	Example	Valence of Peripheral atoms	Valence of Central atom	Type of Valence of Central Atom	Type of Orientation
0.	Ifs	(1)	5	enhanced neutral shift 2+(8-x)	enhanced neutral >< normal
7.	VCl_3	(1)	3	magnetic normal	m.n.><n.
8.	$ZnCl_2$	(1)	2	neutral (8-x)	neut.><n
9.	Ag_2O	(2)	1	neutral (8-x)	neut.><n.
10.	NH_3	1	(3)	normal negative	n.><m.n.
11.	$LaCl_3$	(1)	3	normal positive	n.p.><n.
12.	$BeCl_2$	(1)	2	normal positive	n.p.><n.
13.	BeH_2	(1)	2	normal positive	n.p.><n.
14.	SO_3	(2)	6	neutral (8-x)	neut.><n.
15.	SO_2	(2)	4	enhanced neutral shift 2+(8-x)	e.neut.><n.
16.	As_2O_5	(2)	5	neutral (8-x)	neut.><n.
17.	As_2O_3	(2)	3	enhanced neutral shift 2+(8-x)	e.neut.><n.
18.	IF_7	(1)	7	neutral (8-x)	neut.><n.
19.	$MnCl_3$	(1)	3	magnetic normal	m.n.><n.
20.	Mn_2O_7	(2)	7	normal positive	n.p.><n.
21.	VF_3	(1)	3	magnetic normal	mn.n><n.
22.	VF_4	(1)	4	enhanced magnetic	e.m.><n.
23.	VF_5	(1)	5	normal positive	n.p.><n.
24.	$FeBr_2$	(1)	2	diminished magnetic	d.m.><n.
25.	C_3O_2	(2)	CO 2 C_2O 1	primary magnetic secondary magnetic	p.m.><n. s.m.><n.
26.	$KClO_3$	(2) 1	5	enhanced neutral normal positive	e.neut.><n. n.p.><n.
27.	K_2SO_4	(2) 1	6	neutral (8-x) normal positive	neut.><n. n.p.><n.

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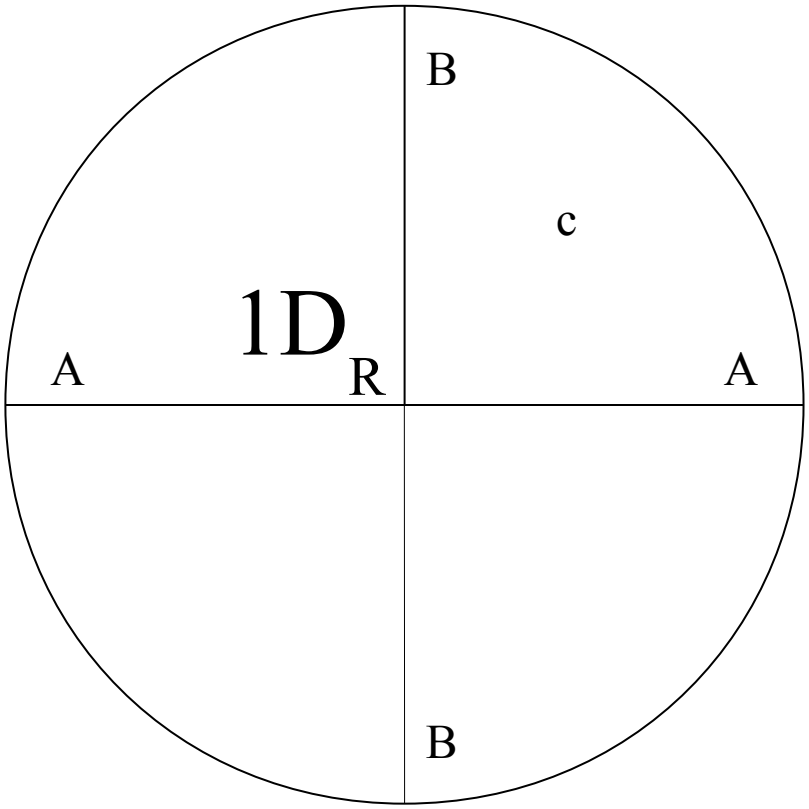
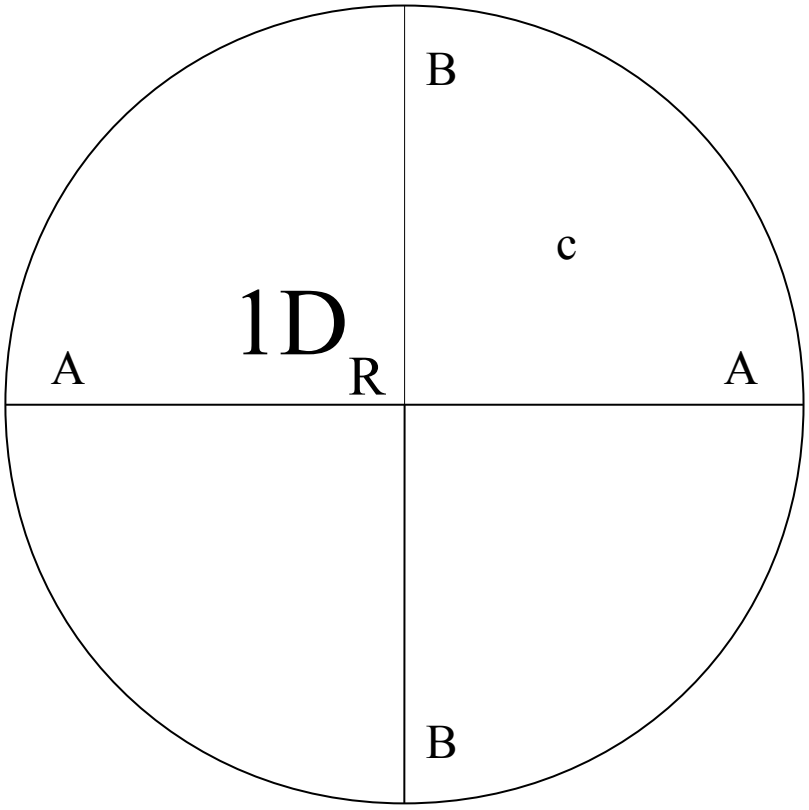
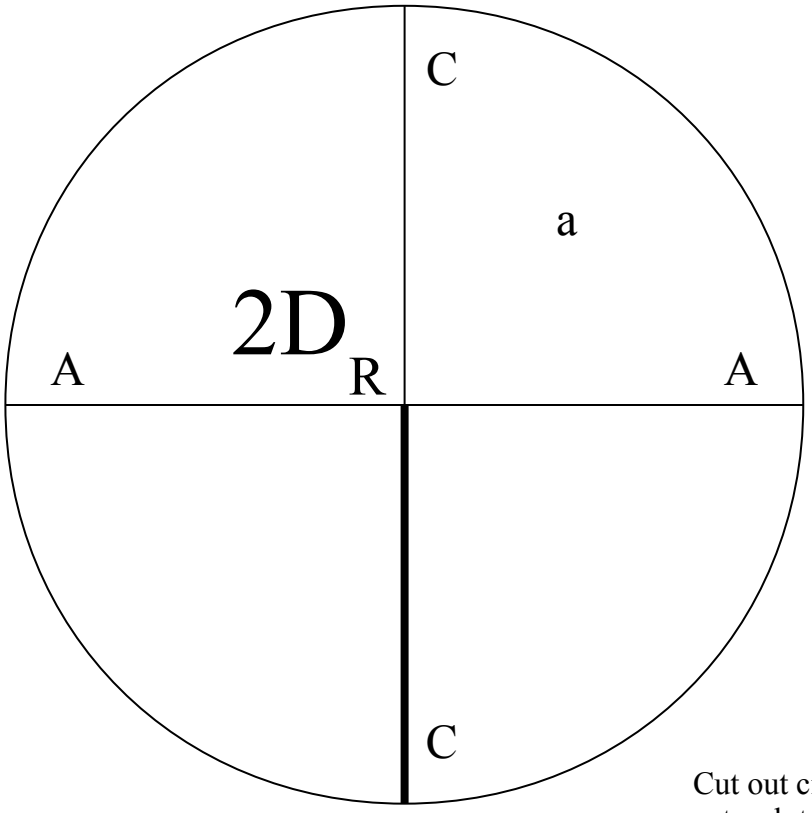


Cut out circles.





Cut out circles and cut a slot along the double-lines so the discs can interlock.