THE WORLD ACCORDING TO NATURE: A NON-MATHEMATICAL APPROACH TO THEORETICAL PHYSICS

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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. Subjects to be studied in this way include cause, dimension, direction, effect, frame of reference, interaction, measurement, microcosm, motion, nature, oscillation, particle, period, point, symmetry, time, universe, and wave.

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.

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 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.

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

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

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 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.

A history of our knowledge of the microcosm 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.

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