

Notes on a Uniformitarian Hypothesis of the Microcosm

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Abstract

The problem with mathematical theoretical physics is anthropocentrism. The mental activities of observation, recording, calculation, and manipulation are not relevant in the microcosm. An alternative method of natural philosophy is to neglect the human experience and describe the phenomena of nature from the point of view of the center of a fundamental particle. The smallest, simplest particle and form of motion, called an oscillon, is assumed here to be the sole constituent of space, matter, light, and neutrinos. The oscillon is visualized as a self-generating, self-measuring, and oscillating physical system of a point of tangency moving relative to a constant center point. The interactions of pairs of oscillons vary from complex to simple, according to the dimensionality of their relativity. When the spatial relations of interacting oscillons are three-dimensional, they form matter. When their relativity is two-dimensional, they form light. When they interact in one dimension, they form neutrinos.

1. Anthropocentrism

Our search for knowledge and understanding about the world and the natural phenomena that we observe is an endeavor that has been made more difficult by our self-awareness. We tend to place ourselves at the center and to believe that our existence and our consciousness are of the greatest importance. This is called anthropocentrism.

This tendency has affected the work of philosophers and scientists since the ancient Greeks and is still doing so today. We have to be aware of the effects of our bias and to struggle to overcome them. Nevertheless, great progress has been made over the centuries, and the pace of new discovery is constantly accelerating.

In the past, anthropocentrism was responsible for the idea that the Sun, Moon, and planets revolve around the Earth. For more than two thousand years, this idea was the prevailing view of astronomers. Together, the European Renaissance, the Copernican revolution, and the invention of the telescope were sufficiently powerful to push the old belief aside.

The old false world-view was geocentric. The new correct understanding was that the Sun is at the center of the solar system, that Earth is a planet, and that planets revolve around the Sun. The heliocentric theory of the motions of the planets was tested and proved, resulting in great advances in the work of astronomers and all those who use the scientific method.

The process of overthrowing a false theory involves several steps. First, all the assumptions of the theory must be identified. Next, each assumption must be examined and tested. If an assumption is found to be inadequate in any way, then alternative assumptions should be proposed. In their turn, the alternative assumptions require study and experiment.

Anthropocentrism manifests itself in other aspects of science. We have a tendency to put matter at the center, thereby neglecting the other forms of motion. Our identification with the three-dimensional world in which we exist results in other possible interactions being ignored.

We elevate the properties of matter—such as mass, temperature, charge, gravity, magnetism, density, and chemistry—to the status of fundamentals when they may be mere side effects. We seem to be obsessed with the search for life on other planets and on whether humans are unique.

1.1. Geocentric Theory

The knowledge used by the first natural philosophers to develop their theory of motion was the store of data gathered by their predecessors: time-keepers, astronomers, astrologers, calendar officials, and teachers.

These forerunners had no “geocentric theory”; they just observed, measured, and recorded what they saw in the Solar System. They did not need the “relativity of moving objects” to accomplish their tasks successfully. The more observations they recorded, the more accurately they calculated future events. Their method worked, and it was a functional system of time based on the motion of the Earth, even though the practitioners believed it was the motion of the heavens.

Copernicus initiated the scientific revolution in the sixteenth century by overthrowing the assumption that the Earth is stationary at the center of the universe, and by asserting that the Earth is a planet like the others orbiting the Sun. Since then, there have been a series of setbacks of the anthropocentric worldview.

Darwin established in the nineteenth century that humans are animals like the others. Then we learned that the chimpanzee is our closest relative and that we originated in the highlands of East Africa. We had earlier realized that the Sun was a star like the others. The geologists Hutton and Lyell overthrew catastrophism and demonstrated the great age of the Earth and the irrelevance of our species to its history.

2. Uniformitarianism

The modern scientific study of geology got started when Charles Lyell, following the hypothesis of James Hutton, formulated the principle of uniformitarianism. Lyell suggested that the processes of geological change are the same now as they were in the past. He postulated that the entire history of the Earth could be accounted for by the agents of change that we now observe, which include deposition, earthquakes, erosion, floods, glaciation, mountain building, volcanism, weather, and so on.

At the time that Lyell advanced his new principle, the main alternative theory was catastrophism, a concept that derived from Biblical and mythical accounts of the history of the Earth. Its main idea was that periodically devastating floods or earthquakes transformed the surface of the planet. This meant that there was no record in the present of the pre-catastrophic state of affairs.

Catastrophism proposed that geological change was sudden, violent, and global. Uniformitarianism countered that (a) change is gradual, incremental, and local; (b) that geological processes are evolutionary; (c) that the processes occurring currently are the same processes as have always been happening; and (d) that the results of those processes are always the same. Uniformitarianism proposes that all geological formations are caused by physical and chemical processes that have operated continuously and uniformly throughout time.

The question arises whether uniformitarianism is only a geological theory, or can be a theory of nature as a whole. Furthermore, is it only applicable to a particular place and time, or does it explain with equal validity the phenomena of other places and other times? Is it a useful doctrine for the study of both macrocosmic and microcosmic processes? Is it adaptable to the sciences of

astronomy and particle physics?

2.1. Fundamental Processes

Microcosmic processes such as combustion, deposition, erosion, evaporation, flow, freezing, growth, melting, and solution are generally unceasing and occur at any time. Macrocosmic processes, such as collisions, eruptions, explosions, and tremors, usually start and stop and are time-specific.

Natural selection, the fundamental process in biological history, is consistent with the uniformitarian principle. A fundamental process such as evolution, the hydrological cycle, plate tectonics, and sedimentation may be interrupted or reoriented by earthquakes, volcanism, asteroid impacts, nuclear winter, and extinction, but will immediately resume unchanged.

2.2. Continuous Motion

The assumption that microcosmic phenomena are uniformitarian is the important idea here. The motion of a particle, its oscillation and interaction, is continuous and cannot be changed or stopped. The particle's measurement of itself and other particles with which it interacts is also continuous, and the method of measurement does not change. No matter what macrocosmic events occur that may cause changes in larger structures of which the particle is a constituent, the particle remains intact, its motion is the same, and its being after the event is identical to its previous existence.

3. Time

The human experience of time is very much related to its passage. The interaction with our environment that enables us to survive is shaped by the succession of night and day, the yearly seasons of heat and cold and rain and drought, and the times of flowering and fruiting. Our lives are a progression over time from birth and growth to maturity, followed by old age and death.

In the course of our lives, we store experience in our brains by means of memory. The elders pass on their accumulated knowledge through their leadership, parenting, teaching, and storytelling. For thousands of generations, this culture of tradition, common sense, lore, and mythology was passed orally from mind to mind as our species thrived and spread across the continents.

Human memory is thus a non-technological means of recording experience and retrieving it at a later date when the cycle of life makes it useful. In prehistoric days, we started to record events by means of pictures, such as paintings on rock and carvings on bone. We learned the cycles of movement of the Earth, Sun, Moon, planets, and stars, and used this knowledge to invent calendars.

Subsequently, we made use of monuments, alphabets, ideograms, writing systems, books, libraries, printing, film, photography, audiotape, and videotape as permanent recordings independent of memory.

Our experience of time is dominated by our awareness of the present, past, and future. Our knowledge of the past is entirely dependent on memory and recording, which are products of human consciousness. Without such recording and transmission, the past does not exist.

3.1. Experience of Time

The most anthropocentrically misleading aspect of human behavior is our experience and

understanding of time, which are dominated by our recording of it. Our relation to time is fundamentally different from the particle's experience of time. In the microcosm, there are no means of recording, and the only time is now.

The function of time in the microcosm is a quantity of motion. The period of oscillation is the time of the simplest form of motion. When two spatially identical oscillating particles interact, the variables in their temporal relation are duration and phase. Are the periods the same length? Are the points of reflection simultaneous?

3.2. Memory

How is time experienced by a particle without memory? What is motion without memory? Is there a passage of time without memory?

Time is a quantity that relates to change and variation. Period, frequency, and speed are all temporal measurements. Oscillation, a process of change wherein the direction of motion regularly reverses, involves a measurable quantity of time.

3.3. Recording

In nature, time is only duration. In order for the past to exist, there must be a record, and for a record such as memory, writing, film, or tape to exist, there must be a brain.

3.4. Units of Time

Our units of time are based on an arbitrary standard derived from the natural period of terrestrial rotation. The division of that period into a functional minimum unit, the second, is based on the human biorhythm—that is, the heartbeat. Any period of time less than a second is not practical. Nevertheless, it is short enough that at a given order of magnitude, it is within the range of the natural unit of time, which I will discuss at length in Section 14.

3.5. Measurement of Time

What is time without sensing, observing, and analyzing? There is no origin, no past, no memory, no history, and no future.

What is the particle's self-measurement in respect to time? An oscillating particle has a period, frequency, and phase. A particle in motion has distance, direction, and speed.

The devices and techniques used in the measurement of time, including clocks, calendars, stopwatches, carbon dating, dendrochronology (measurement of tree rings), and stratigraphy (study of rock strata) are all artificial. Units of time such as the nanosecond, second, minute, hour, day, week, month, and year are also man-made.

3.6. Now and Then

Nature is all about order, uniformity, symmetry, constancy, and repetition. To the human mind, this is uninteresting, even boring. We prefer the unusual, the sudden, and the unexpected changes, which are more stimulating and entertaining to our senses and mind. However, to experience an event as unusual, one needs memory in order to compare now and then. Nature has no such expectations.

Of course, there is change in nature; otherwise, there would be no universe. Motion is the difference between nothing and something, and all change in nature is a form of motion.

4. Mathematics

Mathematics is a mental, abstract, and artificial activity that requires a means of recording and retrieval. It is a process that uses observations, measurements, and data acquired at intervals of time.

Calculation is a behavior that is not possible for a microcosmic particle. But self-measurement and short-range measurement of other directly interacting particles are within the competence of a particle.

4.1. Nature's Mathematics

When it came to selecting a method of inquiry for this work, by necessity I chose natural philosophy over mathematical physics because my formal training in mathematics ended at high school graduation. Subsequently, I learned that nature's mathematics is exclusively metrical—that is, about measurement.

Nature is simple and so is geometry. The symbolism of higher mathematics is impossible for a simple, minimal, oscillating particle, whose capabilities are limited to the four measurements of distance, angle, direction, and period.

4.2. Unreasonable Effectiveness

Sometimes the use of mathematics in science is unnatural. That is, it is contrary to nature. It is artificial, forced, and affected.

Many physicists refer to the phrase *the unreasonable effectiveness of mathematics*. Mathematics can be described as flexible, versatile, conformable, adaptable, facile, contrivable, or handy. An example of this artificiality is “renormalization,” a mathematical procedure used in relativistic quantum field theory.

Another case of anthropocentric mathematics in mainstream physics is the use of probability and statistics. This requires many observations over a period of time, the gathering of data about prior and subsequent conditions, and calculations that use sophisticated techniques. This process is unnatural, mental, and artificial. The particle in the microcosm does not have the capability of statistical analysis. Therefore, such work is of dubious value to natural philosophy.

4.3. An Invented Tool

Modern science is extremely dependent on modern mathematics. Newton initiated this fundamental relationship within the scientific method when he demonstrated mathematics' utility in explaining and describing motion. Nowadays, facts and theories cannot be deemed proven unless they include an accepted mathematical description.

However, we must not forget that mathematics is a tool. It is artificial rather than natural. Before the rise of homo sapiens there was no calculating with numbers, but the phenomena of nature were the same as today. In fact, Newton achieved his understanding of motion after he invented the method of calculus.

We invented mathematics because it was useful, just as we made tools because they made our everyday tasks easier. Nature is the source of materials like stone, wood, fiber, clay, and metal. Our counting, observing, and measuring of objects and events in our environment led us to the science of numbers - arithmetic, geometry, algebra, trigonometry, and calculus.

So, what are nature's numbers?

4.4. Epicycle and Deferent

In the pre-Copernican period, when it was mistakenly believed that the Sun, Moon and planets revolved around the earth, it was still possible for astronomers and astrologers to predict the movements and positions of these bodies. There was a mathematical foundation for their work, which was based on analysis of long-term observation. Here is a demonstration of the power of human intellect using the tool of calculation to produce practical mathematical analysis and description, despite inaccurate observation, primitive technology and a false set of assumptions.

The epicycle and the deferent were among the mathematical constructions that enabled the ancient astronomers to make sense of the observed retrograde motion of the planets in the course of their annual path through the heavens. The assumption was that a planet's motion had two components – a circular orbit of the earth called the deferent and a smaller circle, called the epicycle, about points on the deferent. To improve the accuracy of the calculations Ptolemy added the equant and the eccentric, both mathematical constructs based on imagined motion. But these devices did not describe anything real and, when the heliocentric theory came to the forefront, they were shown to be inventions of the mind.

In the present age, as investigation of nature extends in scale from the smallest particle to the largest group of galaxies, but direct observation is impossible in either case, scientists have markedly increased their dependence on mathematics. In other words, we already have deficits in observation and technology, so beware false theory, mistaken assumptions, anthropocentrism, misleading analogies and unnatural inventions.

5. Motion

On the planet Earth, a macrocosmic object, we see that processes of change other than voluntary animal locomotion are cyclical. A cycle is a sequence of events or phases that are repetitive, continuous, and connected in a circular way, such that the last is followed by the first. Among such cycles are the hydrological, atmospheric, biological, and tectonic.

Water is the material of the hydrological cycle. It evaporates from the surface of the ocean, rises into the air, and accumulates into clouds. In the clouds, water condenses and forms droplets that precipitate back to the surface as rain, dew, or snow, which flow into the ground, streams, and rivers. Small rivers are tributaries of large rivers that flow downhill until they discharge their water back into the ocean.

The air of the atmosphere is a mixture of several substances. Plants inspire carbon dioxide from the air and through photosynthesis extract the carbon and expire oxygen. Animals breathe in the oxygen and use it as fuel through respiration.

In the biological cycle, molecules of the various elements and compounds found in the atmosphere, hydrosphere, and lithosphere are used in the growth of plants and animals. When a life form dies, its tissues are eaten or otherwise transformed, and its chemicals are returned to the soil.

Rock is the material of the tectonic cycle. Heated rock from the mantle layer of the Earth flows to the surface of the lithosphere at the mid-ocean ridges and forms new oceanic crust. It also accumulates in the magma chambers of volcanoes and is erupted as lava, ash, and gas. The oceanic crust and its added layer of sediment are subducted at the continental margins as the less dense oceanic plate descends under the heavier continental crust and is returned to the mantle.

Another cycle is found in the action of wind and water eroding surface rocks into sand, stones, mud, and minerals, which are transported and deposited elsewhere. Surface currents in

the ocean move warm water from the tropics toward the poles, while deep currents carry cold water in the opposite direction. Similarly, the movement of air—that is, the weather—results in heating and cooling in different locales, depending on the direction of flow between the equator and the poles. The cycle of seasons—winter, spring, summer, and fall—is determined by the annual orbit of the Earth and its changing orientation toward the Sun.

All these cycles are species of motion—that is, change in the spatial relations of molecules or objects. The cycles are also uniformitarian processes—that is, they are continuous and never stop. And whereas the effects are macrocosmic, the agents are, by and large, microcosmic particles.

5.1. Theory of Motion

A theory of motion is a theory of everything. The final theory will be a correct, complete theory of motion in the microcosm. Every physical thing, object, phenomenon, particle, and form of energy is a species of motion.

A theory of motion is a description of change in spatial relations. All possible arrangements of systems of particles are the stable endpoints of changes in the spatial relations of the members of the system.

5.2. Wave or Particle?

Since the scientific revolution began, there has been debate and confusion about whether a given microcosmic phenomenon is exhibiting wave or particle motion. *Particle* describes structure and substance more than motion. *Wave* describes motion while ignoring structure.

Light has historically been deemed to be waves, not particles, and has been described by writers as sunbeams, rays, sunshine, rainbows, shadows, radiation, emanation, flames, lightning, and so on. One former hypothesis was that light is corpuscular—that is, consists of corpuscles. When the hypothesis that light is a wave became ascendant, its motion was described as wave trains and wave fronts. Its wave motion is transverse, not longitudinal.

The light produced in Crooke's Tube was named cathode rays. Subsequently, it turned out to be a stream of electrons, particles of matter.

Radioactivity was determined to be alpha particles (helium nuclei), beta particles (electrons), and gamma rays (high-frequency electromagnetic radiation).

The photon is a calculated quantity of radiation energy, used mathematically as if it were a particle.

Cosmic rays were found to be energetic atoms and protons and are now called cosmic particles.

The neutrino began as a quantity of energy that was calculated to be “missing” during certain radioactive transformations. Later, a similar calculation found it to be part of the process of nucleosynthesis in stars. It was calculated to be magnetically neutral and was named the “neutrino,” a small neutral particle. The physical hypothesis of the neutrino has always been as a particle. Until now, it has never been described as a wave or a form of radiation. This calculating, hypothesizing, and naming was a process in which anthropocentrism was influential.

Having been deemed to be a particle, the neutrino was then assumed to have mass, a property of all particles of matter. Efforts have been made to determine a measurable mass for the neutrino, and some experimenters have claimed success.

However, light is deemed to be massless and chargeless, so little experimental effort has been made to measure its mass.

5.3. Flocking and Schooling

The flocking of birds, the schooling of fish, and the swarming of insects are a familiar type of motion. A large number of animals move as a group, seemingly in unison. How do individuals in the group maintain their position and direction?

These animals have a field of vision that is practically spherical. The sight of an individual animal gives it a constant three-dimensional view of the adjacent members of the group. The eyes are the organ that senses the information needed for measurement. The ones in front of and behind the measuring animal are in its radial dimension, those to the left and right are in its tangential plane, and those above or below are in a parallel plane.

The motion of the animal at the center is defined by its central spherical frame of reference. The spatial relations between the central member and each adjacent member are determined by an external tangential frame of reference. The information obtained by the central member visually enables it to determine whether the other is approaching or receding, turning left or right, or moving up or down. It can then make instantaneous adjustments in its own motion, as necessary, to stay at the same distance and in the same direction as its fellows.

6. Measurement

The only natural part of mathematics is measurement. The rest of mathematics is performed by humans and is artificial, symbolic, and mental. Nature does not calculate. Nature does not record. Nature has no memory.

The explanatory power of mathematics regarding natural phenomena is undoubted. Words, pictures, diagrams, models, and animation are equally powerful. Mathematics is the least realistic method of explanation. Realism requires a moving three-dimensional representation.

Measurement is integral to the interaction of two identical particles. The one has “knowledge” of the other by means of their common frame of reference. Natural measurement is a continuous process. It is an ongoing “estimation” by one of the relativity of the other. Is its distance farther or nearer? Is its angle changing leftward or rightward? Is its direction the same or opposite?

The range of interaction between the two particles is limited in an inverse square relation. The maximum amount of the cause and effect of the interaction occurs at the minimum separation.

The four quantities that a particle can measure are distance, angle, direction, and duration. The three spatial dimensions—radial, tangential, and axial—and the temporal dimension are derived from these measurements. They determine relations and properties of plane, size, volume, separation, phase, symmetry, synchronicity, front/back, up/down, left/right, clockwise/counter clockwise, and same/opposite.

With its internal spherical frame of reference, a particle measures itself. It measures the other with an external frame of reference—the common frame of reference of the two particles. An external frame is tangential; and when the two particles are at minimum separation, the external frame is tetrahedral.

7. The Practice of Physics

The relationship between the phenomena of nature and the mathematical theoretical practice of physics needs to be reassessed. Among the topics to be considered here are:

1. The role of mathematics: calculation vis-à-vis measurement.

2. Awe of mathematical prediction.
3. The baneful effects of anthropocentrism.
4. A suffocating orthodoxy.
5. Denigration of visualization and modeling.
6. Experiments that are manipulative rather than imitative of nature.
7. Theories about the observer.
8. Misconceptions about time.
9. Expensive technology; e.g., the large hadron collider and the space telescope.

7.1. Mathematical Assumptions

James Clerk Maxwell is remembered for his equations. He changed natural philosophy into the mathematical physics that today is the ascendant methodology in the study of nature. He is admired for his successful “prediction” of radio, the long-wave part of the spectrum of radiation. He did not discover radio. That laboratory task was achieved by Heinrich Hertz, two decades later. One could say that Hertz invented radio, since both the transmitter and the receiver were manmade. Natural radio was “discovered” when the study of static interference affecting commercial broadcasters was traced to lightning and the Sun, Jupiter, and the Milky Way.

Prediction is no big thing. Successful discoverers or inventors ask the right questions, make true assumptions, and see the way forward. During the course of their work, most of them have also made wrong assumptions and failed to demonstrate that those assumptions conform to nature. Many other researchers have never succeeded because their speculations, conjectures, assumptions, hypotheses, and theories were not “predictions.” Their imaginings did not come true, their ways forward were dead ends, and their hypotheses were falsified, but their work was a necessary part of the process of increasing knowledge of nature.

Sometimes, false assumptions still produce acceptable mathematical results. One such case is the 2,000-year reign of the geocentric Ptolemaic theory of the solar system. In this case, the acceptable results were the calculation of future solar eclipses, the positions of the planets and stars, and the time of the New Moon, upon which the calendar and astrology were founded. In those days, professional mathematicians made a good living as astronomers, astrologers, and calendar officials because their observations and calculations were sufficiently accurate to satisfy their employers. The admiration engendered by their ability to foretell and prophesy future events is still with us.

This sad story of ignorance can largely be attributed to the flexibility of mathematics, its ease of manipulation, and its susceptibility to “renormalization.” Mathematics is a tool, an artifice, whose users are adept at inventing and theorizing. In their imaginations, the ancient practitioners of the numerical arts, who were the leading applied mathematicians of their time, found the deferent, the epicycle, the equant, and the eccentric.

The geocentric theory was falsified by the work of Copernicus, Brahe, Kepler, Galileo, and other philosophers and inventors, with the end result being a scientific revolution. The accuracy and quantity of data resulting from Brahe’s patient observations, the new technology of the lens maker’s magnifying telescope, and the imagination, mathematical skill, and thirst for knowledge of Copernicus, Kepler, and Galileo came together to conceive, express, and find evidence for an alternative hypothesis of the solar system. It was a heliocentric system, which assumed that the Sun was at the center, and the Earth was a planet like the others.

7.2. Maxwell's Equations

Maxwell, who founded the school of mathematical theoretical physics, was a master of applied physics. One of his assumptions was that it was impossible to “know the mechanism of electricity and magnetism.” This meant that it didn't matter if his mathematical model of electrical phenomena were based on false or unproven assumptions, so long as the methods, applications, and technologies derived from this model worked in everyday practice.

This puts him in the same category as Ptolemy and other ancient applied astronomers. Their highly successful mathematical method of determining future positions of the heavenly bodies was based on false assumptions about the motions of the Earth, Sun and planets. However, unlike Maxwell, they did not express the pessimistic, unscientific view that the actual motions were unknowable.

7.3. Microcosmic Causes

The microcosm is primary, the macrocosm is secondary. The microcosm is hidden. We cannot see, touch, or sense it, and our instruments cannot detect or measure it. It can only be imagined, assumed, conjectured, visualized, modeled, and hypothesized. Its visible effects can be observed, detected, measured, calculated, and manipulated. Knowledge of these effects leads indirectly to theories about their causes.

For twenty-five centuries, the atomic hypothesis of matter successfully explained every terrestrial phenomenon that was investigated. However, it remained a theory, unproven according to its doubters. Then, in 1896, radioactivity was discovered. This previously unknown phenomenon, now revealed by nature itself, provided ample evidence of atomic processes, configurations, magnitudes, and properties. This discovery required a revision of the ancient atomic theory to account for the particles that matter and space are made of.

7.4. Imponderable Fluids

Over the centuries, natural philosophers and physicists frequently assumed that the unknown cause of an observed effect was “an imponderable fluid.” Phlogiston was involved in combustion. Caloric was the fluid of heat. The phenomenon of electricity was a current (some said two). The medium of light waves was an ether. Vitalism was the force of life.

The mysteries of nature, especially the motion of particles in the microcosm, were deemed to be forever invisible, undetectable, and immeasurable. That kind of assumption is still being used today. “Dark” matter and “dark” energy are postulated to explain mathematical hypotheses and interpretations about space and its contents, gravity, and natural history.

7.5. Atomic Structure

When radioactivity was discovered in 1896, exploration of the microcosm went into top gear. A succession of discoveries using this new tool occurred over the next fifty years. Radioactivity was found to consist of alpha particles, beta particles, and gamma rays. Cathode rays and beta particles were found to be different manifestations of the same phenomenon—free electrons, which were identified as the negatively charged constituents of atoms.

After the atomic nucleus was discovered, its positively charged constituent was named the proton. The hydrogen atom was correctly described as having a nucleus of a proton orbited by an electron. Isotopes of elements were discovered, and the constituent of the atom that is neither negative nor positive was named the neutron—a transformed proton.

Nucleosynthesis, the stellar process whereby hydrogen atoms are transformed by fusion into

helium and the other elements, accompanied by the emission of gamma rays and neutrinos, was correctly described. Neutrinos were noted to be the least interactive particle in the microcosm.

The shell structure of the electrons and its role in the formation of molecules was understood. We learned that the electron's trajectory was variable, and more than one electron shared the same orbit.

7.6. Natural and Artificial Electricity

Natural electricity is static electricity. It manifests itself as a discharge.

A current or flow of electricity in a metal wire is artificial, invented electricity. The electricity of a chemical battery or other storage device is also man-made. The power of an electromagnet or generator is a product of human technology.

The word *charge* is derived from the Latin *carrus*, which means "wagon" or "load."

7.7. Observers and Interactors

Theories about or including the observer are common in physics today. This tendency is anthropocentric to the extreme. The observer may be a physicist, philosopher, mathematician, or participant in a thought experiment, who experiences relativity, simultaneity, uncertainty, or some other physical concept deemed to be a mystery of nature. An explanation of the concept is deemed to be necessary for the progress of science.

However, an observer is *not* relevant to natural phenomena, such as the motion of particles in the microcosm, because an observer is not an interactor. Particles do not sense that they are being observed, and their motion is not affected by the presence of humans. The involvement of a human is not reacted to nor measured. Nature can only be understood by describing its own experience, and the human experience is not pertinent.

Being on a train in a station and glancing out to observe a passing train on an adjacent track is a familiar experience. Which train is moving, or is it both? The immediate visual information is insufficient for a determination and must be supplemented by looking at the ground or sky, so that the observer may sense his own movement or lack thereof.

The relativity of the trains' motion is irrelevant because they are not interacting. Each train, one with an observer, is interacting with the Earth, either in motion in one direction or the opposite, or it is standing still. The motion of each train is not a reaction to the other nor the cause of the other.

7.8. Thought Experiment

Thought experiment is a method of inquiry used by theoretical mathematical physicists. Usually, the subject of the thought is microcosmic motion, which leads to calculations and equations related to the real, natural, and observable consequences of unobserved, unknown fundamental motions. Examples of thought experiments include: a planet's orbit having a perfect circle; Maxwell's demon; blackbody radiation; an observer moving at near-light speed; Schrödinger's cat; and the leap of the electron.

However, frequently the type of imagined motion is physically impossible, improbable, or unnatural. But despite that, it is possible to describe these observable effects mathematically in ways that enable us to make use of them.

The process of thought experiments results in formulas, equations, statistics, and designs that are useful in applied physics and technology. Electrical and electronic engineers are dependent on such mathematics, but many of them have doubts about the assumptions regarding the

microcosmic causes of the effects that they make use of.

7.9. Non-Euclidean Geometry

The *Cambridge Dictionary of Scientists*, in its entry for Euclid, states:

In the 19th century, it was accepted that...the fifth postulate (axiom XI) cannot be deduced from the other axioms.... [There were other] geometries in which this “parallel axiom” is false....

In the 20th century, Einstein found that his relativity theory required that the space of the universe be considered as a non-Euclidean space.¹

These statements are illustrative of the divergence of mathematics from nature. Euclid’s postulates (self-evident axioms) are straightforward statements about measurement and how nature works, derived from his experience, reason, and observations and those of his predecessors.

Some mathematicians later challenged Euclid’s claim of having proven his “system” of geometry. This constituted a debate about Euclid’s method, not his description of reality. Those mathematicians offered the “thought experiment” that Euclid’s statement about parallelism is false. However, their assumption was contrary to nature and cannot be depicted or modeled.

Einstein proposed the thought experiment that the geometry of space is non-Euclidean. Can a theoretician “require” nature to be something that it is not? No, but mathematicians have been using this method for twenty-five centuries.

7.10. Prediction

A prediction in astronomy is a statement about future events based on existing knowledge. In the case of eclipses, calculations of future events are accurate because the motions of the Sun, the Moon, and the Earth are known to a high degree.

A hypothesis is a statement about the unknown. It may be accurate and correct if it conforms to knowledge acquired in the future.

In the method of mathematical theoretical physics, a mathematical hypothesis is called a prediction. The logical, precise, and elegant mathematics of the hypothesis is deemed to be physical and real, and therefore natural. That is, if, following experiment and observation, the hypothesis turns out to be correct, then the calculations themselves are a kind of pre-existing knowledge that deserves to be called a prediction.

Avogadro’s hypothesis was called just that. When Mendeleev wrote about new elements, he did not use the word *predict*. Maxwell hypothesized that the spectrum of radiation extended beyond infrared to the long waves. His idea was subsequently labeled a prediction.

7.11. Empty Space

The division of the universe into outer and inner space is an example of anthropocentric thought. It obstructs a natural definition of the concept of “space.” Outer space is thought of as everything above Earth’s atmosphere, or as the “void” between stars, or what sunlight travels through. Inner space is not thought of nearly as often, but it could mean the mind or the internal organs. The term seldom refers to the body’s cells, molecules, atoms, protons, electrons, and

¹David Millar, Ian Millar, John Millar, and Margaret Millar, *Cambridge Dictionary of Scientists* (Cambridge, England: Cambridge University Press, 1996), p. 103.

neutrons.

Our worldview causes us to refer to “empty” space, as if the absence of matter means “nothing.” In fact, matter is *in* space and *of* space. Whatever space may be, it is what matter is made of.

7.12. Theory of the Universe

Current cosmology is a hypothesis about the macrocosm with which hypotheses about the microcosm are now obliged to be consistent. It should be the other way around: particle theory should be capable of explaining everything in the universe. Who knows what direction particle physics might have gone if it were not barking up that wrong tree?

The Big Bang is a theory of origins, of possible events in the remote past. It is a throwback to the ancient cosmologies and creation myths. Assuming that the uniformitarian principle governs nature, a theory of the universe should be about current, ongoing, minimal local processes and interactions. The past is not relevant to particles because they have neither memory nor means of recording.

The explosive expansion cosmology is primarily a gravitational theory, but gravity is not a fundamental force. Gravity is the interaction of stars—the largest accumulations in the universe of particles of matter. The weak, electromagnetic, and strong interactions are short-range and fundamental to the motion of particles.

The present state of knowledge about the microcosm means that any theory of nature will be based on a series of interdependent hypotheses, assumptions, and analogies derived from indirect, rather than direct, observation and measurement of particles. Some of the assumptions may not be true.

7.13. The Big Bang

The Big Bang theory of the universe proposes that everything in the cosmos was concentrated in the distant past in an infinitely small volume. Then there was an event that initiated an expansion and transformation that resulted in the universe as it exists today. That unique event is referred to as a singularity.

The *Gage Canadian Dictionary* defines Big Bang theory as “the scientific theory, now generally accepted, that the universe as we know it began with an enormous explosion” (p. 148).

This puts the Big Bang theory in the category of creation theories that offer explanations of the origin of things. A uniformitarian approach to nature seeks to explain processes that operate continuously and uniformly throughout time. It does not seek to describe how processes got started.

7.14. Visualization and Modeling

We cannot directly observe particles and their interactions. Particles are too small, and our instruments are incapable of resolving the details. Optical and electron microscopes have greatly assisted in discoveries of the very small, but their limit is greater than the largest atom.

Any possible technology that we might use for this purpose includes the probability that the actions of detecting and measuring will change the particle being observed. A beam of particles reflecting off an object during an experiment can change its motion, direction, speed, or temperature, so that it is no longer in its original state.

Manipulating a particle by grasping has the same effect. Causing a particle to collide with other particles may result in its destruction, and only indirect information can be obtained.

Nevertheless, manipulation followed by observation of the consequences has provided much of what we know about the microcosm.

The absence of direct observation of particles necessitates the use of modeling. Assumptions about motion, structure, trajectory, interaction, and relationship are made, and the resulting model is compared to the known facts. The model that best accounts for the evidence will usually be accepted by the scientific community as a basis for further work.

Often a model may be inspired by an analogy with something familiar from another field. An example is the use of the term *nucleus* to describe the position and arrangement of protons, electrons, and neutrons. The structure of a living cell seen by biochemists is assumed by particle physicists to be similar to the unseen structure of an atom.

Similarly, astronomy provides the analogy of electrons orbiting the nucleus as planets orbit the Sun. Previously, borrowing from cookery, the arrangement of electrons and protons in the atom had been likened to raisins in a bun.

Microcosmic interactions and transformations are described by using words such as *emission*, *absorption*, *decay*, *fission*, *fusion*, *annihilation*, and *radiation*. From the point of view of the participating particles, a visualization of these processes, which cannot be observed in detail, is possible.

The Heisenberg Uncertainty Principle is relevant here. It is a statement about the impossibility of determining with unlimited accuracy the position and momentum of a particle. If a particle's position is known, then its momentum is uncertain, and when we know its motion, we cannot pinpoint its location.

This principle is not a description of the reality of nature. A particle has a position and momentum that are known to it at all times. The Uncertainty Principle is part of the method used by mathematical theoretical physicists.

7.15. Sense of Sight

The pursuit of science and knowledge about the world is dependent on our interactions with that world. We use our senses to obtain information about our location and what is happening in our environment. Principally, it is our eyesight and our vision system that accomplishes this job.

The human vision system evolved over millions of years when our ancestors lived in trees. The arboreal way of life requires a binocular arrangement of the eyes and a high level of focus, acuity, and spatial definition, without which one would fall. In tandem with the evolution of our eyes, the brain developed ways of interpreting and responding to the information received through the eyes.

Human vision has a short range and is sensitive only to visible light, the radiation reaching us from the Sun. It is more than adequate for survival and has successfully adapted to a bipedal way of life and our recent cultural evolution.

The guiding principle of the brain's interpretation of information obtained through the sense of sight is that the image is the object. When our ancestors reached for some fruit or a tree branch, the brain directed our movements to accomplish the desired result. If the perceived location of the object were correct, then it would be grasped successfully.

There are situations arising in everyday life when this guiding principle fails. A reflection from a mirror or a similar surface is only an image. Light reflected from an object under water bends because of the difference in the speed of light in water and in air. A mirage on a desert horizon on a hot day is an example of the optical illusions that the brain has trouble interpreting.

When we look out into interstellar space with our telescopes and other radiation detectors,

our vision system must adapt. We must remember that the distance to the source of the observed radiation is immense, as is the time required for the radiation to reach us. Both the source and the observer are in motion and have changed position in that time. Therefore, the image is not the object.

7.16. What Nature Does

Nature is simple. There are only a few constituent fundamental particles, and everything observable is made of them. Nature is economical. Having found the ways that work, there is no need for alternatives.

Nature is constrained by the “laws of physics.” This means that every natural phenomenon takes place in three-dimensional space, in an internal spherical frame of reference and an external tangential frame of reference. Only what is possible in these reference frames actually occurs.

A division of nature has been revealed by science and technology: (1) what nature does; (2) what nature can do but does not; and (3) what nature cannot do, but humans can. In the first category are the natural phenomena that we are familiar with: stars, planets, light, elements, life, magnetism, lightning, fire, and so on. Electrical current and transuranic elements are examples of what nature can do but does not. Nature produces electrical discharge such as the static caused by friction, but does not have batteries, electromagnets, or generators. In the third category is our description of planetary motion. A planet’s orbit is determined by its size, its distance from the Sun, and its gravitational interaction with other bodies of the solar system. This is synodic motion. A planet’s sidereal motion, relative to a distant star with which it is not interacting, can only be calculated by a human.

8. My Method

For the past twenty-five centuries, progress in natural philosophy has been hindered by five ongoing problems: false assumptions, insufficient data, inadequate technology, contrived mathematics, and anthropocentrism. In the last five centuries, these difficulties have been significantly overcome by the work of great thinkers, but they are still with us, some as powerful as ever.

An attempt to deal with false assumptions arising from facile mathematics and anthropocentrism is the subject of this work. I wish to study nature by using only nature’s numbers, by avoiding calculation and adhering to measurement. I propose to cease being an observer on the outside, and to visualize phenomena from the insider’s central point of view.

As a particle, I wish to answer five questions: What am I? What do I do? How do I do it? What could I do, but don’t? What can other human beings manipulate me to do?

8.1. Natural Philosophy

This is a work of natural philosophy. It is metaphysical, hypothetical, speculative, and theoretical. It is about nature and our knowledge of it. Thus, it is about science and the observation, measurement, and description of natural phenomena. It is about the practice of physics. It is about cosmology. It is a theory of the universe. It is not a report of experiments or calculations. It is about the microcosm and the macrocosm. It is about particles, motion, interaction, and transformation. It is about matter, radiation, and neutrinos.

This work has two parts: (a) a history of our knowledge of the microcosm; and (b) a hypothesis based on alternative assumptions. The history will involve the identification of the

facts, assumptions, and interpretations of the current paradigm. It will account for the development of physics over the centuries and the specializations, schools, and models that exist today. The history of natural philosophy divides into four periods: (a) from classical Greece to Copernicus (1534 A.D.); (b) from Copernicus to Lavoisier (1789); (c) from Lavoisier to Becquerel (1896); and (d) from Becquerel to the present.

This work is also about method. It is about the human factor and the role of the observer. It will discuss experiment, calculation, and visualization. It will discuss the difficulties presented by anthropocentrism, careerism, the act of measurement, and dependency on mathematics. It will describe the problems encountered in measuring the very large and the very small. It will discuss the limitations of technology.

In the second part of the work, there will be an attempt to describe nature from the perspective of nature itself, eliminating the observer and the problems of invisibility and immeasurability. Answers will be offered to questions such as: What is a particle? Does a particle have a structure? What does a particle do? What is a particle's frame of reference? What is nature's mathematics?

8.2. Methods of Description

Methods of describing nature include words, numbers, pictures, diagrams, and models. Three-dimensional models and two-dimensional pictures are representational of nature, but they are static.

Motion is a property of every natural phenomenon. In order to describe a change in nature, a difference from one state to another, verbal, mathematical, and diagrammatic tools are used. To describe motion accurately and comprehensively, mathematics is essential.

A law of physics is not a human creation. It describes what nature is doing in its reference frame of three spatial dimensions. Nature is constantly measuring, while constantly changing position relative to a fixed point.

The mathematics of nature is measurement or estimation. In formal and practical mathematics, it is geometry (Earth measure). In a particle's frame of reference, it is autometry (self-measure), or topometry (place measure), or stereometry (three-dimensional measure). The ability to measure—to sense the constantly changing position of another particle—is intrinsic. There is no motion without measurement, because all motion is relative.

A measuring particle uses units based on itself. Its radius is the distance-unit, and its period of oscillation is the time-unit. A complete description of motion can be provided with a *distance* and a *period*, plus an *angle* that is either a fraction or a multiple of pi, and a *direction* that is either positive or negative.

From these measurements, the triangle, sphere, and tetrahedron can be constructed; and the line, plane, vertex, angle, perpendicular, and parallel can be defined. These are all the “mathematics” that nature needs.

8.3. Assumptions

The consistent application of the uniformitarian principle leads to insights of great utility:

1. The microcosm is primary and fundamental, whereas the macrocosm is secondary and consequential.
2. For a particle, time is merely the present, while the past exists by means of

recording and recall.

3. Biological natural selection is a trial-and-error process of variation in spatial relations.

4. Ordinary Euclidean solid geometry is sufficient for a full mathematical description of natural phenomena.

5. Natural phenomena involve motion, since they are all interactions between two oscillating particles. The “output” of one interacting particle is the “input” of the other. The motion of each particle is both a cause and an effect.

6. A natural philosophy should be a process of putting questions, uncovering assumptions, and exploring alternative assumptions, hypotheses, and theories of nature in a non-exclusive fashion unrestricted by orthodoxy.

8.4. An Alternative Method

My method is:

1. To ignore human experience completely in order to avoid anthropocentrism, the greatest obstacle to natural knowledge.

2. To be a visualizer and modeler and to abandon the role of observer, quantifier, and manipulator.

3. To follow Ernest Rutherford, who said that he asked himself, “What would I do if I was one of those little buggers?” and Linus Pauling, who expressed a similar thought process.

4. To remove myself from the situation by pretending to be a particle.

5. To write a description of the universe from the point of view of a particle.

6. To use ordinary Euclidean three-dimensional solid geometry.

7. To adhere strictly to simplicity and minimalism as fundamental to nature.

8. To apply the uniformitarian principle universally.

9. To deem the macrocosm as non-fundamental and consequential.

10. To use mathematics in the same way that nature does, without recording.

11. To position myself in the schools of Copernicus, Kepler, Galileo, Newton, Boscovich, Lavoisier, Dalton, Faraday, Mendeleev, and Rutherford.

12. To distance myself from theoretical mathematical physics, Big Bang

cosmology, quantum mechanics, and Einstein's theory of relativity.

13. To ignore questions of origin, creation, history, the past, and the future.
14. To apply the following assumptions:
 - a. Stable interactions consist of identical particles that are face-to-face and move in opposite directions.
 - b. Nature is binary: constant/varying, odd/even, positive/negative, right/left, and clockwise/counterclockwise.
 - c. Trajectories are finite: that is, motion is oscillatory, reflective, and cyclic.
 - d. The first dimension is radial, the second is tangential, and the third is axial.
 - e. The universe is a system in which all phenomena are interactive and interdependent, and feedback is always present.
 - f. Motion is relative: that is, for every moving part there is a constant unmoving center.
 - g. Fundamental interactions are stable: therefore, collapses, collisions, impacts, contacts, ejections, explosions, punctuated equilibria, and catastrophes are not fundamental.
 - h. Interacting particles are not contiguous but at a distance.

9. The Smallest, Simplest Particle

Since the invention of electrical current, more than two centuries ago, investigation of matter and radiation has revealed that nature is simple. The constituent particles are few and infinitesimal. From the stable fundamental microcosmic particles, a macrocosm of astonishing complexity has been constructed by means of a multitude of spatial interactions.

A proton and an electron arrange themselves in an atom of hydrogen. In stars, hydrogen atoms transform and fuse into the other elements, which combine to form the myriad material molecules of the terrestrial world. From an ancient, microscopic, single-celled creature evolved the diverse species of viruses, bacteria, plants, and animals.

In 1758, Roger Joseph Boscovich published *A Theory of Natural Philosophy*, in which he made an early attempt to model the atom, visualizing the particle as a point. That concept has been useful ever since, because neither the atom nor any other particle has been directly observed and measured, although a great deal has been learned indirectly. In the full range of physical things, the point is the smallest object observable or imaginable. In geometry, the point is defined as having position but no extent.

Following Boscovich, a hypothesis of the smallest, simplest particle as a microcosmic base

of the stable fundamental particles suggests a system of two points at minimum separation, one of which is a constant center point, and the other is a varying point of tangency. For convenience, this hypothetical two-point minimal oscillating particle is named the oscillon (see Figure 1, below).

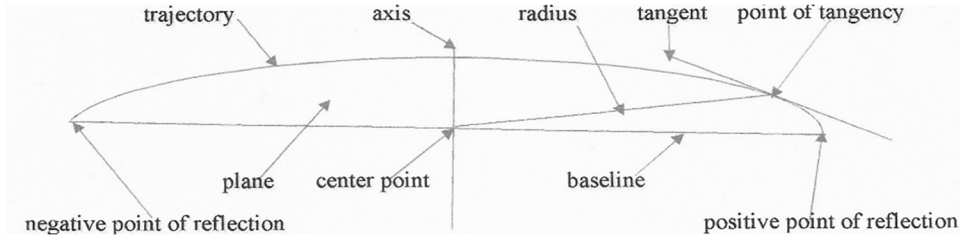


Fig. 1: The Oscillon, Its Frame of Reference, and the Trajectory and Direction of Its Motion

The variation of the position of the point of tangency relative to the center is an oscillation through an angle of π (180°). Its trajectory, which is a semicircle, terminates at two points of reflection. The direction of motion at one point of reflection is positive, and at the other is negative. The period of the oscillon is the time between reflections, and two periods constitute a cycle.

Measurement is an integral part of motion and interaction. Nature demonstrates this fact in the inverse square relation that determines the motion of a planet orbiting a star. In the microcosm, there are no “observers”; therefore, the process is one of self-measurement by the oscillon. Measurement is the quantification of spatial and temporal relations. In order to measure, the oscillon uses the spherical frame of reference based on its center point.

The oscillon has the ability to measure four quantities: distance, angle, direction, and period. These are sufficient for its purpose. A line from the center to the point of tangency is a *radius*, and the particle, its oscillation, and its frame of reference are based on the radial dimension. A line through the moving point of tangency, at right angles to the radius and in the direction of its motion, is a *tangent*, which defines the tangential dimension. Together, the radial and tangential dimensions define the *plane* of the oscillon. A line through the center at right angles to the plane is the *axis*, which locates the axial dimension. The three dimensions jointly determine the structure, frame of reference, and motion of the oscillon.

It is worth noting that the tangential dimension does not pass through the center. It is the external dimension, while there is an orthogonal line through the center that is parallel to the tangent. Nature here demonstrates its beautiful symmetry, in that the radial dimension passes through both the center and the point of tangency, the tangential dimension only passes through the tangent point, and the axial dimension only passes through the center.

The units of measurement used by the oscillon are self-referential. Its radius is the unit of distance. The angle between the points of reflection is π . The direction of motion from a point of reflection is either of two opposites: positive and negative or clockwise and counterclockwise. The oscillon’s period of motion from one point of reflection to the other is the unit of time. The system of numbers used by the oscillon is probably not the decimal system, which was derived from the number of human fingers and toes. A reasonable conjecture is that the numbers 0, 1, 2, and 3 fulfill all its functions.

9.1. An Ur-Particle

Is there an elementary particle that is the building block of all the stable elementary particles?

Is a small, simple particle all that is needed to construct the known particles? Do such minimal particles interact, combine, and transform in ever more complex relations to form neutrinos, radiation, and matter? Is there an ur-particle—the original, most primitive form of motion in the universe?

If so, what would the smallest, simplest particle be like? There is nothing smaller physically than a point, described by Euclid as having place but no extent. The universe is well defined as the infinity of points.

A particle is a quantity of space that is physically separate from and particular from all other quantities. It has an interior and an exterior. It is three-dimensional. The possession of a center distinguishes one particle from all others because no object has two centers, nor does one thing have the same center as another.

9.2. Nature's Economy

We know that matter (hydrogen, atoms, elements, molecules, and chemicals) is made of only two particles: the proton and the electron. We know that plants and animals, from the smallest viruses and bacteria to the largest whales and redwoods, are made of cells. We understand that nature tends to stick to the tried and true. Having found a way that works, nature does not need an alternative.

Is it logical to assume that all of nature, including space, is made of a single foundational form of motion, and that the complexity that we observe is merely a variation in the dimensionality of the interactions of ur-particles?

10. Frame of Reference

What is the meaning of *frame of reference*? Grammatically, *frame* is a noun; and *refer*, the root of *reference*, is a verb. A noun represents a thing, object, or entity, and a verb represents an action, experience, or phenomenon. Thus, when describing a frame, object-words like *base*, *figure*, *line*, *plane*, *point*, *space*, and *vertex* are used.

When describing a reference, action-words like *differ*, *measure*, *oppose*, *pass*, *process*, *project*, *relate*, *start*, *use*, and *view* are used. Also used are words that describe quantities, such as *angle*, *distance*, *radian*, *ratio*, *separation*, and *unit*, as well as numbers such as 0, 1, 2, π , and $\pi/3$. Relations and qualities are described by using words such as *axial*, *constant*, *dimensional*, *directional*, *external*, *internal*, *invariable*, *minimal*, *natural*, *physical*, *radial*, *real*, *straight*, and *tangential*.

The oscillon, a system of two points in a spherical frame of reference, has self-knowledge and a capability of measuring both itself and beyond. It has the means of sensing its surroundings and the potential of interacting with other such systems.

10.1. Continuous Measurement

The measuring done by interacting particles in the microcosm is similar to that of birds in a flock, or fish in a school, or NASCAR drivers in a race. It is dependent on a continuous feed of information about the adjacent members of the group in all directions. The members achieve an optimum distance between individuals by maintaining a balanced separation from their immediate neighbors.

They do not “record” the precise numerical length of a measurement. Because each individual is moving relative to the combined trajectory of the group, the distance from each

other is subject to variation at any time. This necessitates continuous comparison and continuous response. Of course, that is what an interaction is—a process of feedback whereby every action is a reaction, and one’s output is another’s input.

The process of interaction involves more estimation than measurement. The question is not so much “How far away is the other?” as “Is its distance changing?” This involves an assessment of ratios that relate to directions of movement. The measurer responds with actions and changes, such as: accelerating, getting closer, going down, moving up, pitching, rolling, slowing, turning left, turning right, yawing, and so on. Measurements like this are valid only in the present, to be redone over and over, in a process that needs no recording.

10.2. The Self’s Point of View

There are two views of a phenomenon: (1) the view from the center, called the internal viewpoint or the self’s view; and (2) the view from an infinite number of surrounding points, called the external viewpoint or the observer’s view.

The centers of interacting oscillons, by a process akin to natural selection, determine the distinction between front and back, left and right, up and down, in and out, forward and reverse, and clockwise and counterclockwise. It is the orientation of structure and the alignment of motion of one to the other within their common frame of reference that enables them to specify the various different or opposite directions that each is experiencing.

10.3. Absolute Space and Time

There has been a debate in natural philosophy since the time of Newton about whether there is such a thing as absolute space or absolute time. The question, which relates to motion, measurement, frame of reference, and units to be used, is asked from the point of view of an observer-measurer.

I have assumed that the observer is irrelevant to a description of nature, and that the central point of view is paramount. A particle has a center and a frame of reference that are constant, unchanging, and therefore absolute. Each particle has a unique center and its own frame of reference.

For a self-measuring oscillon, there is an absolute space and time, defined by its own frame of reference and by units based on itself and its motion. Thus, a particle’s absolute space is not the same as that of any other particle. But since all oscillons are identical, the process and method of self-measurement are the same. The distance-unit and time-unit of nature are absolute.

10.4. The Purpose of Senses

Biochemical evolution has produced animal senses of great diversity and acuity. Our senses operate at all scales—from very large, such as touch and gravity, to very small, such as light waves and pheromones. However, the purpose of these senses is the same as the “senses” of the oscillon: namely, to provide a frame of reference for internal and external measurement and for effective interaction with the environment.

Vision is the most useful human sense because of its range: near to far, large to small, dark to bright. It is light-dependent, and direct and reflected light are ubiquitous in our environment.

10.5. Are There More Than Five Senses?

Reference is often made to the five senses of hearing, sight, smell, taste, and touch. Listing

only five is meaningful if we are talking about what our conscious mind is ordinarily aware of. However, there are other senses that operate at a more unconscious level, such as:

1. Sense of gravity (up and down)
2. Sense of balance (vertical and horizontal)
3. Sense of time (fast and slow)
4. Sense of distance (near and far)
5. Sense of temperature (hot and cold)
6. Sense of pressure (soft and hard)
7. Sense of moisture (dry and wet)
8. Sense of weight (light and heavy)
9. Sense of identity (self and other)
10. Sense of change (constant and variable)

11. Oscillation, Interaction, Locomotion, and Wave Motion

Is it a universal characteristic of motion to be two-stroke? Is every type of motion a back-and-forth cycle? Is there a power stroke followed by a return stroke? Does every trajectory lead to a return to an earlier position? Is there always reflection and repetition? Is there motion in one direction followed by motion in the opposite direction? Both oscillation and rotation exhibit this characteristic.

A piston moves “down” on the power stroke and “up” on the exhaust stroke. Humans move with bipedal locomotion: when one extended leg plants on the ground and thrusts forward, the other leg bends in the air and swings back through the same angle and distance. While the body travels relative to the ground, the legs oscillate relative to the torso.

11.1. Synodic Motion

Synodic is a good word to describe the interaction of particles. The Gage Canadian Dictionary gives the Greek origin of the word as *syn-* “together” + *hodos* “going.” The synodic period of one planet relative to another is the time between their nearest approaches to each other when their gravitational interactions are greatest. A planet’s synodic motion is the orbital trajectory determined by its varying gravitational interaction with the other bodies of the solar system.

The interaction of particles results in motion that is synodic. Microcosmic input/output and action/reaction processes are continuous and uniform. Synodic motion is natural motion.

11.2. Motion in the Plane

All trajectories have a center; all trajectories are planar; all trajectories are cyclic. A trajectory is the path taken by a moving point in relation to a constant point. The constant point is the center of the frame of reference containing the two points. A trajectory is the time-related change in the direction, angle, and distance of the moving point relative to the fixed point.

Only two-dimensional trajectories are possible in nature’s three-dimensional space. All trajectories are in the plane that contains the center and all possible positions of the moving point. Planar trajectories may be rectilinear or curvilinear and may have the shape of a line, spiral, circle, ellipse, parabola, or hyperbola. Trajectories are finite in distance and continuous in time.

Nature imposes the limits of a minimum and a maximum on motion. These are manifested in

the oscillon. The distance between the varying point and the constant point is the minimum. The distance between the points of reflection of the varying point is the maximum. The radius of the oscillon is a minimum, and the semicircular trajectory is a maximum.

11.3. No Nature Without Motion

So far as we know, everything in the universe is in motion. Nothing is at rest. Motion never stops. When a person is unconscious, the lungs breathe, the heart beats, the nerves fire, and the Earth rotates and revolves in a rotating galaxy. Every form of energy, work, force, power, or change involves motion.

There are two types of motion: oscillation and locomotion. When a particle oscillates, part of it changes position relative to its center, but the whole stays in the same place. When a body is in locomotion, its center moves relative to another center, and the whole moves from one place to another.

11.4. Repetitive Motion

In common practice, the word *oscillation* is used synonymously with *vibration*, *swing*, and *wave* to describe the repetitive motion of objects that return to their starting positions. Familiar examples are sound waves, seismic waves, ocean waves, ripples on a pond, and vibrating strings. In these cases, there is a material medium through which energy propagates after the application of a force. The oscillatory movement of the air, earth, water, or fiber continues as long as the force is applied, and then, as the energy dissipates, the medium returns to its original state.

The movement of a pendulum is an oscillation. The Gage Canadian Dictionary defines *pendulum* as “a body or mass hung from a fixed point so as to move to and fro under the forces of gravity and momentum” (p. 1089). The period of a pendulum is the time taken to swing from one limit to the other, and the cycle is the time of a to-and-fro motion. The angle of swing is the amplitude. The frequency of a regularly repeating motion is the number of cycles completed in a given time.

To discuss the oscillation of a solitary particle in an imaginary empty universe, I find the analogy of the pendulum most helpful, since I am looking for a regularly repeating motion, self-generated, free not forced, and to and fro, with a curvilinear trajectory. However, rather than having a continuous spinning or rotating trajectory, the motion reaches a certain point, reflects without stopping, and continues in the opposite direction to the starting point.

11.5. Attractive Interaction

Regarding the self-generating, self-measuring, oscillating particle and a second identical particle, there are an infinite number of possible spatial and temporal relationships. If their positions are within range—that is, if their external frames of reference overlap—then interaction may occur. Two of these interactions are meaningful, but only one results in stability.

The spatial relation of identical particles is symmetrical if they are in the same plane, and if their points of reflection are co-linear. Their temporal relation is synchronized if their periods are in phase. If their directions of motion are opposite, one clockwise and the other counterclockwise, then the interaction is attractive. If they are oscillating in the same direction, both clockwise or counterclockwise, they repel each other.

11.6. A Solitary Particle

How should a particle be defined? Is it the smallest division of space? Is it the minimum volume? Is it the smallest quantity of motion? Does it have the shortest radius? Is it a quantity of one?

A natural object or phenomenon may be defined in terms of its properties, which are determined by observing it, measuring it, breaking it, and causing it to interact with other objects. To answer the question of what a particle is, we can imagine a time and a place in which there is only one particle. Since there is nothing external to such a particle, and it is not interacting with any other particles, the only view of its existence is from within. That view is of the properties of the particle in and of itself, its being, its reality, and its physicality.

11.7. Natural Selection

Natural selection, the felicitous phrase introduced by Charles Darwin, is the way nature deals with alternative spatial relations. Is it possible for particles to interact in a way that is different from the existing arrangement? Can the same particles interact in more than one spatial configuration?

The more complex the particle, the more alternatives are possible. Particles of matter form complex molecules, or chains of atoms. An atom of carbon can combine with atoms of other elements in a seemingly limitless number of ways.

Over time, all alternative spatial configurations may occur by chance. Nature “tries” to see if an alternative works or results in “error.” If the alternative is a stable interaction, harmonious with existing nature, then it may be selected and become common.

The history of the universe is a process of successive natural selections. The first natural selection occurred when two identical points in space differentiated into a constant point and a varying point, and motion began. Next, there was a choice of positive or negative, and the direction of motion was selected. Then a point of reflection was chosen, and the trajectory of motion was selected.

11.8. Wave Motion Is an Optical Illusion

All the familiar terrestrial waves occur in a material medium. Ripples in a pond and whitecaps on a lake occur in water; sound is a movement of air; and seismic waves are a quaking of the ground. The molecules of the medium oscillate in place. Water waves and ground tremors are transverse waves, meaning that the motion of the particles is at right angles to what we perceive as the direction of the wave. In air, the motion is longitudinal—that is, the molecules are oscillating in the same direction that the sound wave is propagating. These familiar waves are caused by macrocosmic events such as a golf ball landing in a pond, the wind interacting with the surface of the ocean, or a sudden slip of two plates of the Earth’s crust along a fault line.

What we experience as a wave—that is, a horizontal movement of the medium from the originating phenomenon to another location—is an illusion. The real motion is a sequence, over time, of microcosmic particles oscillating relative to a constant center and interacting with adjacent particles. The brain, receiving information through the visual sense, interprets the observations by using its experience of time—that is, memory—so that it seems like something is moving from place to place.

The illusion becomes obvious when we observe the actual motion of a medium of macrocosmic particles oscillating in sequence, creating what is called a stadium wave, also known as a Mexican or audience wave. Here the particles are human bodies, and the oscillation

is a vertical movement by each person from the sitting to the standing position with an extension of the arms over the head, followed by a return to the seated position. It appears to our brain that something is moving around the oval stadium in an up-and-down fashion, and that that movement has the shape of a wave.

The participating individuals in the audience, facing inward, interact with their neighbors on one side by means of vision and create the wave by moving in an orderly, regular, and uniform sequence. This is metachronal motion (from the Greek *meta-*, “before,” and *chron-*, “time”)—that is, motion produced by sequential action.

A diagram of wave motion is also illusory. It is a curved line of crests and troughs relative to a baseline, indicating a trajectory or direction of motion. In fact, the motion is of particles oscillating transversely to the baseline, and there is no physical connection between the particles other than their interaction in a common frame of reference.

11.9. The Medium of Light

Light and the other frequencies of electromagnetic radiation are also transverse wave motions. Light is emitted by stars and propagates through space in all directions. Some of it is absorbed or reflected by material bodies. Scientists generally have accepted that starlight is a wave, but there is no consensus about the medium through which it is propagating.

Is space the medium? If so, what is space made of? Is it ether? That is a hypothesis based on the assumption that the medium of light is made of matter. However, no experimental evidence of an ether has ever been demonstrated, which indicates that the medium is not material. Other hypotheses about space and the medium of light have been proposed, but the debate continues.

Experiments using stadium waves could demonstrate the different frequencies and wavelengths of the motion of interacting particles. The motion of particles when waves intersect could be investigated. Various periods of oscillation and intervals of interaction could be researched.

12. The Model of an Oscillon

An oscillon is a system of two points. One of the points is a constant, invariable center. The center is zero: a point of reference, a viewpoint, a base, and an origin. The other point is a variable, moving point of tangency. The oscillon is a binary system made of points, of which there are two; they are separate and different, one constant and the other in motion. The center point and the point of tangency are real, physical, and natural.

An oscillon has identity, dimensionality, size, and shape. It has an interior and an exterior. The oscillon has a frame of reference, which is a process of measurement of distance, angle, direction, and shape (see Figure 1, above). The process makes use of lines, figures, planes, intersections, angles, and numbers, which are not physical. A frame of reference is not physical, but the act of referring is real.

The distance between the oscillon’s center and point of tangency is a radius that is constant. The straight line between the center and the initial position of the point of tangency is the baseline of the frame of reference. The radius, which passes through both the center and the point of tangency, defines the radial dimension of the oscillon. The distance between the points is the minimum physically possible separation, whose length is one distance-unit.

The numerical name of the center is zero (0) and of the point of tangency is one (1). A radius has two directions: outward from the center to the point of tangency ($0 \rightarrow 1$ or $1 \leftarrow 0$), and inward from the point of tangency to the center ($1 \rightarrow 0$ or $0 \leftarrow 1$). Conventionally, the outward direction is

frontward and positive, and the inward direction is backward and negative.

There is an extension of the baseline from the center in the negative direction. On this line, at 1 distance-unit from the center, is the opposite point of tangency—that is, the point of reflection. The distance between the starting point and the point of reflection is 2 distance-units. The line between them is a diameter, and each of its segments is a radius. The number of the opposite point of tangency is 2.

The space between the baseline and any other line through the center, and the difference in their directions, is an angle. The center—that is, the point of intersection of such lines—is the vertex of the angle. One such line is the co-linear extension of the baseline radius, and the measure of the angle between the radius and the extension is pi. The angular measure is the same, regardless of the direction of measuring. Pi is a number. The equivalent of an angular measure of pi is 180 degrees.

A line through the point of tangency at an angle of 90° to the radius is a tangent. The tangent, which passes only through the point of tangency, defines the tangential dimension of the frame of reference. The radius and the tangent together establish the plane. The tangent has two directions—of which, conventionally, one is right and positive, and the other is left and negative.

A line through the center at an angle of 90° to the plane is an axis. The angle is constant. An angle of 90° is a right angle, and the relation of the axis and plane is perpendicular or orthogonal. The axis, which passes only through the center, defines the axial dimension of the frame of reference. It has two directions: conventionally, one is up and positive, and the opposite is down and negative. The radius, tangent, and axis are all perpendicular to each other, and this relation is constant.

An oscillon is a fundamental particle with an oscillating point of tangency. Any line through the center in the oscillon's plane is a radius. There is a point of tangency on such a radius at 1 distance-unit from the center. Thus, in relation to the baseline of the frame of reference, a radius and tangent, moving in tandem in the plane, have angular variability. Tangents in the plane at opposite points of tangency are parallel to each other. The difference between the directions of any radius in the plane and the baseline of the frame of reference is an angular measure that varies from zero to pi. The direction of the angle from the baseline is either positive or negative.

The internal frame of reference of an oscillon is based on two physical points: the center point and the point of tangency. The frame has three dimensions: the first is radial, the second is tangential, and the third is axial. The separation of the points and the angular relation of the dimensions are constant. The shape of the frame of reference is spherical.

12.1. The External, Tangential Frame of Reference

The common center of two oscillons is the point of intersection of their common tangents. That is the center of tangency, and it is co-linear with and equidistant from the centers of the particles. It defines their common frame of reference and lies on their common radius (see Figure 2, below).

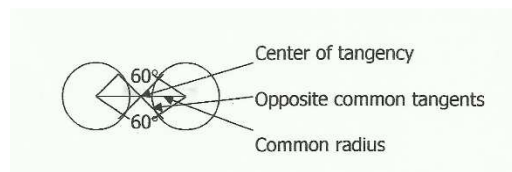


Fig. 2: Diagram of Center of Tangency and Center of the Common Frame of Reference of Two Interacting Oscillons

The angle of intersection of pairs of common tangents depends on the distance between the oscillons. When the separation is zero, the particles are tangent to each other, and the angle is zero. The common tangents coincide, and the particles are touching.

The oscillons also have common tangents that are co-linear. Their angle of intersection is 180° . Such tangents are parallel to each other and to the common radius.

When the interaction of two oscillons is stable, their separation is minimal and non-contiguous. Their centers and the center of tangency form a common radius. Their common tangents intersect at supplementary angles of 60° and 120° .

The acute angle between the tangents is 60° , and the angle between a tangent and the common radius is also 60° . This special intersection is equiangular—that is, all six angles between the tangents and radius are 60° .

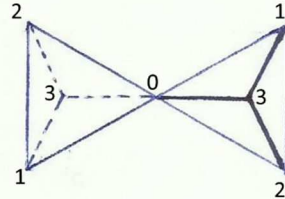
12.2. The Tetrahedral Frame of Reference

A 60° angle is special because it is the angle of the equiangular, equilateral triangle, the simplest two-dimensional plane figure, or polygon. Similarly, it is the angle of the tetrahedron, the simplest three-dimensional “solid” figure, or polyhedron. The Greek roots of these words are: *tri-* “three,” *tetra-* “four,” *poly-* “many,” *-gonia* “angle” or “corner,” *-hedra* “side,” “face,” or “plane,” as well as *stereo-* “solid” or “three-dimensional.” A tetrahedron has four vertices, six edges, and four planes or faces, each of which is an equiangular triangle. Three edges intersect at each vertex at an angle of 60° , and two planes meet at each edge at a dihedral angle of 71.529° .

Thus, the common frame of reference of such stable interacting oscillons is tetrahedral. The center of tangency, where the tangents intersect, is both a vertex of a tetrahedron and the base of this frame of reference. An edge of a tetrahedron is a segment of a tangent. The rest of the frame is a continuous array of co-vertical tetrahedra derived from this starting point. None of these lines, points, and figures are physical, but they make up a real frame of reference that is indispensable to the measurement that relative motion requires (see Figure 3, below).

The array of co-vertical tetrahedra; the vertices of each tetrahedron labeled 0, 1, 2, 3;

A pair of opposite co-vertical tetrahedra, one positive and one negative: the co-planar edges (01, 10, 12, 21, 20, 02) drawn in thin solid line; the background edges (03, 13, 23) in dotted line; the foreground edges (30, 31, 32) in thick solid line.



A central tetrahedron and its four opposite co-vertical tetrahedra; the plane, background and foreground edges drawn as above; the edges (01, 12, 23, 30) of the tetrahedron in the extreme foreground opposite to the edges (10, 21, 32, 03) of the central tetrahedron behind it.

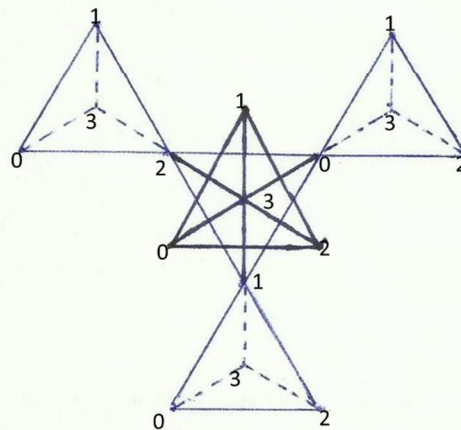


Fig. 3: Diagram of Co-Vertical Tetrahedra

The tetrahedra connected to each other at their vertices enclose a space with the figure of a truncated tetrahedron. The edges of the tetrahedra form the eighteen edges of the truncated tetrahedron, which also has twelve vertices and eight planes. This frame of reference is also referred to as the space-filling combination of tetrahedra and truncated tetrahedra.

A regular polyhedron, such as a tetrahedron or truncated tetrahedron, is the locus of spheres (see Figure 4, below): the circumsphere passes through the vertices, the insphere is tangential to the planes, and the midsphere is tangential to the edges. In the external frame of reference, the spherical internal frame of reference of each interacting oscillon coincides with a midsphere of a truncated tetrahedron.

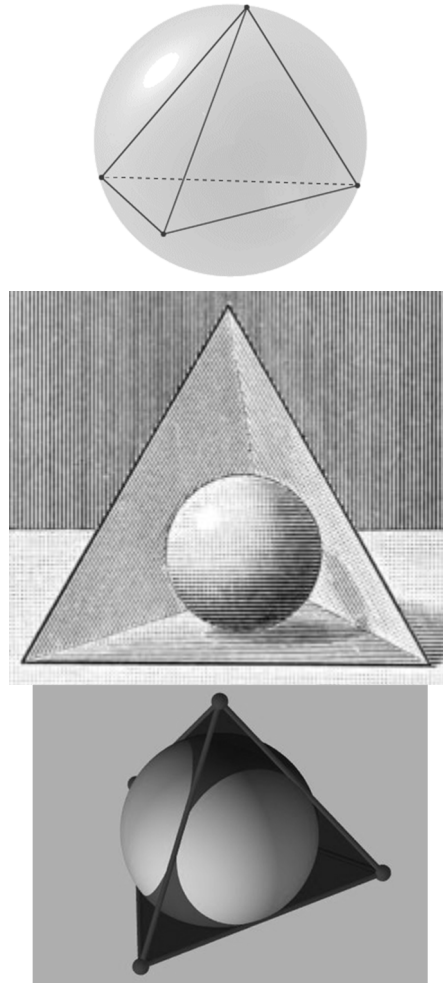


Fig. 4: The Spheres of a Tetrahedron: Circumsphere (top), Insphere (middle), Midsphere (bottom)

12.3. The Midsphere of the Truncated Tetrahedron

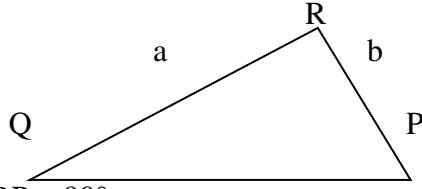
This tetrahedral array is an external tangential frame of reference of a spherical frame of reference. The midsphere of a truncated tetrahedron is the locus of an oscillon and its internal frame of reference. None of the components of the frames—the baselines, edges, faces, planes, spheres, tetrahedra, triangles, truncated tetrahedra, and vertices—are physical objects. The array exhibits symmetry in four planes.

The common vertex of a pair of co-vertical truncated tetrahedra is the common center of the midspheres of the pair of truncated tetrahedra. In a tetrahedral frame of reference, the center of tangency of two co-planar oscillons coincides with the common center of such spheres. The angle between intersecting tangents is 60° , and the angle between such tangents and the radius of the pair is also 60° . The angle between the common radius and the point of tangency, at the center of an oscillon, is 30° .

If the radius of an oscillon is 1 unit, then, calculating from the geometric relation between sides and angles in a 90-60-30 right triangle, the distance from the center of the oscillon to the common center of the pair is $2 \div \sqrt{3}$ units (1.154). The length of an intersecting tangent segment is $1 \div \sqrt{3}$ units (0.577). The length of an edge of a tetrahedron is also $1 \div \sqrt{3}$ units.

12.4. The 30-60-90 Triangle

The Pythagorean Theorem states that in a right triangle, the square of the length of the hypotenuse equals the sum of the squares of the lengths of the legs. The 30-60-90 triangle is a special right triangle and is half an equiangular, equilateral triangle. Triangle QPR, below, is a 30-60-90 triangle, and the following is the proof that the length of the hypotenuse is twice the length of the shorter leg, and the length of the longer leg is $\sqrt{3}$ times the length of the shorter leg.



Angle QRP = 90°

Angle RPQ = 60°

Angle PQR = 30°

RP = shorter leg = b

QP = hypotenuse = $2(\text{RP}) = c = 2b$

QR = longer leg = $\sqrt{3}(\text{RP}) = a$

Since $c^2 = b^2 + a^2$

And $a^2 = c^2 - b^2$

$$a^2 = (2b)^2 - b^2$$

$$a^2 = 4b^2 - b^2$$

$$a^2 = 3b^2$$

And $a = \sqrt{3}b$

$$b = a \div \sqrt{3}$$

$$c = 2a \div \sqrt{3}$$

Let triangle QPR be the base of the tetrahedral external frame of reference of a pair of interacting oscillons. Then:

Q = center of an oscillon

R = point of tangency of an oscillon

P = common center of interacting oscillons

QR = longer leg = radius of the oscillon

RP = shorter leg = tangent segment of the oscillon

QP = hypotenuse = common radius of the pair of oscillons

Then QR (radius) = $a = 1$

And RP (tangent) = $b = 1 \div \sqrt{3} = 0.57735$

And QP (radius of the pair) = $c = 2 \div \sqrt{3} = 1.1547$

12.5. Tangential Relations

An oscillon also has an external frame of reference. This is the common frame of reference of two oscillons or, more specifically, of two centers. Thus, it is also the frame of reference of two spherical internal frames of reference. The part of the internal frame that is external to a particle is the tangent. The frame of reference of two interacting particles is defined by the spatial relation of their tangents.

The external frame of reference is tangential and has no physical center. The center of the frame is the point of intersection of the common, shared tangents of the interacting particles. The center of the frame is also the midpoint of the line that joins the centers of the two oscillons.

12.6. An Array of Co-Vertical Tetrahedra

The tetrahedral frame of reference is an array of co-vertical tetrahedra; each tetrahedron shares a vertex with four other tetrahedra (see Figure 5, below). The spaces between the

tetrahedra are truncated tetrahedra. The combination of tetrahedra and truncated tetrahedra is space-filling. The array of tetrahedra is three-dimensional and continuous, and has four planes of symmetry.

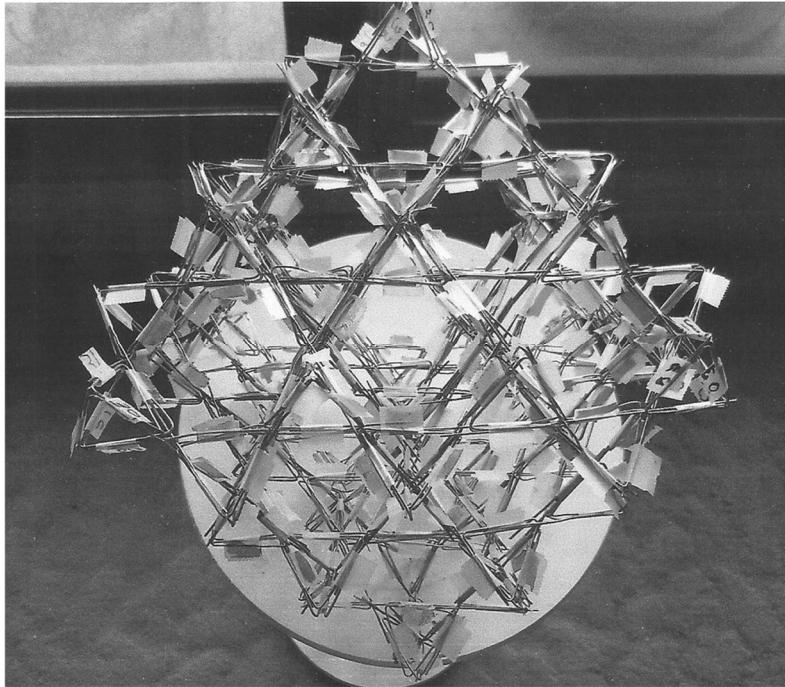


Fig. 5: Model of the Array of Co-Vertical Tetrahedra Made of Paper Clip Wires and Translucent Tape

12.7. The Space Filling Combination of Tetrahedra and Truncated Tetrahedra

This construction is a model (see Figure 6, below), built of paperclip wires, transparent tape, and balloons, of:

1. An array of co-vertical tetrahedra.
2. The tetrahedral frame of reference of two interacting stable fundamental particles at minimum separation.
3. The space filling combination of tetrahedra and truncated tetrahedra.
4. The common tangential frame of reference of a pair of spherical frames of reference.
5. A description of the linear, planar, perpendicular, parallel, and symmetrical relations of the polyhedra.
6. An illustration of a variant sphere packing, that is, the linear, perpendicular, parallel, and layered relations, of non-contiguous midspheres.
7. A representation of the direction of the ordering of the vertices, by means of labeling the vertices with the numbers 0, 1, 2, and 3.

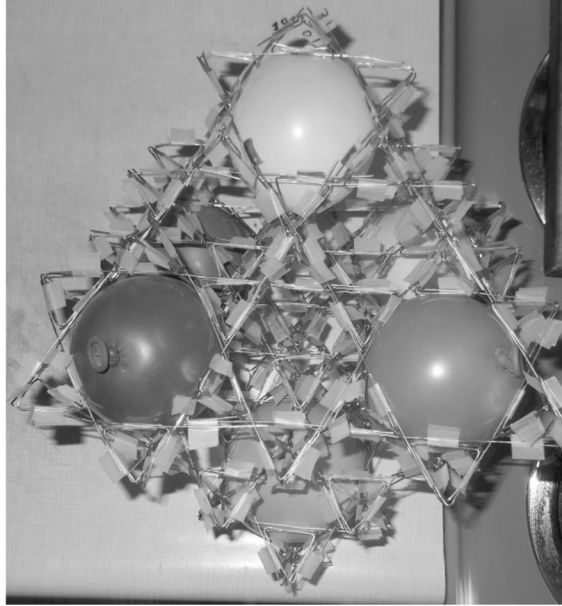


Fig. 6: Model of the Space-Filling Combination of Tetrahedra and Truncated Tetrahedra

In Figure 6, the balloons represent the midspheres of truncated tetrahedra. The midspheres are separated by a truncated tetrahedron occupied by segments of four midspheres. A balloon is missing from the central truncated tetrahedron because of difficulty of access. This arrangement of seven non-contiguous midspheres is a close sphere packing.

13. Interaction of Two Oscillons

Regarding the self-generating, self-measuring oscillon and a second identical particle, there are an infinite number of spatial and temporal relationships. If their positions are within range and their external frames of reference overlap, then interaction may occur.

The spatial relation of identical oscillons is symmetrical if they are in the same plane, and if their points of reflection are co-linear. Their temporal relation is synchronized if their periods are in phase (see Figure 7, below).

In pairings A and B, the motion of both oscillons is either clockwise or counterclockwise. In pairings C and D, the motion of one oscillon is clockwise, while the other is counterclockwise. In pairings A and C, the motion of both oscillons is either to the left or to the right. In pairings B and D, the motion of one oscillon is to the right, while the other is to the left.

The two oscillons in C and D are front to front—that is, their moving points of tangency meet at adjacent points of reflection. When interacting oscillons are back to front, as in A and B, the moving points do not confront each other.

The interaction illustrated in pairing D is attractive and stable. The combined motion of the two oscillons resembles wave motion. The motion illustrated in A, B, and C is not connected in a symmetrical, synchronous, and comprehensive fashion and does not have the shape and order of waves. Therefore, the orientation of the pairs of oscillons in A, B, and C does not result in attractive, stable interaction.

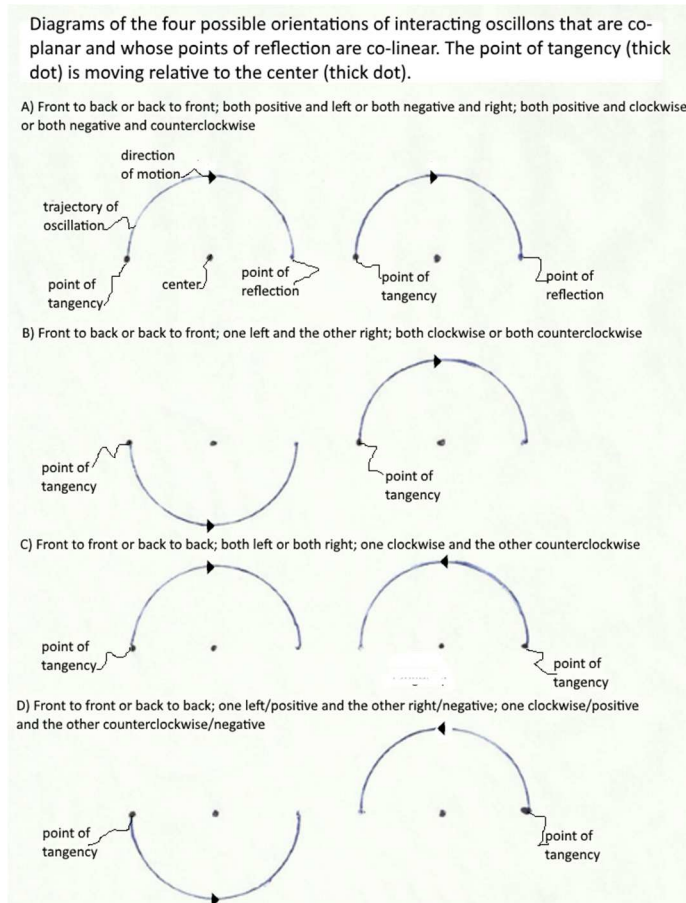
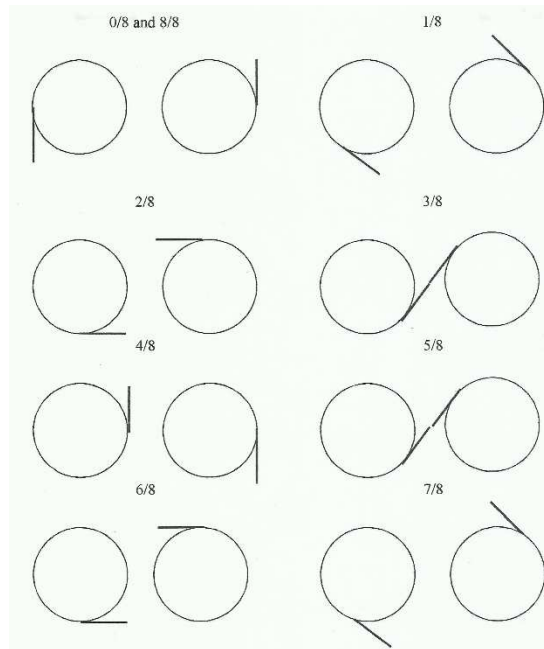


Fig. 7: The Four Possible Orientations of Interacting Oscillons That Are Co-Planar and Whose Points of Reflection Are Co-Linear

The diagrams are drawn from the external point of view, and the motion is described as seen by an observer. This means that the sense of a left or a right direction is that of the observer and applies to both oscillons. However, the view from the center of an oscillon, when it is interacting front to front with another oscillon, is such that its sense of positive and negative, or of left and right, is opposite to the other's sense and applies only to itself.

13.1. The Cycle of Oscillation

The cycle of oscillation of a pair of oscillons can be demonstrated, in the absence of animation, by the diagrams in Figure 8, below.



Legend:

circle = spherical frame of reference of an oscillon

straight line = tangent segment of an oscillon

intersection of line and circle = moving point of tangency

1/8= fraction of cycle of oscillation

*Fig. 8: Cycle of Eight Positions of a Pair of Interacting Oscillons
(one clockwise, the other counterclockwise)*

Eight positions of the moving point of tangency are shown, and between each position the point moves through an arc of one-eighth of a circle.

At the initial position (0/8 cycle), the point of tangency and one of the two points of reflection coincide. Halfway through the cycle (4/8), the moving points encounter each other at the opposite point of reflection. After reflecting, the points return through an angle of 180° to their original positions (8/8), and the cycle is complete. Another reflection initiates a new cycle.

13.2. Action at a Distance

What is the range of the oscillon's external frame of reference? To what distance from the oscillon's center does its capability of measuring extend? At what maximum separation does the oscillation of one particle affect the motion of another such that they interact attractively?

I have assumed that "action at a distance" is a definitive principle of natural phenomena. Particles are not contiguous. The oscillons' moving points of tangency have separate trajectories that do not coincide. Their internal spherical frames of reference do not overlap. They never touch.

However, the tangential dimension is external to both the oscillon and its frame of reference, except at the oscillating point of tangency where a tangent intersects a radius. The length of the such tangent is indefinite, but we can assume that a segment is at least as long as a radius, i.e. one distance-unit in each direction.

When oscillons are interacting stably and their common frame of reference is tetrahedral, a pair of 30-60-90 triangles are formed by their co-linear tangents, their parallel radii and the line

joining their centers (see Figure 2). Assuming that the length of a radius is 1 unit, then the length of a co-linear tangent segment is $1 \div \sqrt{3}$ units = 0.577. The length of the hypotenuse of the triangle, from an oscillon's center to the common center, is $2 \div \sqrt{3}$ units = 1.154, and the distance between their centers is $4 \div \sqrt{3}$ units = 2.309.

The length of the moving point's trajectory between points of reflection is π units = 3.1416. The length of the segment of the moving point's curved trajectory, from the point where a radius and tangent intersect to the line joining the centers, is $\pi/6$ units = 0.5236.

All these natural values are derived from the internal and external frames of reference, and the length of the trajectory, 3.1416 units, is the longest. If, for example, the length of the tangent segment were 3.1416 units, then the angle of intersection of co-linear tangents with the common radius would be approximately 18° , and the distance between the centers would be about 6.6 units. Therefore, the range of interaction and measurement, the extent of the external tangential frame of reference, is within the limits of a maximum length and minimum angle of the intersecting tangents.

14. Natural Units of Measurement

The oscillon is a self-measuring oscillating particle, whose center, radius, period, and trajectory are constant. The path of the oscillon's motion is semicircular like a pendulum. This means that the distance of its oscillation and the speed of its motion are also constant. Its units of measurement are self-referential. The natural distance unit is the radius of the oscillon, and the natural time unit is its period.

Using the formula c (circumference) = $2\pi r$ (radius), and, giving the radius a value of 1, we calculate that the variable point of tangency of the oscillon moves π distance-units, and its speed is π distance-units per time-unit. For the oscillon, since it does not calculate or use formulas, π is a measurement like the other natural units.

The oscillon is the smallest, simplest, and most fundamental quantity of space and motion. The separation of its center and point of tangency is the least possible distance given by a natural differentiation of one part of space from another and is therefore a minimum. Since its radius is a minimum distance, it follows that its oscillation is a maximum distance, and its rate of motion is a maximum speed.

14.1. The Speed of Light

The speed of light is a fundamental quantity of nature. It has been measured at 299,792,458 meters per second. Its symbol is c . All frequencies in the spectrum of radiation—including gamma rays, x-rays, ultraviolet light, visible light, infrared light, microwaves, and radio waves—travel at this speed. It is also the speed of electricity, and is assumed to be the speed of neutrinos.

Speed, a ratio of two measurements, is a quantification of motion. Usually it is an expression of distance per time, such as 60 kilometers per hour. Or it can be time per distance, as in, "It takes about five hours to fly from Toronto to Vancouver." Direction is the third measurement implied by speed. The scientific term for *speed* with a specified direction is *velocity*, but the two words are often used interchangeably.

In interstellar space, light travels at a constant speed. When propagating from one material medium (such as air) to another (such as water or glass), the speed diminishes. C is a maximum speed. No object, particle, ray, or wave can travel faster than c .

The constant and maximum properties of the speed of light need to be explained. What do those properties mean in relation to the motions and interactions of microcosmic particles? What

is revealed by the numerical value of 299,792,458, a measurement in the decimal system of numbers and the metric system of units? Why that number and not some other?

The speed of light can be expressed in different systems of measurement, as indicated in Table 1, below:

Table 1: The Speed of Light in Various Units of Measurement

Inches per second	1.18028×10^{10}
Feet per second	0.983571×10^9
Yards per second	3.27857×10^8
Meters per second	2.99792458×10^8
Kilometers per second	2.99792458×10^5
Miles per second	1.86282397×10^5
Leagues per second	0.62093×10^4

14.2. The Metric System

Measurement requires a specification of units, and the *Système Internationale* (SI) is the standard used in science, commerce, construction, transport, and other activities. In this system, the basic unit of distance is the meter and of time, the second. Both of those man-made quantities were originally derived from measurements of the planet Earth. The polar circumference is the base for distance, and the period of rotation is the base for time.

The rotation period of a day was divided into hours, minutes, and seconds. The numerical value of those units was based on the system of angular measurement, already in use, of the circle divided into 360 degrees, which in turn was loosely based on the number of days per year. That resulted in a day of 24 hours, an hour of 60 minutes, and a minute of 60 seconds.

The shortest unit, the second, is conveniently close to the normal cadence of counting and to the human heartbeat. The day is equal to 86,400 seconds ($24 \times 60 \times 60$), and the second is equal to 1.1574×10^{-5} ($1/86,400$) times the length of the day. The scale of these artificial time units extends to shorter or longer time periods, such as milliseconds or millennia, of any order of magnitude.

When the metric system of measurement was devised in France after the revolution of 1789, the new standard unit of distance was based on the supposedly measured and calculated distance from the North Pole to the equator through the meridian of Paris. This quantity, which was defined as the meter, was recorded on a platinum bar by marks separated by one 10-millionth of the measurement. The length was similar to previous units based on a man's pace or an archer's arrow.

For distances greater or less than a meter, the metric system uses the orders of magnitude of the decimal system of numbers. Commonly used distances, such as the nanometer (10^{-9} meter) and the kilometer (10^3 meter), are named, and prefixes have been derived for the others. The megameter is usually written 10^3 kilometers.

14.3. The Ratio c/π

A comparison of the speed of light and the speed of the oscillon, both of which are constant and maximum, shows that their numerical values ($c = 299792458$ and $\pi = 314159265$, respectively) are similar in a significant way. The ratio (c/π) of the two quantities is 0.95426903.

Is this proximity a coincidence, or is it a clue to the mysteries of nature? Is it possible that the natural distance-unit, the radius of the oscillon, equals 0.954269×10^{-7} meters, the order of magnitude being uncertain.

The size of a hydrogen atom is 1×10^{-10} meters, and the size of a proton is 0.84184×10^{-15} meters.² The proton-to-electron mass ratio is 1,836 to 1. The highest frequency gamma ray has a wavelength in the range of 10^{-13} meters—some scientists say 10^{-15} . The size of a neutrino is unknown. The oscillon, postulated to be the precursor particle of these microcosmic phenomena, must be smaller than any of them and have an order of magnitude in the range of 10^{-16} to 10^{-18} .

15. The Oscillon Hypothesis

This section is an account of how the oscillon hypothesis describes and explains the known universe. It outlines the essentials of the alternative assumptions of a uniformitarian hypothesis of the microcosm. Alternative assumptions will be elaborated in subsequent chapters.

The oscillon hypothesis is a theory of the universe. It is specifically a theory of the microcosm and the fundamentals. It is a particle theory about protons, electrons, light, neutrinos, and space. It is a theory of motion regarding oscillation, interaction, and transformation.

The oscillon is the simplest, smallest kind of particle and motion. It is a system of two physical points, one of which oscillates relative to its constant center. The oscillation is self-generated, and the relativity is self-measured.

The whole of space, of matter, of light and neutrinos, of the macrocosm and the microcosm—of everything, in fact, that exists and moves—is made of oscillons. Each phenomenon of nature is one of the different interactions that oscillons are capable of.

15.1. A Difference of Dimensional Relativity

Oscillons can interact with each other in one dimension, two dimensions, or three dimensions. When oscillons interact in one dimension, we call them neutrinos. When their interaction is two-dimensional, we experience light. When oscillons interact three-dimensionally, they do so as matter.

Oscillons can transform the dimensionality of their interactions. Nuclear fusion in stars is a change of the three-dimensional interaction of matter into the two-dimensional interaction of light. The emission of neutrinos in nuclear fusion is a transformation from motion in three dimensions to motion in one dimension. The absorption of radiation by matter is a change from two-dimensional to three-dimensional interaction.

In the oscillon hypothesis, there are three additional transformations, for a total of six. A change from two to three dimensions of interaction is the process of formation of protons, in addition to being the absorption of light by matter. When the dimensionality of interacting oscillons changes from that of a line to that of a sphere, in the presence of a proton, an electron is produced. When oscillons transform from one- to two-dimensional interaction, the phenomena change from neutrinos to light. The sixth transformation, from two dimensions to one, does not appear to be necessary. Such transformations do not alter the oscillon in any way.

Nuclear fusion is the stellar process whereby hydrogen atoms combine to form helium. The unstated assumption underlying the standard account of this phenomenon is that the helium atoms, the light, and the neutrinos produced are innovations. The oscillon hypothesis is based on

²*Scientific American*, 303:4, 24.

an alternative assumption—namely, that the light and the neutrinos are *not* novelties, but are reproductions of the sources, the precursors, of the proton and electron union.

15.2. The Medium of Light and Neutrinos

The oscillon hypothesis postulates that all of nature is made of an ur-particle, the oscillon. This means that space consists of oscillons and that oscillons are the medium through which both light and neutrinos propagate. In this hypothesis, neutrinos are a kind of radiation and are not independent particles. The phenomenon of light is the interaction of the particles of the medium in two dimensions. The phenomenon of neutrinos is the interaction of the medium in one dimension.

The oscillon hypothesis is a steady state cosmology, like that proposed by W. D. MacMillan. It assumes that there is an ongoing process of the formation of protons and electrons. It is not a hypothesis of the origin or history of the universe, because it deems the past to be irrelevant. Nor is it a hypothesis based on gravity, because it holds that the gravitational interaction is not fundamental.

15.3. From Simple to Complex

The oscillon hypothesis of variation of dimensionality conforms to the observed order of natural phenomena from simple to complex. The motion of neutrinos is the least interactive phenomenon. Neutrinos rarely interact with matter, and it is unlikely that there is any interaction between them and light. The interaction of oscillons solely in the radial dimension is simple.

The interaction of light *out of* matter is emission, and the interaction of light *into* matter is absorption. There is a spectrum of frequencies of electromagnetic radiation, of which visible light is the central component. The spectrum extends from high-frequency gamma rays to low-frequency radio waves. Light is the interaction of oscillons in both the radial and tangential dimensions. Its properties are considerably more complicated than those of neutrinos.

The most complex phenomenon with the greatest set of properties is matter. This is because, compared to a linear or planar interaction, the interaction of oscillons in three dimensions allows an unlimited variety of spatial arrangements. A three-dimensional interaction is in the radial, tangential, and axial dimensions. The internal motion of oscillons is always in a plane. When oscillons interact three-dimensionally, they are in the same or a parallel plane, and their axes are either co-linear or parallel.

15.4. Formation of Hydrogen

The transformation of the interaction of oscillons from two dimensions to three is a process of self-assembly into a ring of 6 oscillons (see Figure 13). The ring has a toroidal shape with an empty center. Self-assembly continues until there is a complete proton that consists of 612 oscillons arranged in 102 rings, which are arranged in layers and shells (see Figure 11). There are 11 layers parallel to the plane of the oscillons' motion, arranged from top to bottom in layers of 7, 8, 9, 10, 11, 12, 11, 10, 9, 8, and 7 rings. There are 6 concentric shells, arranged from inner to outer shells of 2, 8, 14, 20, 26, and 32 rings (see Figure 15). This arrangement of layers and shells also has the shape of a torus. The arrangement of oscillons in a proton is derived from the number 1,836. One of the fundamental relations revealed by nature is that the mass of the proton is 1,836 times the mass of the electron.

The electron is an oscillon that transforms from one-dimensional to three-dimensional interaction when it passes through the central hole of a toroidal proton. The oscillon's motion

changes from an oscillation of 180° to a rotation of 360° . The association of a proton and an electron in a hydrogen atom is a union, and the members of the pair cannot exist without each other. The hole in the torus is the opening through which the electron orbits the proton.

An electron passing through the hole in the proton is rotating and orbiting in the plane at right angles to the plane of motion of the oscillons of the proton. This difference of plane is the spatial relation that accounts for charge. Charge is a property of matter that derives from the relativity of the interaction between the proton and its electron. The proton is described as having a positive charge, the electron as having a negative charge, and the charges are described as opposite.

According to the oscillon hypothesis, because there is a third charge—namely, the neutral charge of the neutron—the variation in charge is best described as *different* rather than *opposite*. The different neutral charge of the neutron is a consequence of the spatial relation of its interaction with the proton and the electron in an atom. The neutron is a proton whose internal motion is in the plane at right angles to the planes of the proton and the electron (see Figure 20, below).

15.5. Formation of Helium

An atom of hydrogen is a union of a proton and an electron. The next more complex and heavier element is helium. An atom of helium is a combination of two protons, two electrons, and two neutrons. The oscillon hypothesis theorizes that the interaction of these constituent particles takes place in a three-planed configuration. The protons are side by side in one plane. The electrons are in an orthogonal plane and share an orbit that passes through the centers of the protons. The plane of the two neutrons is at right angles to that of the protons, and the electrons also pass through the holes of the neutrons (see Figure 19).

The electron has a number of properties, including: bound, co-orbital, excited, flowing, free, grounded, ionized, leaping, and shared. The oscillon hypothesis suggests that changes in the trajectory of the electron's orbital motion account for these properties. An electron has a variable trajectory because its center, or focus, is not fixed. The proton's center is a vertex of the electron's orbit and is constant. The orbit may be circular, elliptical, parabolic, or hyperbolic; its radius may vary from a minimum to a molecular distance; and its vertices may be the centers of protons in separate atoms. Change in an electron's orbit takes place when the electron is at the vertex in the hole of its proton. (see Figure 18).

15.6. A Disk of Protons

The oscillon hypothesis proposes that the nucleus of an element is a disk of protons assembled into a close sphere packing, known as a Groemer packing. The sequence of numbers 2, 8, 14, 20, 26, and 32, the sum of which is 102, is a clue to the periodic arrangement of protons in the elements. The noble gases—helium, neon, argon, krypton, xenon, and radon—sit at the end of each row of the periodic table. Their atomic numbers, the number of their protons, are 2, 10, 18, 36, 54, and 86. The number of protons added to each element in this sequence is 8, 8, 18, 18, and 32. This is indicative of a planar arrangement in a sphere packing to a base of two.

Thus, the atom, the torus-shaped protons, and the vibrating oscillons are all in the same plane. The plane of the neutrons is at right angles to the plane of the disk of protons. In the atoms of the heavier elements, the neutrons form two layers, one above and one below the disk of protons. The number of neutrons in an element or isotope is always less than twice the number of protons. (see Figure 19).

15.7. The Location of Proton Formation

Central to the oscillon hypothesis is the uniformitarian assumption that protons, electrons, and hydrogen atoms are now being made somewhere in nature. Since stars are made of hydrogen, it seems likely that hydrogen is formed within a galaxy, the location of stars and star formation. Emissions of radiation, such as quasars, gamma ray bursts, and fast radio bursts, have been observed that are different from those of stars. The oscillon hypothesis assumes that the sources of these emissions are not material objects, so they are good candidates for the location of proton formation.

The proton is an extremely stable particle, and the oscillon hypothesis implies that there are more protons now than there once were. Stellar nuclear fusion produces gamma rays and neutrinos, while the protons and electrons of the original atoms of hydrogen remain intact. Thus, the gamma rays and neutrinos are surplus quantities of motion or energy that a star, with its immense size, pressure, and temperature, is capable of generating. This is an increase of motion and radiation that leads to an increase in the amount of matter.

The oscillon hypothesis assumes that while the weak nuclear, the electromagnetic, and the strong nuclear interactions are fundamental, the gravitational interaction is not. Gravity is too weak to operate at the scale of the particle. Gravity is the consequence of the accumulation of great amounts of atoms in clouds of molecular hydrogen, which then grow into stars. It is a three-dimensional interaction and, as a consequence, its range is immense, leading to huge galactic assemblies of gravitationally interacting stars.

15.8. Nature's Numbers

The oscillon hypothesis suggests that the number system of nature is the base four system of numbers. The decimal system (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10...) is an anthropocentric invention based on the number of fingers on a pair of human hands. A natural number system should be simple, for which an even numbered base is necessary. The binary system (0, 1, 10...) seems awkward. The next simplest system is the base four or quaternary system (0, 1, 2, 3, 10...). The first five numbers of the base four system include the first three prime numbers, the first square, pi, the simplest plane figure (the triangle), and an optimal order of magnitude. The base four system encompasses the three planes of the sphere, the four planes of the tetrahedron, and the range of measurements of the spherical and tetrahedral frames of reference. The genetic code of the biosphere uses a base four number system. A more appropriate name for the base four system is "two-squared," since the word *decimal* (which also applies to the base four system) is already in use (referring to the base ten number system), and there is no *four*, *4*, or *quater* in it.

16. Dimensionality

Matter, light, and neutrinos are the three distinctly different phenomena of nature that must be described and explained by a scientific philosophy. A uniformitarian hypothesis of nature assumes that motion is the physical property of the phenomena that differs in a simple way. The hypothesis assumes that all phenomena—the different frequencies of the spectrum of radiation; the varying properties, structures, and chemistry of elements; or the countless diverse molecules of organic life—are explainable by simple variation in spatial relations of interaction. The oscillon hypothesis of the microcosm assumes that the three different types of motion are the result of a difference in the dimensionality of oscillons' interactions.

Why are there three such phenomena of nature, and not two or four? The oscillon hypothesis suggests that it is because space has three dimensions. Relative motion and its inherent property

of self-measurement take place in a frame of reference that has radial, tangential, and axial dimensions. The relativity of motion is not necessarily three-dimensional. The assumption that two-dimensional and one-dimensional relativity of motion also occur is the foundation of the alternative view of nature in the oscillon hypothesis. The essence of this theory is that the most logical explanation of the co-existence of matter, light, and neutrinos is the variation in relativity that three dimensions enable.

It is indisputable that matter is a three-dimensional relative motion. The hydrogen atom, the simplest and most common form of matter, is made of the union of two very different particles, the proton and the electron. Matter has a set of complex properties and is capable of combining in the astonishing variety of elements and objects that constitute the macrocosm. Humans are made of matter, so our experience of relativity is exclusively three-dimensional.

When the relativity of oscillons' motion is three-dimensional, their interaction is not just linear or planar but omnidirectional. The field of interaction is not limited to those oscillons whose motion is in the same relative line or the same relative plane, but encompasses a sphere of relativity.

16.1. Linear, Planar, and Spherical Relativity

The stable interaction of a pair of oscillons discussed in Section 13 is one-dimensional. The oscillons are either front-to-front or back-to-back, their centers are co-linear, and their oscillations are in phase. In the same way, an oscillon interacts with more than one other oscillon, the one in front and the one behind. Thus, a linear chain of oscillons could extend indefinitely, and the sequence of their oscillations would have the appearance of wave motion in both directions. Oscillons interacting with those in front of and behind them are in the radial dimension only, and their relativity is linear.

When oscillons interact in two dimensions, they interact with particles whose oscillation is in the same plane as their own. They interact with the particles beside them, on the left and right, in addition to those in front and behind. The field of interaction is formed by the radial and tangential dimensions, and the relativity is planar.

An oscillon that interacts in three dimensions interacts with those in front, back, left, and right, plus those above and below—that is, oscillons whose motion is in a parallel plane. Their relativity is spherical and omnidirectional, and the field of interaction is formed by the radial, tangential, and axial dimensions.

17. Transformation

Transformation is the phenomenon of oscillons changing the dimensionality of their interactions. Six such transformations are possible in three-dimensional space. The emission of light by material objects, the absorption of light by matter, and the emission of neutrinos by stars are transformations of this type, according to the oscillon hypothesis. These phenomena account for transformations from three to two, from three to one, and from two to three dimensions.

The other three transformations have not been observed in nature. The change of dimensionality from two to three occurs when protons are formed. This is the same transformation as the absorption of light in photosynthesis, in photoelectric cells, and in the rise in temperature when the Earth faces the Sun.

At the same time that a proton is formed, a change from one to three dimensions occurs when an electron is formed, which unites with a proton to make hydrogen. The location of this transformation is the hole in the torus of the proton. It takes place at the same time as the

formation of a proton and results in a hydrogen atom—that is, the proton-electron union that constitutes 80 percent of matter in nature and is the building block of the other elements.

A transformation from one to two dimensions is the change from the motion of neutrinos to the motion of light. The transformation from two dimensions to one is not needed in order to account for the known phenomena of nature.

These five transformations constitute the interconnected creation of every natural phenomenon by means of the varying interaction of oscillons, the fundamental universal ur-particle.

The conjecture that six transformations are connected as a set of uniform processes means that the transformations from three dimensions to two or to one—that is, the emission of light or of neutrinos—are replications of precursor interactions. Thus, the oscillon hypothesis disagrees with the unstated assumption of the current explanation of these emissions that light and neutrinos are new or innovative phenomena.

17.1. Emission and Absorption

A hypothesis of the microcosm needs to describe and explain the phenomena of transformation of motion. Three such transformations are currently known.

The motion of matter transforms into the motion of light in stellar nuclear fusion, radioactivity, lightning, and the incandescent lamp. The motion of matter transforms into the motion of neutrinos in nuclear fusion and certain radioactive processes. The motion of light transforms into the motion of matter in the absorption of radiation as heat, photosynthesis, vision, and the photoelectric effect.

The fact that the transformation involving matter and light works both ways is highly significant. Atomic motion becomes radiant motion, and the propagation of light becomes the flow of electricity.

The neutron is a transformed proton. The neutron exists naturally only in association with the proton-electron pair. Outside the nucleus, a neutron decays into a proton. But how does a proton become a neutron? The spatial arrangement of these three particles in an atom—that is, the dimensional relation of their individual motions—is the key to understanding the different charges of neutrons, electrons, and protons.

Figure 9, below, is a representation of the set of transformations of nature and their relation to each other. At the top is the oscillon, the particle that constitutes space. Neutrinos, which are referred to here as a form of radiation, are the one-dimensional interaction of oscillons. Light, or electromagnetic (EM) radiation, is the phenomenon of two-dimensional interactions of oscillons. The hypothetical location and process of formation of light from neutrinos is indicated by the arrows of combination and transformation connecting them.

The process of formation of protons from light, and the process of formation of electrons from neutrinos—that is, the change of the interaction of oscillons from two to three dimensions and from one to three dimensions, respectively—are indicated by the arrows of combination and transformation connecting them. A proton and an electron unite in an atom of hydrogen, and hydrogen atoms then accumulate to form molecules and stars.

In stars, hydrogen atoms combine through nuclear fusion and nucleosynthesis to form helium and other elements. In the process, two protons transform into neutrons by interacting with the remaining protons in the plane at right angles to the base plane of the helium atom. Consequent to this process of fusion and synthesis is the release of two electrons and the change of some of the original internal motion of the hydrogen atoms into radiant light and neutrinos. The

interaction of oscillons as three-dimensional matter transforms by emission into the interaction of two-dimensional light and one-dimensional neutrinos. This replication of precursors and the closed interconnection of the set of transformations are represented by the arrows connecting light to light and neutrinos to neutrinos.

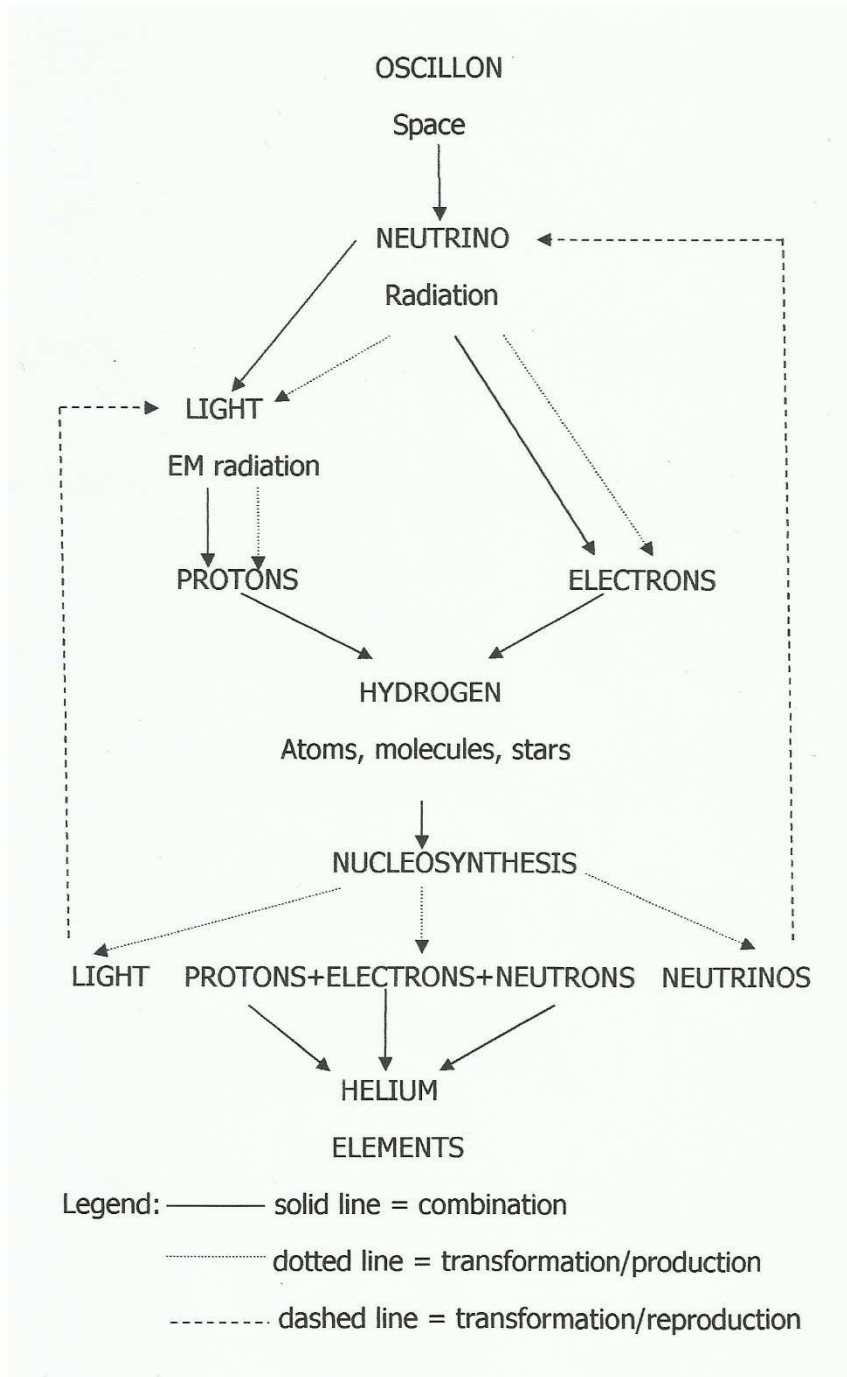


Fig. 9: Schematic Diagram of the Processes of Combination and Transformation of All Three Forms of Motion in the Microcosm

18. Space and Ether

The words *space*, *universe*, *nature*, *particle*, *motion*, and *phenomenon* all have connotations of each other. The whole is described by the first three words, and the parts by the other three. Everything in nature is made of particles, and every particle is a form of motion.

Does it make sense to divide nature into matter and space? To separate and isolate matter in that way is an anthropocentric concept. Matter is *in* space and *of* space. Only an infinitesimal fraction of space is occupied by matter.

Is space empty? In the parts of space not occupied by matter, there are light and neutrinos propagating from every direction. There is motion and there are phenomena. Are there particles?

For a long time, space was hypothesized to be the medium through which the wave motion of light propagates. The medium was an elastic, invisible substance called ether. This hypothesis was based on the assumption that a medium was necessarily some form of matter, based on the analogy of water waves and sound waves.

Subsequently, it was demonstrated that space was *not* made of matter and that the material ether does not exist. However, the idea of space as a medium persists because it is counterintuitive to assume that space is empty.

It is their different motion that distinguishes matter, light, and neutrinos. Each interacts with others of its own kind in a stable, synchronized, symmetrical, and constant spatial relationship. It is the dimensionality of their interaction—that is, of that spatial relationship—that varies. A different dimensionality could be described as a different spacetime, or perhaps as a different topos—*topos*—from the Greek *topos* (“place”) and *chronos* (“time”).

19. Matter, Light, and Neutrinos

What has happened to the radiation and neutrinos emitted by all the stars in all of time?

Do neutrinos have a destination?

Does radiation have a function?

Certainly, the function of our sun’s radiation is *not* to provide heat and light to other material bodies. Only a tiny fraction of the sun’s output is intercepted by the planets and moons (to say nothing of their occupants). Furthermore, the function of the sun’s radiation is *not* to reveal the sun’s presence. An even tinier part of a star’s light is detected by an observing eye or camera. Has this prodigious amount of energy been wasted? Do these emissions propagate eternally, never to transform, accumulate, or cycle?

Is the universe a system in which all things are connected through interdependent processes? Are all the forms of motion, matter, radiation, and neutrinos derived from a common source, having transformed in stages from simple to complex, from weakly interacting to strongly, from having few properties to many? What is the fundamental physical property that distinguishes the three types of motion?

The transformations that we are aware of may provide answers to some of these questions. In particular, the emission of gamma rays and neutrinos by atoms in the process of stellar fusion is a good place to start. One underlying assumption of the current theory of the universe is that the products of fusion are novel—that is, the heavy elements, radiation, and neutrinos produced in nucleosynthesis and supernovæ from atoms of hydrogen are something new under the sun. There is an anthropocentric assumption that the complex atoms and molecules that are the building blocks of planets and life forms really matter, whereas the motions of radiation and neutrinos are incidental byproducts.

19.1. Reproduction of Precursors

Instead, let us assume that light and neutrinos are reproductions of the precursors of protons and electrons. Furthermore, let us assume that the dimensionality of interaction with its own kind distinguishes one form of motion from another. Also, let us assume that neutrinos are a one-dimensional interaction, light is a two-dimensional interaction, and matter is a three-dimensional interaction.

These assumptions mean that a necessary part of nature is a process whereby protons and electrons are currently and constantly being formed from their precursor particles. Needless to say, that phenomenon has not been observed. However, this conjecture is not new. It is the basic assumption of steady state cosmology, which contradicts the idea that all matter was formed in the explosive expansion of the Big Bang. It is possible that, while the formation of hydrogen atoms is hidden from us, the raw materials of that phenomenon are very much in evidence.

A process of formation of a complex particle from simpler precursor particles implies that the precursors accumulate at a given location, and their combination results in a transformation into something different.

19.2. Dimensionality and Complexity

Judging from the number of interactions that these forms of motion are involved in, it is evident that matter is the most complex form of motion in nature and that neutrinos are the least complex, with radiation in between. Presumably, neutrinos are interacting with each other as they stream outward from the Sun. When they reach Earth, most of them pass through the planet as if it were transparent, while a few may interact with atoms and thereby reveal themselves to our detectors. It is not known whether there is any interaction between radiation and neutrinos.

Matter, which is the three-dimensional interaction of protons, electrons, and neutrons, has a large suite of complex properties, arrangements, and behaviors. A partial list of these would include:

absolute zero, acid, air, alpha particle, aluminum, animal, atom, ash, beta particle, brain, carbon, charge, chemistry, cloud, comet, continent, cosmic ray, density, dust, electricity, element, fission, fusion, galaxy, gas, glacier, glass, gravity, heat, helium, hydrogen, ion, iron, isotope, life, liquid, machine, magnetism, mass, metal, mineral, molecule, moon, nitrogen, nucleosynthesis, ocean, organism, oxygen, planet, plant, plate tectonics, polarity, pottery, pressure, rain, salt, sand, silicon, solar system, solid, spectroscopy, star, technology, temperature, volcanism, water, and weight.

Radiation arrives at Earth from the Sun in the form of wave trains and wave fronts. Some of it is reflected, and the rest is absorbed by matter. Light is also produced in natural phenomena such as aurora, bioluminescence, chemistry, combustion, fluorescence, heat, lightning, phosphorescence, radioactivity, sparks, and static electricity. Numerous artificial devices also emit light.

Radiation interacts with the chlorophyll of plant cells in the process of photosynthesis. The motion of sunlight transforms into the motion of electricity in solar cells. There is a spectrum of frequencies of radiation, the so-called electromagnetic spectrum (see Figure 10, below), from high-frequency gamma rays and x-rays, to ultraviolet, visible, and infrared light, to microwaves and low-frequency radio waves.

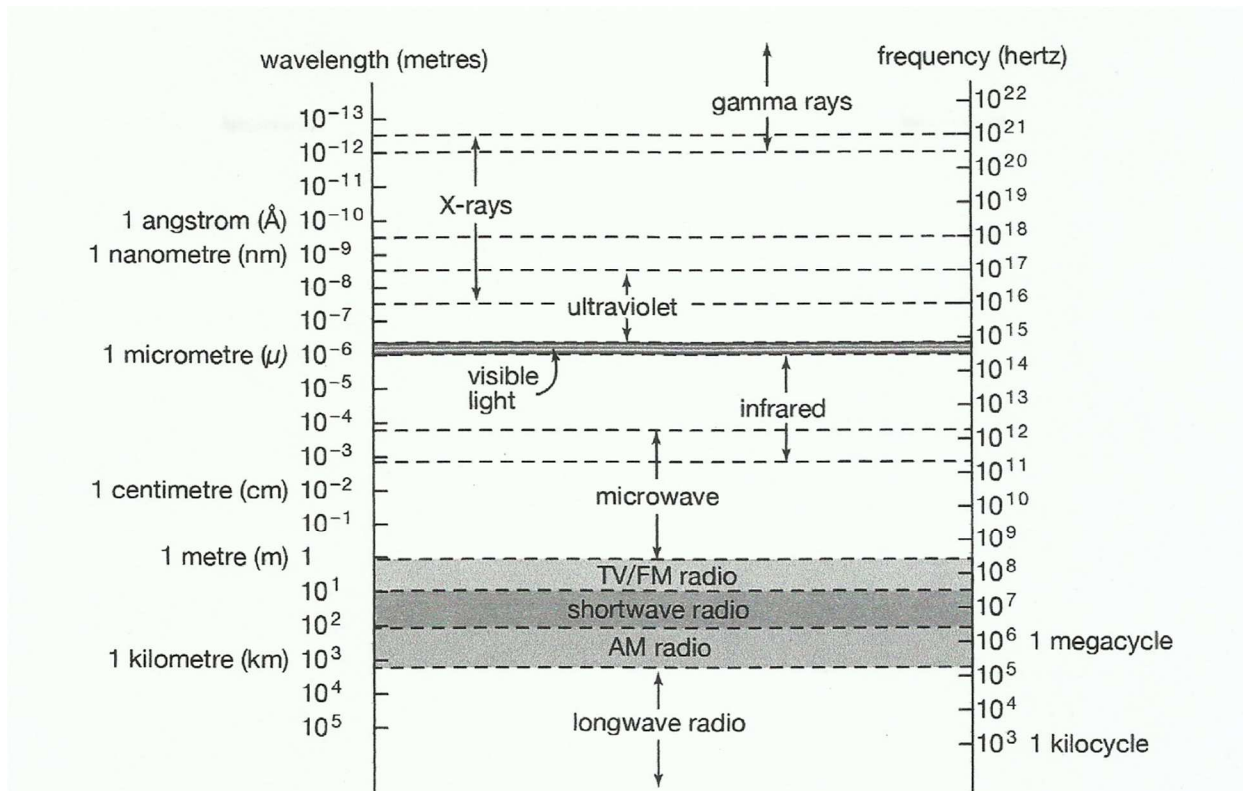


Fig. 10: The Spectrum of Frequency of Radiation³

19.3. The Hidden Microcosm

The microcosm is the world of protons, electrons, light, and neutrinos. It is the realm of matter, radiation, and neutrinos. It is the universe of stable, elementary particles. Its scale is the very small, the minimal, and the infinitesimal.

The microcosm is a hidden world that has never been seen by human eyes. It has been visualized over the centuries by philosophers and scientists. It has been observed and measured, both directly and indirectly, by technological means. Using these measurements, mathematicians have calculated and quantified the motions of matter, radiation, and neutrinos.

19.4. Classification of Phenomena

Is it possible to arrange the stable particles in order from simple to complex? Is there a hierarchy of the forms of motion? The factors to be considered include a particle's interaction with its own kind, its interactions with other particles, and the variations in its properties.

A simple particle is one with a dynamically straightforward relationship with its twins, the lowest number and fewest kinds of interactions with alien particles, and the lowest number of variables in structure and behavior. Conversely, a complex particle is one with a full range of interactions with different particles, great variability in structure, properties, and behavior, and a complicated spatial relation of its constituents.

The neutrino seems to be the simplest natural type of motion. Neutrinos are emitted by stars as a product of nuclear fusion, but they rarely interact with matter. Presumably, they interact with

³"The Electromagnetic Spectrum," *Encyclopædia Britannica*, available at <https://www.britannica.com/science/electromagnetic-spectrum/media/183297/5342/>.

each other, perhaps in a train. They seem to be massless and chargeless.

Matter is at the opposite position in the hierarchy. An atom of hydrogen is the union of a proton and an electron, two very different particles. The proton can change into a neutron and vice versa. The electron can change the trajectory of its motion—for example, from circular to elliptical, or vice versa.

Protons, electrons, and neutrons combine to form the ninety-two natural elements, each with a unique set of properties. Different elements combine to form the host of substances that make up the lithosphere, hydrosphere, atmosphere, and biosphere of Earth.

Hydrogen is involved in processes that produce light and other forms of radiation, neutrinos, and cosmic rays. It accumulates into molecules, clouds, stars, and galaxies. Stars age and change into supernovæ, which produce the heaviest elements.

In the middle of the hierarchy sits radiation. Its motion varies in frequency and wave length, which is manifest in the electromagnetic spectrum. Its velocity and trajectory in space are constant. Radiation is massless and chargeless.

The motion of radiation is described as wave trains and wave fronts. Radiation is absorbed, reflected, and emitted by matter. It is a product of nuclear fusion and radioactivity. It is produced by static electricity, combustion, bioluminescence, and other natural phenomena.

When the light from one star intersects with the light from another, it does not reflect, collide, combine, or change in any way. Radiation and neutrinos are propagating through space, even occupying the same space without the slightest interaction with each other.

20. Gravity

The mainstream theory of the universe assumes that there are four fundamental forces: gravity, the strong nuclear force, the electromagnetic force, and the weak nuclear force. These phenomena are also referred to as the fundamental interactions: gravitational, strong nuclear, electromagnetic, and weak nuclear.

The word *force* is misleading in this context because it implies only causative action. That is, it implies that the cause can be separated from its effect, that the cause of the force can be ignored, and that the cause is somehow optional rather than mechanical and automatic.

But as the classic phrase says, for every action there is a reaction. In the microcosm, every action is a reaction and vice versa. In the realm of particles, there are only interactions—that is, a succession of motions that are both actions and reactions.

Why should the inclusion of the gravitational interaction in this list of fundamentals be questioned? The most revealing difference between it and the other three is that the strong, electromagnetic, and weak interactions are nuclear interactions between individual particles of matter, whereas the gravitational interaction is between accumulations of atoms. In other words, the first three interactions are fundamental in the microcosm, whereas gravity is operational, applicable, and determinant in macrocosmic interactions and dominates at the largest scales.

This difference may be restated by noting that physicists use quantum theory as a means to understand the strong nuclear, electromagnetic, and weak nuclear interactions, while using continuum theory to describe gravity. According to the *Oxford Astronomy Encyclopedia*, “Attempts have been made to quantize gravity but with little success.... No quantum theory of gravity has been found, and the mathematics describing the fundamental forces disallow this unification.”⁴

⁴*Oxford Astronomy Encyclopedia*, ed. Sir Patrick Moore (New York: Oxford University Press, 2002), p. 149.

20.1. Is Gravity a Fundamental Interaction?

The view that gravity is fundamentally the same as the other forces is anthropocentric. Gravity is central to our existence; our sense of gravity is operating constantly. A human being, an accumulation of matter at the interface between the ground and the air, interacts with the Earth, also a material body.

The three microcosmic interactions have become known only recently. The microcosmic phenomena in our bodies—electrical signals in the nervous system, the extraction of oxygen in respiration, the absorption of nutrients in digestion, the regulation of temperature, etc.—are within the realm of the unconscious. The locomotion of a macrocosmic terrestrial life form is dominated by gravity. We have been reluctant to downgrade the status of the gravitational interaction and to recognize that it is profoundly different from the microcosmic interactions.

According to the *Oxford Astronomy Encyclopedia*, “the weakest of the four fundamental forces dominates the evolution of the universe.”⁵ There are anthropocentric views of nature expressed in this statement. The cosmology of astronomers focuses on the macrocosm of accumulations of hydrogen, stars, and galaxies, and the universe as a whole. In fact, the microcosm, where the basic fundamental processes of nature take place, is dominant in determining the contents, motions, and phenomena of the world.

If the gravitational interaction is not fundamental and does not operate at the microcosmic scale, how is it to be accounted for? In the oscillon hypothesis, gravity is the result of the accumulation of numerous hydrogen atoms in clouds and stars. It is a cumulative effect of the strong nuclear interaction of the proton-electron union, as these basic units of matter assemble into macrocosmic bodies. Both the strong nuclear interaction and gravitational interaction are three-dimensional, whereas the weak nuclear interaction is one-dimensional, and the electromagnetic interaction is two-dimensional. This three-dimensional property explains the immense range of gravity and the fact that it is always attractive.

20.2. Causative or Consequential

Fundamental is necessarily a description of the microcosm. Causes are the exclusive realm of particles. Everything in the macrocosm is an effect rather than a cause. Gravitational interaction is a phenomenon of the whole, not the parts. It is the consequence of the accumulation of atoms into stars and galaxies.

21. Mass

The *Gage Canadian Dictionary* defines *mass* as “a measure of the amount of matter that a body contains.” It is a measurement of size or quantity. It is a count or enumeration of the parts of the whole. The thing being measured is a material body made of protons, electrons, and neutrons.

The volume, or amount of space, of an object of known measurements, such as a ball or box, can be determined by using a formula that results in a three-dimensional quantity expressed in cubic units. Density is a ratio of the quantity of matter in a particular unit of volume. The property of density relates to the separation, or amount of space, between the constituent particles of a material body. Weight is a measurement of the mass, or heaviness, of an object that is interacting gravitationally with the Earth.

⁵*Oxford Astronomy Encyclopedia*, p. 149.

In order to measure an object's mass, a balance or scale is required that compares the object to another object of known mass. This process yields the weight of the object. Everybody knows his or her own weight, but how many people know their volume?

The mass of a body such as a moon or a comet can be calculated relative to the known mass of a planet or star with which it is gravitationally interacting.

In the microcosm, there is no such thing as a balance, nor the builder and operator of a balance, nor a calculator. The microcosm is the world of autometric oscillating interactors having the ability to measure—which ability is limited to distance, angle, direction, and period. The oscillon also has a sense of self or oneness. It is a quantity of one, and its size is the unit of mass.

21.1. Measurement of Mass

Mass is a quantification of the amount of matter. It is a measurement of the whole, the sum of the parts. For the self-measuring oscillon, the unit of mass is the self, and the act of measuring mass involves counting the number of interacting oscillons. Mass, matter, gravity, and three dimensions are inseparably connected.

The gravitational interaction is a form of relative motion that incorporates an act of measurement. Because it is three-dimensional, its range is limited only by the size of the largest material object, a star, and the largest accumulation of such objects, a galaxy.

If every natural phenomenon is an interaction of oscillons, the process of counting the number of oscillons participating in the phenomenon involves determining the number of identical selves. In three dimensions, one oscillon is interacting with all oscillons. Thus, a star is an accumulation of oscillons that have accumulated into protons and electrons that have accumulated into molecules of hydrogen.

An oscillon is a quantity of space defined by its spherical frame of reference, which has a size, extent, or volume determined by its radius. The radius of the sphere is constant, and the amount of space occupied by the oscillon is constant. There is space between each non-contiguous interacting oscillon, and in stable interactions such space is minimal and constant.

21.2. Masslessness

Mass is a measurement of a property of matter. It relates to the size of material bodies made of protons, electrons, and neutrons that vary in scale from a single hydrogen atom to the accumulation of hydrogen atoms in a giant star.

However, light does not have the property of mass, so the photons of electromagnetic radiation are deemed to be massless. “Indeed,” writes Roger Penrose, “the mass of the photon, if non-zero, would have to be less than 10^{-20} of an electron's mass for good observational reasons. Moreover, the photon appears to be clearly singled out, among all the bosons in the theory, by being a massless particle.”⁶

The oscillon hypothesis assumes that neutrinos are massless. The neutrino, writes Penrose, “can be treated as a massless particle. (Its mass is, in any case, extremely tiny in relation to the mass of an electron, and certainly not more than 6×10^{-6} of the electron's mass.)”⁷

Physicists have determined that space is not material and is therefore massless. A form of motion or a type of particle that lacks the property of mass is not a form of matter, nor is it a

⁶Roger Penrose, *Road to Reality* (London: Jonathan Cape, 2003), p. 641

⁷Penrose, *Road to Reality*, p. 635.

form of three-dimensional interaction.

22. The Sphere-Packing Hypothesis

The ratio of a proton's mass to an electron's mass is a fundamental quantity of the microcosm. The mass of a proton is 1836.153503 times that of an electron. Although a proton's mass is not an even multiple of an electron's mass, the number 1836 is a very interesting number, which warrants close investigation. The questions arise, "Why that number and not some other?" and "Is it a clue to the composition, arrangement, motion, and interaction of these particles?"

The prime factors of 1836 are 1, 2, 2, 3, 3, 3, and 17. One of the combinations of these factors is 18×102 ; 18 is the product of $1 \times 2 \times 3 \times 3$, and 102 equals $2 \times 3 \times 17$.

The number 102, a very interesting number (see Figure 11, below), is the sum of $2 + 8 + 14 + 20 + 26 + 32$. Each number is 6 more than the previous one. The sequence 2, 8, 14, 20, 26, and 32 represents the number of spheres in the "layers" or "rings" of a sphere packing. This is a Groemer packing,⁸ whose base is two spheres rather than one. Any number of spheres from 2 to 102 can be assembled into a disk or layer of minimal area that, for larger numbers, always has a hexagonal shape.

22.1 Groemer Packing

Each circle in Figure 11, like those dealt with by Groemer packing, represents a proton—that is, its toroidal shape and spherical frame of reference—as seen from above or below. Whereas in a Groemer packing the circles are contiguous, the uniformitarian hypothesis assumes that protons are not touching, but share a common tangent at 60° to the line joining their centers.

The uniformitarian hypothesis further modifies the assumptions of Groemer packing by stipulating that the number of protons in the base is 2, rather than 1. This assumption is derived from the following clues: (a) the atomic numbers of the noble gases; (b) the electron shell structure; (c) the alpha particle; (d) the cosmic abundance of the elements; and (e) the proton-to-electron mass ratio of 1836 to 1.

Groemer packing is used with the objective of minimizing the area of the convex hull containing the circles. To that end, when there are alternative choices, nature selects the packing with the smallest number of larger edge holes and the biggest number of smaller central holes (the fewest circles in the perimeter). Nature also selects the arrangement that is as hexagonal as possible, since six sides are better than five or four for minimizing area.

The adaptation of the rules of Groemer packing to questions of atomic structure results in the minimization of the area of the disk of protons while promoting symmetry, balance, and harmonious motion. Therefore, when there are two alternative arrangements, nature selects the one with greater symmetry about both axes. Nature also chooses to complete filling the inner layer before starting the next one.

⁸Groemer packing is described by Ian Stewart, "Mathematical Recreations: A Bundling Fool Beats the Wrap," *Scientific American*, 268(6), June 1993, 142–144.

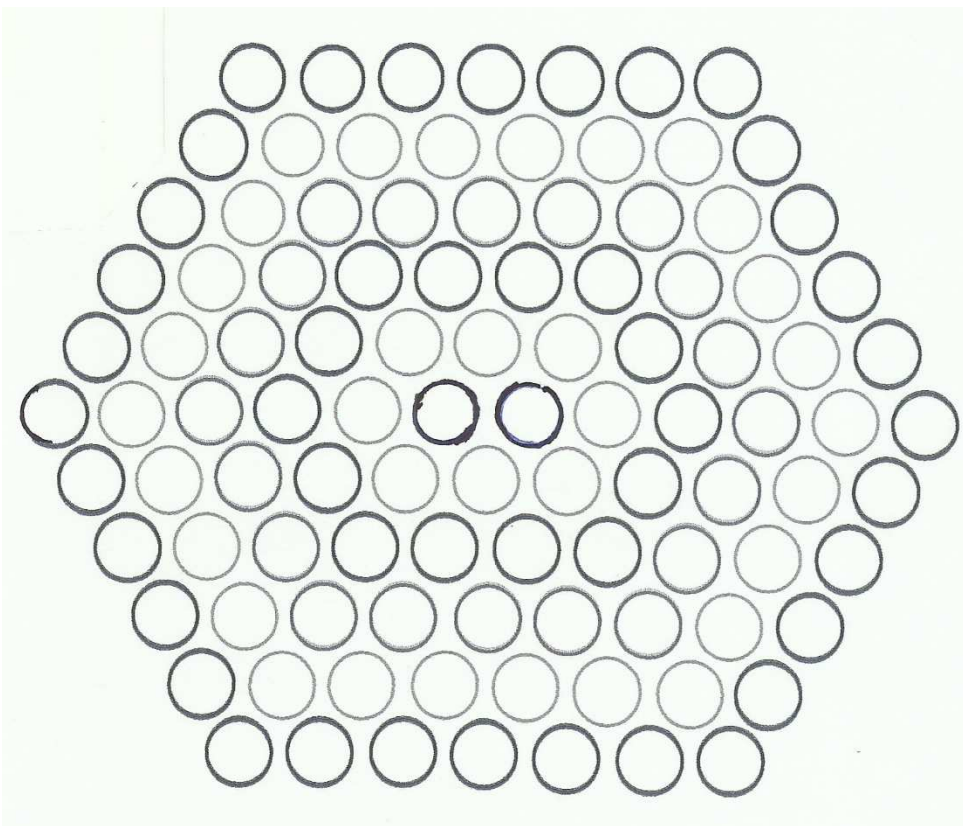


Fig. 11: Diagram of a Packing of 102 Non-Contiguous, Co-Tangential Spheres (circles of the same shadings are in one of six hexagonal layers)

22.2. The Periodic Table of Elements

The periodic table of elements is a fundamental quantification of nature (see Figure 12, below) The table is an arrangement of the ninety-two naturally occurring elements according to their number of protons—that is, the atomic number of the element. The rows and columns of the table reveal the similarities and differences of the elements.

One such column is the noble gases, so-called because they are inert and seldom combine with other elements. These elements and their atomic numbers are: helium, 2; neon, 10; argon, 18; krypton, 36; xenon, 54; and radon, 86. The differences in their atomic numbers, and the number of elements in the corresponding rows of the periodic table, are 8, 8, 18, 18, and 32.

There is a hypothesis of the structure of the atom in which the electrons orbit the nucleus in shells that vary in distance from the nucleus. The electrons in each shell share an orbit—that is, the electrons are co-orbital. There is a limit to the number of electrons that can share an orbit, with the more distant shells having a greater capacity. The sequence of numbers of such limits is also 2, 8, 8, 18, 18, 32.

There is a correspondence between the latter sequence of numbers and that of a packing of 102 spheres. The first, second, and sixth layers are identical. This may not be a perfect match, but neither is it a coincidence.

The microcosm has been stingy in revealing numerical clues, despite our assuming that nature is mathematical. The familiar numerical demonstrations are Euclidean solid geometry; the spherical frame of reference; the tangential frame of reference; the periodic table of elements; the speed of light; and the relative size of the proton and the electron. These are a set of natural,

fundamental measurements that reveal much about the relativity, motion, interaction, transformation, and accumulation of minimal, self-generating, self-measuring oscillating particles.

22.3. The Periodicity of Protons in Atoms

Figure 12, below, is a representation of the order of self-assembly of protons in atoms. Based on the sphere-packing hypothesis of formation of atoms, it is an alternative to the familiar periodic table of the elements. Each sphere is labeled with an atomic number from 1 to 86 and the symbol of the name of the atom. There are 16 gaps in the order where no atom is located.

At the center of the figure are the pair, hydrogen (1) and helium (2). The groups of elements in the columns of the periodic table are represented here in lines radiating from the central pair. The rows of elements of the periodic table are shown in the hexagonal rings surrounding the central pair.

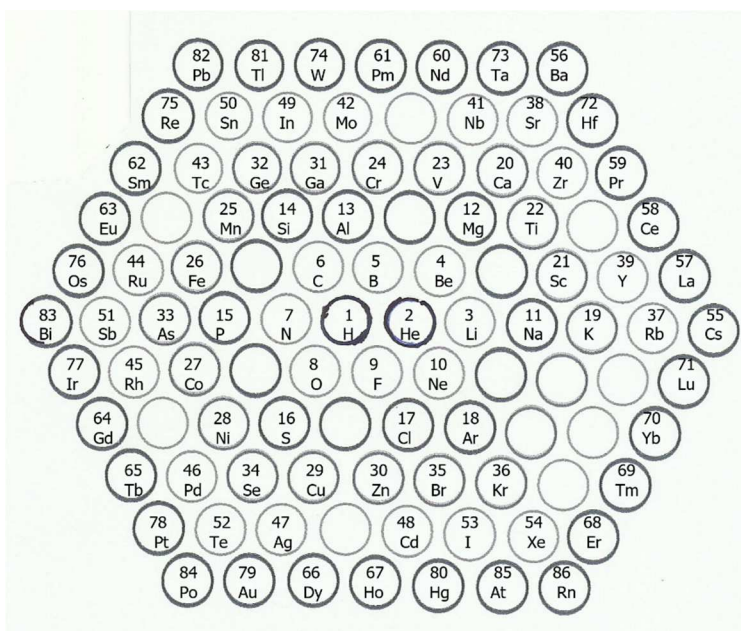


Fig. 12: Diagram of the Periodicity of Protons in Atoms According to the Sphere-Packing Hypothesis (Not Including Numbers 87 to 92)

Thus, the diagonal ray down and right from He is that of the other noble gases, 10, 18, 36, 54, and 86. The horizontal ray to the right of He is the group of 3, 11, 19, 37, and 55. Continuing in the counterclockwise direction are the lines of the other groups, each of five atoms: 4, 12, 20, 38, 56; 5, 13, 31, 49, 81; 6, 14, 32, 50, 82; 7, 15, 33, 51, 83; 8, 16, 34, 52, 84; and 9, 17, 35, 53, 85.

Then there are the groups of three atoms shown in lines radiating from the gaps in the second ring. Starting from the gap between 11 and 12, the line horizontally to the right is the group of 21, 39, and 57. Continuing in the counterclockwise direction are the lines of the remaining groups, each of three: 22, 40, 72; 23, 41, 73; 24, 42, 74; 25, 43, 75; 26, 44, 76; 27, 45, 77; 28, 46, 78; 29, 47, 79; and 30, 48, 80.

The final group of fourteen atoms radiate singly from the gaps in the fourth ring. Their atomic numbers are 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71.

Surrounding the central pair of H and He is the six-sided ring of the group of 3, 4, 5, 6, 7, 8,

9, and 10. The next ring, where a gap is symbolized by (), is the group of 11, (), 12, (), 13, 14, (), 15, (), 16, (), 17, 18, (). The third ring is the non-sequential group of 19, 21, 22, 20, 23, 24, 31, 32, 25, 26, 33, 27, 28, 34, 29, 30, 35, 36, (), (). The fourth ring is 37, 39, (), 40, 38, 41, (), 42, 49, 50, 43, (), 44, 51, 45, (), 46, 52, 47, (), 48, 53, 54, (), (), (). The outer ring is 55, 57, 58, 59, 72, 56, 73, 60, 61, 74, 81, 82, 75, 62, 63, 76, 83, 77, 64, 65, 78, 84, 79, 66, 67, 80, 85, 86, 68, 69, 70, 71. The atoms numbered 87, 88, 89, 90, 91, and 92 presumably are grouped in the next ring possibly in line with numbers 55, 56, 57, 58, 59, and 60.

The sixteen gaps are grouped in the six segments of the hexagonal arrangement as follows: in the lower-right segment, a triangular group of 6 gaps, and in each of the other five segments a linear group of 2 gaps.

23. Proton and Electron Formation

The following description of the composition, arrangement, structure, and internal motion of a proton is the most speculative part of the oscillon hypothesis. It derives from the assumptions that the proton is made of oscillons, arranged in a sphere packing, shaped like a torus and, like the quark hypothesis, divided sixfold.

When oscillons transform from two-dimensional to three-dimensional interactions, they assemble into a ring of six oscillons in the shape of a torus, which has a hole at the center of the ring (see Figure 13, below). Additional rings of six oscillons assemble concentrically to the axis of the initial ring and parallel to its plane. A complete proton consists of 102 rings and 612 oscillons.

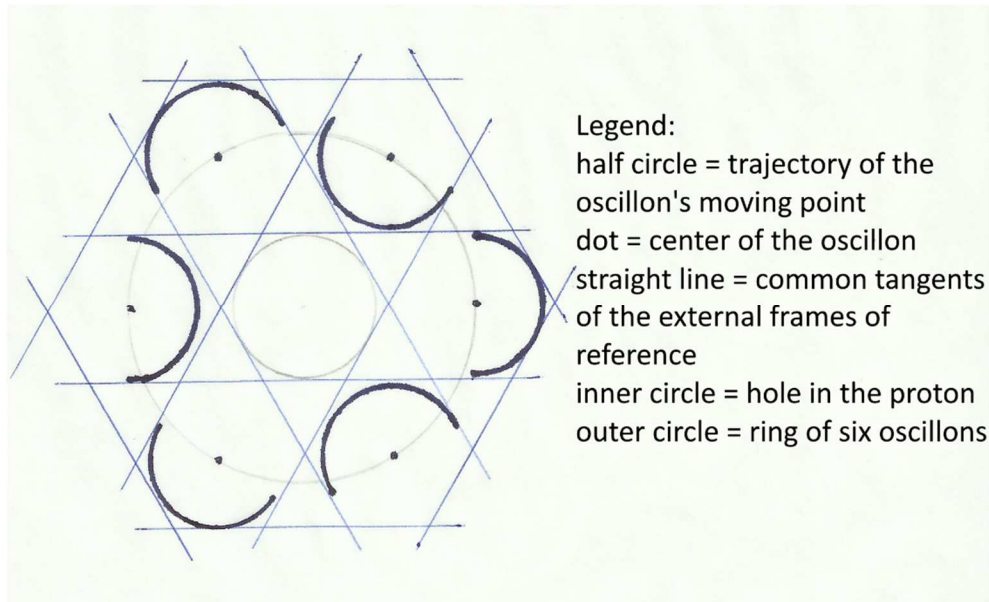


Fig. 13: Innermost Ring of Six Oscillons of a Proton

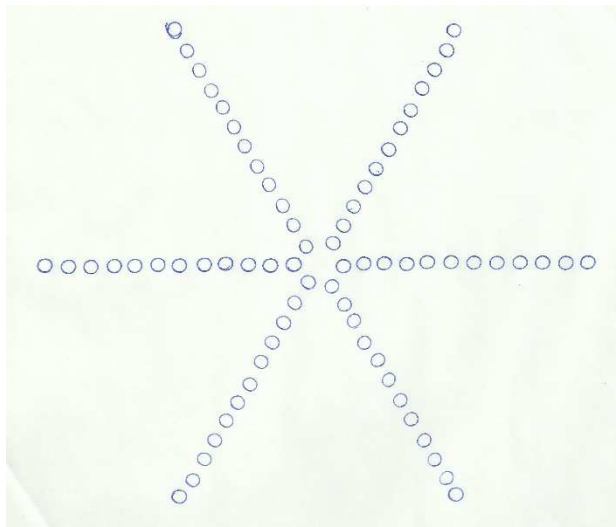


Fig. 14: Horizontal Cross-Section of a Proton

Figure 14, above, shows a cross-section of the central plane and hole of the proton. Each circle represents the internal spherical frame of reference of an oscillon. Each of the six spokes of the proton consists of 102 oscillons arranged vertically in a sphere packing. There are 12 oscillons in the layer of the packing, coinciding with the plane of the proton. Adjacent layers on each side have 11, 10, 9, 8, and 7 oscillons for a total of 102.

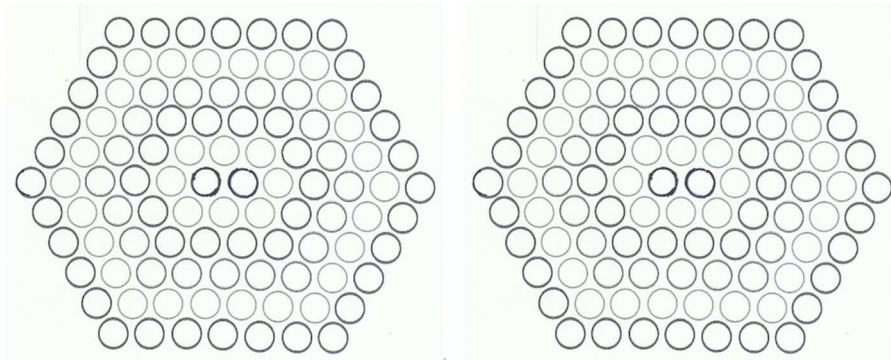


Fig. 15: Vertical Cross-Section of a Pair of Spokes of a Proton Showing the Overall Toroidal Shape

Each circle (in Figure 15, above) represents the internal spherical frame of reference of an oscillon. Each spoke is a sphere packing of oscillons in a hexagonal arrangement. The packing of 102 oscillons has a base of 2 oscillons, and rings of 8, 14, 20, 26, and 32 oscillons surrounding the base. Between the two spokes is the hole in the proton.

The assembled oscillons continue to oscillate. The oscillations of adjacent members of each ring are synchronous, and so are those of the oscillons of each concentric and parallel ring. Their combined motion, a resonant synodic sequence of oscillations, has the appearance of a wave.

The transformation of an oscillon from one-dimensional to three-dimensional interactions takes place in the hole of the proton, resulting in a particle whose point of tangency, rather than oscillating, rotates relative to its constant center point. The new particle is an electron. The center of the proton is a vertex of the electron's trajectory relative to the proton. The proton and the electron form a stable union, and the electron's motion is fundamentally dependent on its proton.

24. Hydrogen and Helium⁹

The constituent particles of atoms are distinguished by having different charges. The proton has a positive charge, and the electron has a negative charge. The neutron, which is a transformed proton, has no charge or a neutral charge. The effects of charge are observed when these particles pass through an electromagnetic field that deflects their motion. The proton is attracted to the negative electrode, and the electron to the positive, while the neutron's motion is not affected.

The charge of an intact atom is neutral, since the equal charges of the proton and electron cancel each other. When the proton and electron separate, in the process of ionization or radioactivity, they are described as charged particles and as positive or negative ions.

What is charge? What is magnetism, electricity, and the electromagnetic interaction? Why are light and neutrinos chargeless, whereas the particles of matter possess charge? Why are there three charges?

The oscillon hypothesis assumes that the observed phenomena are solely determined by variations of the spatial relations, the relativity of the particles, and their motion.

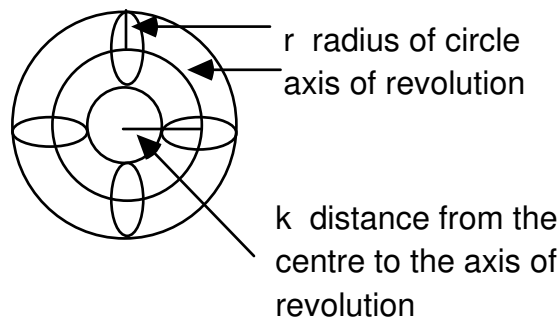
24.1. A Torus-Shaped Proton

Since Ernest Rutherford and other physicists discovered the structure of the hydrogen atom, the proton has provisionally been depicted as a sphere, similar to a billiard ball, suggesting solidity and opacity. In this picture, there is no designation of the proton's plane and axis, nor any indication of motion. Neutrons are depicted as spheres of a different color. The protons and neutrons are grouped randomly into a spherical nucleus. Mathematical physicists are content to leave this analogy unchanged because their scientific method is by calculation rather than visualization, by equation rather than model, by algebra rather than geometry.

The proton does have a plane, an axis, a motion, and a direction that can be described by geometry. In the oscillon hypothesis, the proton has the shape of a torus. The internal frame of reference of an object of this shape is immediately apparent. The oscillation of its constituent particles defines the plane of the proton. In this hypothesis, each of the three differently charged particles moves in its own plane.

Torus is defined as a shape generated by the rotation, in space, of a circle about an axis in its plane but not cutting the circle. Familiar objects that have this shape are donuts, Lifesavers candy, rings, inner tubes, life belts, and chain links. The formula for the volume of a torus is $2\pi^2kr^2$ as shown in Figure 16, below.

⁹A version of this section was previously published in the *Proceedings of the Natural Philosophy Alliance*, ed. Greg Volk, vol. 9, 2012, p. 122.



*Fig. 16: Schematic Diagram of a Torus
(the arrows are pointing to the nearest line)*

A torus has a hole at its center. Its plane and axis are constant. A proton of this shape has an empty center of minimal radius, which is conveniently available for the passage of an electron in the course of its orbital motion. Thus, the vertex of the electron's trajectory is fixed at the proton's center, and the center or focus of the trajectory is variable, as depicted in Figure 17, below.

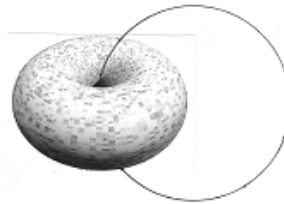


Fig. 17: Diagram of the Interaction of a Proton and an Electron

24.2. The Vertex of the Electron's Trajectory

The variable trajectories of the electron are the curves, circle, ellipse, parabola, and hyperbola, which are collectively known as conics. The vertex of the curve is fixed at the center of the proton, and the axis of the proton is the line that determines the shape of the curve. The center or focus of the curvilinear trajectory lies in the plane of the proton. The distance between the vertex and the focus of the curve is variable.

The relation of (a) the distance of the electron from the focus or foci and (b) the perpendicular distance between the electron and a line parallel to the axis of the proton determines whether the trajectory is a hyperbola, parabola, or ellipse. The relations of distance may be constant sum (ellipse), equal (parabola), or constant difference (hyperbola), as depicted in Figure 18, below.

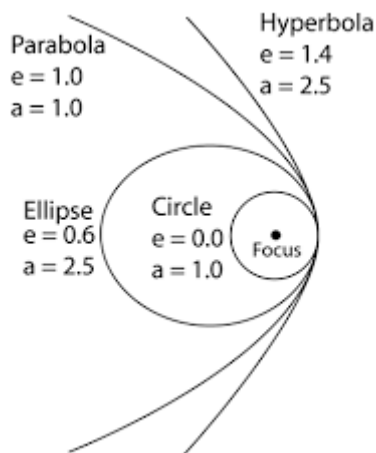


Fig. 18: Variations with the Same Vertex of the Trajectory of an Electron¹⁰

24.3. The Three-Planed Arrangement of Protons, Electrons, and Neutrons

A helium atom consists of two protons, two electrons, and two neutrons. The protons are coplanar, and they form the plane of the atom. The directions of their internal motions are opposite, one clockwise and the other counterclockwise. The electrons are co-orbital, both passing through the centers of the protons, and the angle between them is pi. The neutrons are coplanar in the third plane, one above and the other below the plane of the protons, and their centers coincide with the electrons' trajectory.

The distance between a proton's center and the center of the atom is 1.1547 proton radii, the minimum allowed in their common tetrahedral frame of reference. The distance between a neutron's center and the center of the atom is 2 proton radii. The electrons' trajectory is elliptical. The distance between the centers of the protons and between the centers of a proton and a neutron is 2.3094 proton radii. The distance between the centers of the neutrons is 4 proton radii. (See Figure 19, below.)

¹⁰Available at <http://hyperphysics.phy-astr.gsu.edu/>.

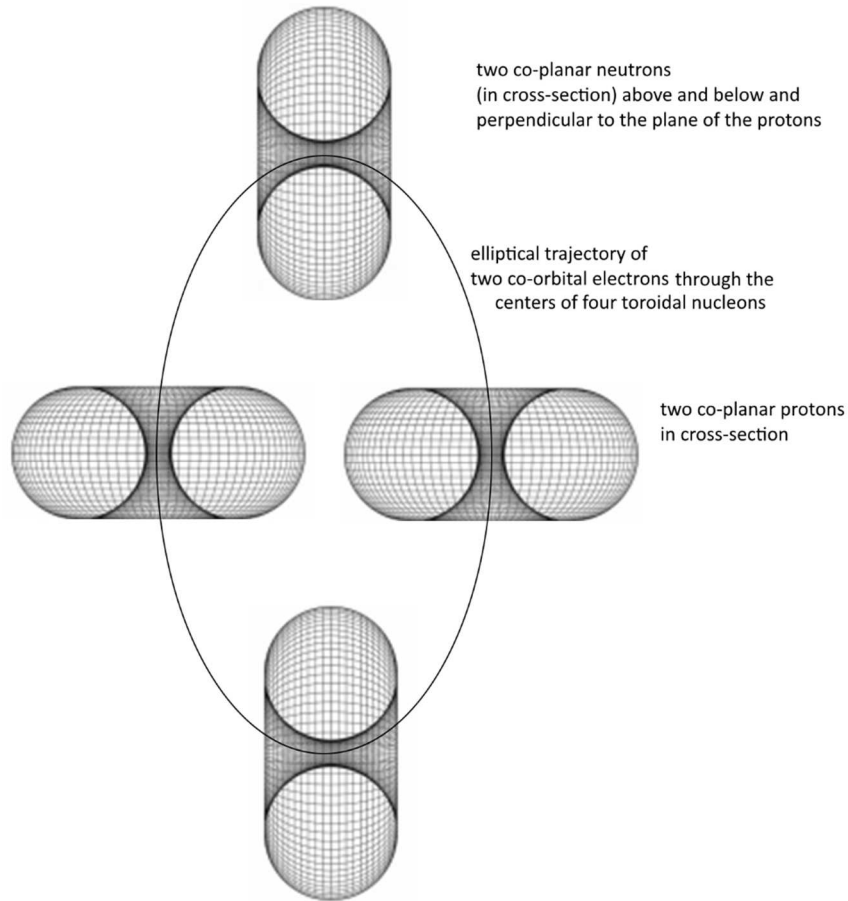


Fig. 19: Cross-Section of a Helium Atom: The Interaction of 2 Protons, 2 Electrons, and 2 Neutrons

24.4. The Relation of the Frames of Reference of Sub-Atomic Particles

The plane of the electron's motion is at right angles to the plane of the proton's internal motion. This leaves the other plane of three dimensions available for a neutron, with its internal motion at right angles to the planes of motion of both the proton and the electron.

From the point of view of the center of a proton, an electron, or a neutron, each has a frame of reference and an internal motion that defines its radial, tangential, and axial dimensions. Because the motion of each is in a different plane, their planes do not coincide, nor do their dimensions. For example, whereas the proton and the electron have the same radial dimension, the proton's tangential dimension corresponds with the electron's axial dimension, and the proton's axial dimension corresponds with the electron's tangential dimension. Similarly, the electron and neutron share the same axial dimension, but their radial and tangential dimensions are interchanged. Also, the tangential dimensions of the proton and neutron correspond.

The correspondence of the internal dimensions of a proton, electron, and neutron in a three-planed atom is represented in Table 2, below:

Table 2: The Correspondence of the Dimensions in a Three-Planed Atom

<i>Dimensions of proton</i>	<i>Electron-to-proton correspondence</i>	<i>Neutron-to-proton correspondence</i>	<i>Electron-to-neutron correspondence</i>
Radial	Radial	Axial	Tangential
Tangential	Axial	Tangential	Axial
Axial	Tangential	Radial	Radial

The fact that the atoms of most elements contain more neutrons than protons but never attain twice as many suggests layering. A disk of protons forms the base of the atom, and above and below this middle layer are layers of neutrons (see Figure 20, below).

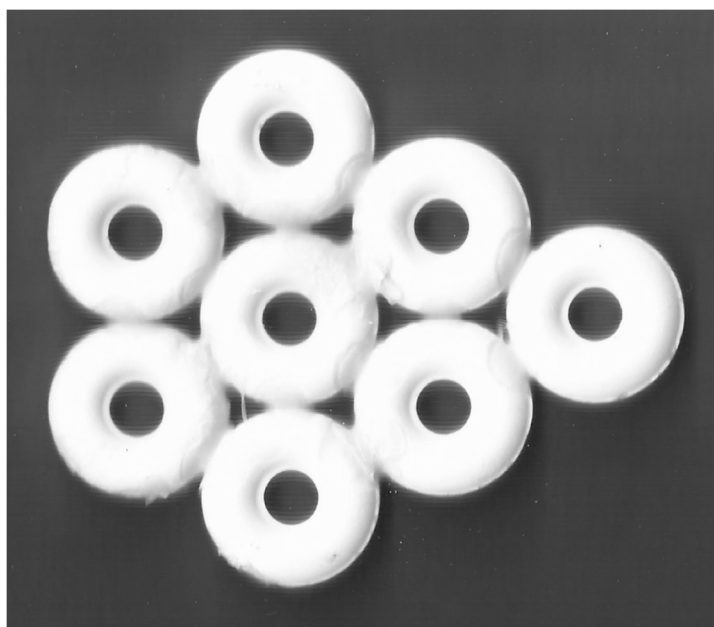


Fig. 20: Model of the Disk of Eight Protons in the Nucleus of an Oxygen Atom

24.5. Elements, Isotopes, Reactivity, and Radioactivity

The interaction of protons, electrons, and neutrons is the process that produces the atoms, elements, molecules, and compounds that make up the material part of nature. There are 92 different microcosmic atoms in nature, each consisting of from one to ninety-two protons, the atomic number. The macrocosmic substance made of such an atom is called an element.

The different atoms also contain neutrons in numbers varying from 0 (hydrogen) to 146 (uranium). An atom of the same element with different numbers of neutrons is called an isotope. The stability of an isotope depends on its number of neutrons, and the most common isotope of an element in nature is the stablest one. Some elements and most isotopes are unstable and are therefore subject to the transformative process called radioactivity. In other words, all unstable elements and isotopes are radioactive.

The ability to form stable atoms is determined by the spatial relations of the protons, electrons, and neutrons—that is, the relativity of their angles, external trajectories (elliptical, parabolic, or hyperbolic), internal motions (clockwise or counterclockwise), numbers, parallelism, perpendicularity, planes, and the tangential frames of reference of two or more than

two. The same variations in relativity determine the atoms' ability to form stable molecules and compounds and to participate in chemical reactions.

The scale of combinations and permutations of such varying relativity is immense, manifesting itself in the complexity of the macrocosm. The oscillon hypothesis proposes that the arrangement of protons in an atom is a disk of Groemer-style sphere-packing, in which the spheres are co-tangential rather than contiguous. Such a packing, which usually has a hexagonal shape, has a minimal area. The base of this packing is two protons, and additional protons are arranged in rings of 8, 14, 20, 26, and 32 protons. The total number of protons in such a packing is 102, which leaves unanswered the question of why only 92 atoms in nature are stable.

Usually, the shape of this packing is fixed, but in the elements that have low atomic numbers, such as carbon (6), the arrangement of their protons may vary in shape to produce different allotropes—in this case, diamond and graphite.

Some questions are unanswered at the present time and require further research. For example, are the internal oscillations of the protons in any atom all moving in the same direction, whether clockwise or counterclockwise, or are the directions opposite—and, if so, in what ratio or sequence? The oscillon hypothesis suggests that the plane of the neutrons is perpendicular to the plane of the protons, but are the neutrons arranged in pairs, are their planes parallel, and are their oscillations in the same direction?

The variable trajectory of an electron is the key to forming chemical bonds between atoms to produce molecules, metals, minerals, acids, bases, inorganic compounds, organic compounds, and so on. An electron is united with a proton due to the vertex of the electron's trajectory coinciding with the proton's center. Again, many questions remain unanswered at the present time. For example, what is the function of co-orbital electrons? When is a trajectory internal or external? When is the direction negative or positive? When is the path an ellipse, a parabola, or a hyperbola? Can electrons share the same vertex? How are their phases related? What effect, if any, does asymmetry in the disc of protons have? The circumstances of such varying relativity are yet to be determined.

24.6. Polarity and Planarity

Opposite, when used to describe charge, implies a linearity or polarity in the relation of positive and negative electrical and magnetic phenomena. This is a misleading assumption that arises from the directionality of attraction and repulsion observed in the magnetic fields of the Earth or an iron bar.

Assuming that the directional difference between positive and negative charges is *not* linear, then the correspondence of three types of charge and three dimensions is apparent. The positive, negative, and neutral charges of the subatomic particles are determined by their relativity, which is planar. Thus, an electron's charge is neither the same as nor opposite to a proton's charge, but the difference is perpendicularity.

24.7. The Union of Proton and Electron

Niels Bohr proposed his model of the atom soon after Rutherford discovered the nucleus. That model has since been modified but not replaced. It introduced the useful ideas of co-orbital electrons and varying electron trajectories referred to above, along with shells of electrons and wave functions. The model also contained the doubtful assumption of an electron leap or jump, a solar system analogy, and an implication that the arrangement of protons is determined by the arrangement of electrons. Bohr's theory omitted, and has not since produced, a model of the

form and constitution of the proton, an ordered spatial arrangement of protons and neutrons, and a spatial explanation of charge.

The emphasis on the motion and interaction of the electron and the corresponding neglect of the proton led to the misleading assumption that atomic structure and interaction are largely dependent on the behavior of the electron. This view prompts the image of the tail wagging the dog. It is an idea that contradicts the fact that the proton is 1,836 times larger than the electron. This disparity in size means that whatever the relativity of the electron and proton, the proton is dominant in their interaction. The proton is the “headquarters,” and the electron is the “agent in the field.”

In every atom, there is always one proton per electron. A proton can handle only one electron, and their union is necessary and complete. The passage of the electron through the proton’s central hole in every orbit illustrates their close, dependent interaction. When the electron is in the hole at the vertex of its path, it is constantly linked to its proton, despite the variation that may take place in its trajectory, whether from ellipse to parabola or from near-centered to far-focused.

The assumption of an electron leaping from one orbit to another can only be described as unnatural. Such a trajectory does not seem possible in a mechanistic universe where processes are continuous. Only the voluntary action of a terrestrial animal fits this kind of motion.

Nevertheless, the electron has a variety of behaviors that are determined by (a) the electron’s relativity within its atom or to other atoms and (b) the different trajectories of motion and interaction that such spatial arrangements permit. This hypothesis suggests that a stable electron and an electron in the ground state have circular orbits. An excited, active, or variable electron has an elliptical orbit. A shared or bound electron is in a parabolic orbit. Free electrons, flowing electrons, and negative ions have hyperbolic trajectories.

When an electron changes its motion, the atom experiences a transformation, which may involve the emission of light or neutrinos. Or the change may initiate a radioactive process. Or the atom may interact with other atoms of the same element or of different elements to form molecules of increasing complexity. The stability of such molecules depends on bonds formed by electrons in the required trajectory.

Having a proton shaped like a torus provides a place where this change of motion can plausibly occur. When the electron is in the proton’s hole, the distance between the two particles is minimal, and the “influence” of the proton is greatest. If this process involves a transfer of energy from one to the other, caused by a change of the proton’s motion, their proximity facilitates it. The electron enters the hole from its old trajectory and emerges in a new one.

The coincidence of the vertex of the electron’s trajectory with the central hole of the proton permits the electron’s motion to be as flexible as necessary, while keeping it linked to and controlled by the proton. Bohr’s assumed leap of the electron can be rejected. The analogies of the solar system and billiard ball are discarded, and a chain link analogy is introduced.

25. Alternative Cosmological Assumptions

According to big bang cosmology, the universe is expanding. Spacetime itself is expanding in volume and carrying its contents along for the ride. By analogy this is visualized as an inflating balloon with points on its surface moving apart. Thus, it is said that there is a mutual recession of galaxies.

The theory of general relativity and other mathematical theories of the universe that preceded the acceptance of the big bang theory also suggested that there is an expansion of the universe.

But does expansion necessarily mean an increase in volume?

The oscillon hypothesis assumes that there is an increase in the total energy of the universe—namely, that there are processes taking place within nature that result in more energy, motion, and interaction than previously existed.

Is this conjecture, that the expansion is an increase in energy, a violation of the law of conservation of energy? It would seem that the answer is yes, in that we are talking about the “creation” of energy. But our universe is full of energy, which must have been “created.” The uniformitarian hypothesis of the microcosm seeks to understand the processes that are needed to account for all the objects, forms, and phenomena of nature.

It would seem that the processes of nucleosynthesis are the best candidates for this possible process. That would make stars the locus of the expansion of energy. This seems reasonable when we consider that over its period of existence a star emits prodigious quantities of light and neutrinos, while the numbers of its protons and its electrons remain the same.

In a star, hydrogen atoms transform into more complex combinations of protons, electrons, and neutrons, but no new stable particles are produced. The proposed processes of transformation, whereby the interaction of oscillons varies in dimensionality, result in the disappearance of the precursor particles and the appearance of the novel successor particles. When a hydrogen atom emits light and neutrinos, it is reproducing its precursor particles while remaining entirely intact.

The protons and electrons of the hydrogen atom do not transform into some novel, higher, and more complex form of energy. A microcosm of three spatial dimensions is the end of the line. There is no next dimensional universe.

25.1. Nucleosynthesis

The interior of a star is a radically different environment from the conditions experienced by the precursors of the hydrogen atoms. The immense pressures and temperatures at the core, the proximity of atoms, their minimal relative velocity, their numerous properties of unlimited variability, and their omni-directional interactions are undoubtedly “something new under the Sun.”

Nucleosynthesis is a feedback process. The universe and the phenomena of nature are a system of continuous cyclical processes. The oscillons—the smallest, simplest, most primitive and fundamental quantities of space and motion, by means of their oscillation, interaction, and transformation of dimensionality—eventually make stars, which in turn make more star-making oscillons. This is a reproductive process that results in an increase in the total energy and an expansion of the universe.

25.2. Conservation of Energy

The law of conservation of energy states that energy can be neither created nor destroyed. Energy may be transformed—for example, from thermal to mechanical, as in a steam engine—but the quantity of energy is the same after transformation as before. Motion never stops.

The first part of the law implies an anthropocentric assumption. Because humans cannot create energy, nor can any terrestrial macrocosmic process, therefore energy is not being created. In fact, nature *has* created energy. The essence of nature is motion. According to the oscillon hypothesis that natural processes are uniformitarian, nature can still produce energy—and, in fact, is now doing so.

The current cosmological theory flows from one observation and a mathematical hypothesis.

The observation is the universal redshift of the light of distant galaxies. The calculation hypothesizes that the universe is expanding. Another observation, the cosmic background radiation, has been used to confirm this cosmology. The universal redshift is interpreted as a mutual recession of the galaxies and an expansion of the space occupied by the galaxies.

The oscillon hypothesis alternatively assumes that the emission of light and neutrinos in nucleosynthesis is a reproduction of precursors, and the continued integrity of the protons and electrons of the emitting hydrogen atoms indicates a closed constructive process rather than destruction. An expansion of energy—an increase of motion—is being described. Restating the hypothesis as a law, energy exists and cannot be caused to stop existing. *Create* is a loaded word best avoided.

25.3. The Doppler Effect

Is the Doppler effect an acoustic illusion? The production and emission of the sound does not change in any way. Its frequency, wavelength, and volume are the same, but the distance and direction of the moving source and the stationary listener change.

The effect is a change in perception—a misinterpretation by the brain of the vibrations of the organs of hearing. A change in the way a constant sound is heard cannot be deemed to be caused by a property of the source of the sound.

25.4. Sources of Radiation

Advances in astronomy using detectors other than visible light telescopes have revealed other sources of radiation in addition to those from stars. Those sources include quasars, gamma ray bursters, and fast radio bursts. They are invariably assumed to be material objects, much larger than stars, and are usually assumed to be outside the Milky Way, and caused by catastrophes.

The oscillon hypothesis alternatively assumes that some sources of radiation may *not* be material objects, but instead may simply be accumulations of radiation. The hypothesis seeks to explain these sources as parts of a uniformitarian system, suggesting that stars are the largest material objects in nature. If there are objects made of matter larger or more powerfully energetic than stars, then, in an ancient universe, there should be as many of them as the stars.

Cosmic rays, originally identified as a form of radiation, are now known to be particles of matter, mainly protons. The early theorists of the steady state universe considered cosmic rays to be strong candidates for the products of a proton-forming process in interstellar space. But the source of cosmic ray particles is an ongoing mystery.

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