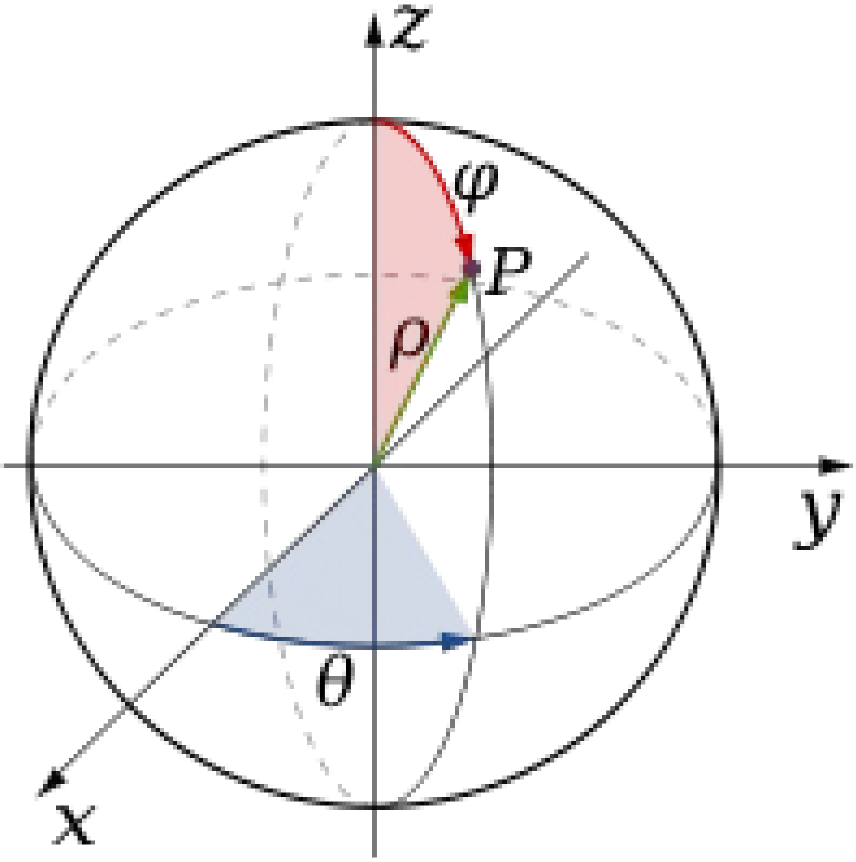
Three Dimensions of Vedic Physics



By John Frederick Sweeney

Abstract

Only three dimensions exist in the Universe, as most humans have long suspected, with the exception of mathematicians and physicists. Albert Einstein at one point approached this realization but geometry prevented his making the logical connections necessary to understand this basic principle. Today mathematicians and physicists fantasize about eleven, fifty – six and two hundred and fifty – six dimensions, which in reality are merely combinatorial aspects of our Universe.

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Introduction

This paper is based on a book about Vedic Physics that is poorly written and which had never been edited. This series of papers provides the editorial oversight needed in that original work with the hope that scientists may more readily accept a work that is correctly written, punctuated and edited according to the standards of American or International English.

The present author believes that this work is of vital importance to humanity to allow bad writing and lack of editing stand in the way of comprehension of this monumental work.

Moreover, the book contains such startling concepts that would astound the

average reader, who is inclined to believe otherwise, considering the power of today's prevailing ideological paradigm. Readers may find this work literally in – credible since it may overpower their knowledge and grasp of science.

Wikipedia on Dimensions

In physics and mathematics, the **dimension** of a space or object is informally defined as the minimum number of coordinates needed to specify any point within it.[1][2] Thus a line has a dimension of one because only one coordinate is needed to specify a point on it (for example, the point at 5 on a number line).

A surface such as a plane or the surface of a cylinder or sphere has a dimension of two because two coordinates are needed to specify a point on it (for example, to locate a point on the surface of a sphere you need both its latitude and its longitude). The inside of a cube, a cylinder or a sphere is three-dimensional because three coordinates are needed to locate a point within these spaces.

In physical terms, *dimension* refers to the constituent structure of all space (cf. volume) and its position in time (perceived as a scalar dimension along the *t*-axis), as well as the spatial constitution of objects within—structures that correlate with both particle and field conceptions, interact according to relative properties of mass—and are fundamentally mathematical in description.

These, or other axes, may be referenced to uniquely identify a point or structure in its attitude and relationship to other objects and occurrences. Physical theories that incorporate time, such as general relativity, are said to work in 4-dimensional "spacetime", (defined as a Minkowski space). Modern theories tend to be "higher-dimensional" including quantum field and string theories. The state-space of quantum mechanics is an infinite-dimensional function space.

The concept of dimension is not restricted to physical objects. High-dimensional spaces occur in mathematics and the sciences for many reasons, frequently as configuration spaces such as in Lagrangian or Hamiltonian mechanics; these are abstract spaces, independent of the physical space we live in.

In mathematics, the dimension of an object is an intrinsic property independent of the space in which the object is embedded. For example, a point on the unit circle in the plane can be specified by two Cartesian coordinates, but one can make do with a single coordinate (the polar coordinate angle), so the circle is 1-dimensional even though it exists in the 2-dimensional plane. This *intrinsic* notion of dimension is one of the chief ways the mathematical notion of dimension differs from its common usages.

The dimension of Euclidean *n*-space $\mathbf{E}^n$ is *n*. When trying to generalize to other types of spaces, one is faced with the question "what makes $\mathbf{E}^n$ *n*-dimensional?" One answer is that to cover a fixed ball in $\mathbf{E}^n$ by small balls of radius ε, one needs on the order of ε^{-n} such small balls.

This observation leads to the definition of the Minkowski dimension and its more sophisticated variant, the Hausdorff dimension, but there are also other answers to that question. For example, the boundary of a ball in $\mathbf{E}^n$ looks locally like $\mathbf{E}^{n-1}$ and this leads to the notion of the inductive dimension. While these notions agree on $\mathbf{E}^n$, they turn out to be different when one looks at more general spaces.

A tesseract is an example of a four-dimensional object. Whereas outside of mathematics the use of the term "dimension" is as in: "A tesseract *has four dimensions*", mathematicians usually express this as: "The tesseract *has dimension 4*", or: "The dimension of the tesseract *is* 4".

Although the notion of higher dimensions goes back to René Descartes, substantial development of a higher-dimensional geometry only began in the 19th century, via the work of Arthur Cayley, William Rowan Hamilton, Ludwig Schläfli and Bernhard Riemann. Riemann's 1854 Habilitationsschrift, Schlafi's 1852 *Theorie der vielfachen Kontinuität*, Hamilton's 1843 discovery of the quaternions and the construction of the Cayley Algebra marked the beginning of higher-dimensional geometry.

The rest of this section examines some of the more important mathematical definitions of the dimensions.

Dimension of a vector space

Main article: Dimension (vector space)

The dimension of a vector space is the number of vectors in any basis for the space, i.e. the number of coordinates necessary to specify any vector. This notion of dimension (the cardinality of a basis) is often referred to as the *Hamel dimension* or *algebraic dimension* to distinguish it from other notions of dimension.

Manifolds

A connected topological manifold is locally homeomorphic to Euclidean n-space, and the number n is called the manifold's dimension. One can show that this yields a uniquely defined dimension for every connected topological manifold.

For connected differentiable manifolds the dimension is also the dimension of the tangent vector space at any point

The theory of manifolds, in the field of geometric topology, is characterized by the way dimensions 1 and 2 are relatively elementary, the **high-dimensional** cases $n > 4$ are simplified by having extra space in which to "work"; and the cases $n = 3$ and 4 are in some senses the most difficult. This state of affairs was highly marked in the various cases of the Poincaré conjecture, where four different proof methods are applied.

Varieties

Main article: Dimension of an algebraic variety

The dimension of an algebraic variety may be defined in various equivalent ways. The most intuitive way is probably the dimension of the tangent space at any regular point. Another intuitive way is to define the dimension as the number of hyperplanes that are needed in order to have an intersection with the variety that is reduced to a finite number of points (dimension zero). This definition is based on the fact that the intersection of a variety with a hyperplane reduces the dimension by one unless if the hyperplane contains the variety.

An algebraic set being a finite union of algebraic varieties, its dimension is the maximum of the dimensions of its components. It is equal to the maximal length of the chains $V_0 \subsetneq V_1 \subsetneq \ldots \subsetneq V_d$ of sub-varieties of the given algebraic set (the length of such a chain is the number of "$\subsetneq$").

Krull dimension

Main article: Krull dimension

The Krull dimension of a commutative ring is the maximal length of chains of prime ideals in it, a chain of length *n* being a sequence $\mathcal{P}_0 \subsetneq \mathcal{P}_1 \subsetneq \ldots \subsetneq \mathcal{P}_n$of prime ideals related by inclusion. It is strongly related to the dimension of an algebraic variety, because of the natural correspondence between sub-varieties and prime ideals of the ring of the polynomials on the variety.

For an algebra over a field, the dimension as vector space is finite if and only if its Krull dimension is 0.

Lebesgue covering dimension

Main article: Lebesgue covering dimension

For any normal topological space *X*, the Lebesgue covering dimension of *X* is defined to be n if *n* is the smallest integer for which the following holds: any open cover has an open refinement (a second open cover where each element is a subset of an element in the first cover) such that no point is included in more than *n* + 1 elements.

In this case dim *X* = *n*. For *X* a manifold, this coincides with the dimension mentioned above. If no such integer *n* exists, then the dimension of *X* is said to be infinite, and one writes dim *X* = ∞. Moreover, *X* has dimension −1, i.e. dim *X* = −1 if and only if *X* is empty. This definition of covering dimension can be extended from the class of normal spaces to all Tychonoff spaces merely by replacing the term "open" in the definition by the term "**functionally open**".

Inductive dimension

Main article: Inductive dimension

An inductive definition of dimension can be created as follows. Consider a discrete set of points (such as a finite collection of points) to be 0-dimensional. By dragging a 0-dimensional object in some direction, one obtains a 1-dimensional object. By dragging a 1-dimensional object in a *new direction*, one obtains a 2-dimensional object. In general one obtains an $(n + 1)$-dimensional object by dragging an n dimensional object in a *new* direction.

The inductive dimension of a topological space may refer to the *small inductive dimension* or the *large inductive dimension*, and is based on the analogy that $(n + 1)$-dimensional balls have n dimensional boundaries, permitting an inductive definition based on the dimension of the boundaries of open sets.

Hausdorff dimension

Main article: Hausdorff dimension

For structurally complicated sets, especially fractals, the Hausdorff dimension is useful. The Hausdorff dimension is defined for all metric spaces and, unlike the Hamel dimension, can also attain non-integer real values.[3] The box dimension or Minkowski dimension is a variant of the same idea. In general, there exist more definitions of fractal dimensions that work for highly irregular sets and attain non-integer positive real values. Fractals have been found useful to describe many natural objects and phenomena.[4][5]

Hilbert spaces

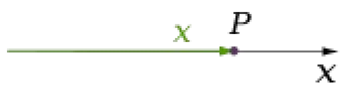
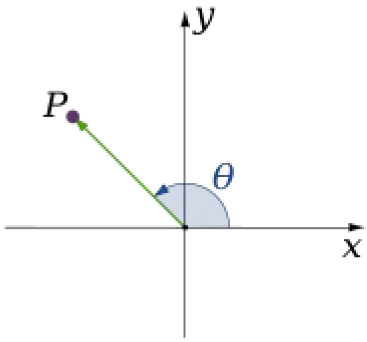
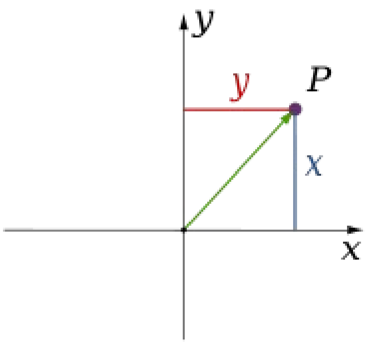
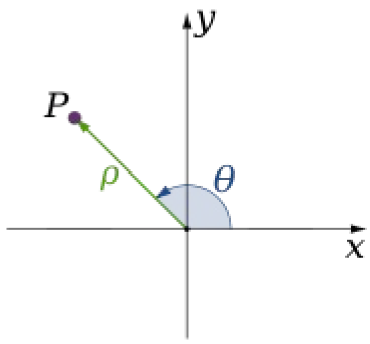
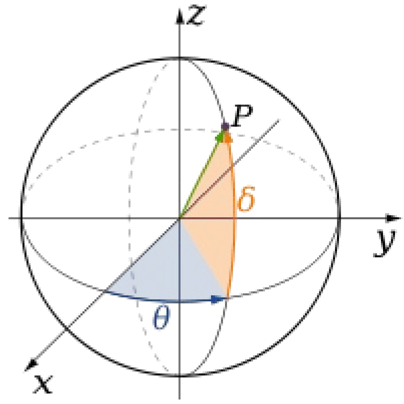
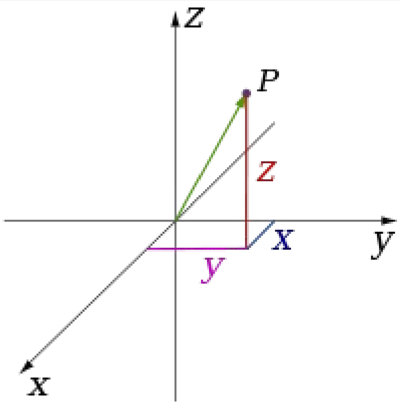
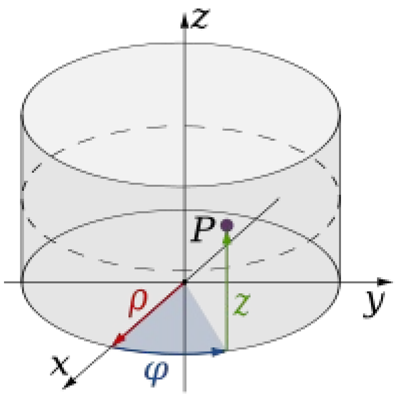
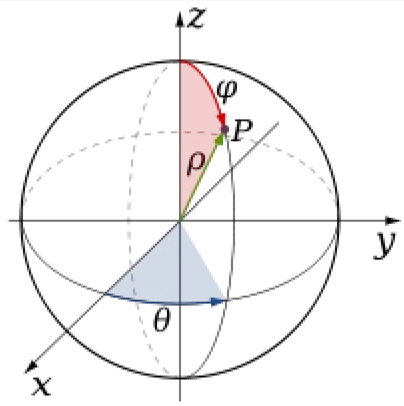
Every Hilbert space admits an orthonormal basis, and any two such bases for a particular space have the same cardinality. This cardinality is called the dimension of the Hilbert space. This dimension is finite if and only if the space's Hamel dimension is finite, and in this case the above dimensions coincide.

In physics

Spatial dimensions

Classical physics theories describe three physical dimensions: from a particular point in space, the basic directions in which we can move are up/down, left/right, and forward/backward. Movement in any other direction can be expressed in terms of just these three.

Moving down is the same as moving up a negative distance. Moving diagonally upward and forward is just as the name of the direction implies; *i.e.*, moving in a linear combination of up and forward. In its simplest form: a line describes one dimension, a plane describes two dimensions, and a cube describes three dimensions. (See Space and Cartesian coordinate system.)

Dim	Example co-ordinate systems
1	 Number line  Angle
2	 Cartesian (2-dimensional)  Polar  Latitude and longitude
3	 Cartesian (3-dimensional)  Cylindrical  Spherical

A **temporal dimension** is a dimension of time. Time is often referred to as the "fourth dimension" for this reason, but that is not to imply that it is a spatial dimension. A temporal dimension is one way to measure physical change. It is perceived differently from the three spatial dimensions in that there is only one of it, and that we cannot move freely in time but subjectively move in one direction.

The equations used in physics to model reality do not treat time in the same way that humans commonly perceive it. The equations of classical mechanics are symmetric with respect to time, and equations of quantum mechanics are typically symmetric if both time and other quantities (such as charge and parity) are reversed. In these models, the perception of time flowing in one direction is an artifact of the laws of thermodynamics (we perceive time as flowing in the direction of increasing entropy).

The best-known treatment of time as a dimension is Poincaré and Einstein's special relativity (and extended to general relativity), which treats perceived space and time as components of a four-dimensional manifold, known as spacetime, and in the special, flat case as Minkowski space.

Additional dimensions

In physics, three dimensions of space and one of time is the accepted norm. However, there are theories that attempt to unify the fundamental forces by introducing more dimensions. Superstring theory, M-theory and Bosonic string theory posit that physical space has 10, 11 and 26 dimensions, respectively. These extra dimensions are said to be spatial.

However, we perceive only three spatial dimensions and, to date, no experimental or observational evidence is available to confirm the existence of these extra dimensions. A possible explanation that has been suggested is that space acts as if it were "curled up" in the extra dimensions on a subatomic scale, possibly at the quark/string level of scale or below.

An analysis of results from the Large Hadron Collider in December 2010 severely constrains theories with large extra dimensions.[6]

Other physical theories that have introduced extra dimensions of space are:

- Kaluza–Klein theory introduces extra dimensions to explain the fundamental forces other than gravity (originally only electromagnetism).
- Large extra dimension and the Randall–Sundrum model attempt to explain the weakness of gravity. This is also a feature of brane cosmology.
- Universal extra dimension

Perhaps the most basic way the word *dimension* is used in literature is as a hyperbolic synonym for *feature*, *attribute*, *aspect*, or *magnitude*. Frequently the hyperbole is quite literal as in *he's so 2-dimensional*, meaning that one can see at a glance what he *is*. This contrasts with 3-dimensional objects, which have an interior that is hidden from view, and a back that can only be seen with further examination.

Science fiction texts often mention the concept of dimension, when really referring to parallel universes, alternate universes, or other planes of existence. This usage is derived from the idea that to travel to parallel/alternate universes/planes of existence one must travel in a direction/dimension besides the standard ones.

In effect, the other universes/planes are just a small distance away from our own, but the distance is in a fourth (or higher) spatial (or non-spatial) dimension, not the standard ones.

One of the most heralded science fiction novellas regarding true geometric dimensionality, and often recommended as a starting point for those just starting to investigate such matters, is the 1884 novel *Flatland* by Edwin A. Abbott. Isaac Asimov, in his foreword to the Signet Classics 1984 edition, described *Flatland* as "The best introduction one can find into the manner of perceiving dimensions."

The idea of other dimensions was incorporated into many early science fiction stories, appearing prominently, for example, in Miles J. Breuer's *The Appendix and the Spectacles* (1928) and Murray Leinster's *The Fifth-Dimension Catapult* (1931); and appeared irregularly in science fiction by the 1940s.

Classic stories involving other dimensions include Robert A. Heinlein's *—And He Built a Crooked House* (1941), in which a California architect designs a house based on a three-dimensional projection of a tesseract, and Alan E. Nourse's *Tiger by the Tail* and *The Universe Between* (both 1951). Another reference is Madeleine L'Engle's novel *A Wrinkle In Time* (1962), which uses the 5th dimension as a way for "tesseracting the universe" or in a better sense, "folding" space to move across it quickly. The fourth and fifth dimensions were also a key component of the book *The Boy Who Reversed Himself*, by William Sleator.

Philosophy

In 1783, Kant wrote: "That everywhere space (which is not itself the boundary of another space) has three dimensions and that space in general cannot have more dimensions is based on the proposition that not more than three lines can intersect at right angles in one point. This proposition cannot at all be shown from concepts, but rests immediately on intuition and indeed on pure intuition *a priori* because it is apodictically (demonstrably) certain."[9]

Space has Four Dimensions is a short story published in 1846 by German philosopher and experimental psychologist Gustav Fechner (under the pseudonym Dr. Mises). The protagonist in the tale is a shadow who is aware of, and able to communicate with, other shadows; but is trapped on a two-dimensional surface. According to Fechner, the shadow-man would conceive of the third dimension as being one of time.[10] The story bears a strong similarity to the "Allegory of the Cave", presented in Plato's *The Republic* written around 380 B.C.

Simon Newcomb wrote an article for the *Bulletin of the American Mathematical Society* in 1898 entitled "The Philosophy of Hyperspace".[11] Linda Dalrymple Henderson coined the term *Hyperspace philosophy* in her 1983 thesis about the fourth dimension in early-twentieth-century art. It is used to describe those writers that use higher-dimensions for metaphysical and philosophical exploration.[12] Charles Howard Hinton (who was the first to use the word "tesseract" in 1888) and Russian esotericist P. D. Ouspensky are examples of "hyperspace philosophers".

Vedic Physics on Dimensions and Paradigms

The control parameters in the Substratum covers six sequences in three loops and is specially dealt with in a number of Theorems (55 to 68) which highlights the constant forward control necessary to maintain a Substratum in a coherent and stable state.

The intellectual efforts of 5 important scientists like Newton, Maxwell, Planck, Hoyle-Narlikar and Einstein, who laid the cornerstones in physics and incidentally extended them to cosmology, could have unified all the five areas of physics.

Newton empirically derived the static gravitational macro field parameters at the outer level, by developing calculus to mathematically prove the concept of a mechanical - object based reality. In order to do so, Newton established the gravity constant G as a unit of dimensionality. The gravity constant G equals half the reciprocal value derived by using Vedic principles, based on the “Thaama – Raja - Sathwa“ Guna concepts.

The Newtonian derivation is equivalent to using only the Thaama aspect and ignoring the Sathwa and Raja factors involved in the common zero interval that reduced the true G value by half.

Maxwell derived from micro field theory the same gravity parameter, that seems very different, by following a combination of empirical and theoretical premises similar to Vedic concepts, but kept aside the Thaama and Raja factors.

The impedance value 377 of Maxwell space is related directly to the Newtonian gravity constant G, because Maxwell took into reckoning again the common cube, between the vertical and horizontal, that made a logarithmic difference, which separated the same coherent field as two different E and B axial activities at the observable level. This equation shows the positive value at index 4. The positive value equals exactly 377 electron volts of energy and as a unit of charge, contributes an ampere/sec the impedance is 377 ohms.

$$\frac{PM}{\left[\left(\frac{7}{k-1}\right)^2\right]} - Me\cdot\left(\frac{1}{2^4\cdot A_4\cdot 2}\right)^2 = 6.7212708\cdot 10^{-34}$$

Wikipedia on the Impedance of Space

The **impedance of free space**, Z_0, is a physical constant relating the magnitudes of the electric and magnetic fields of electromagnetic radiation travelling through free space. That is, $Z_0 = |\mathbf{E}|/|\mathbf{H}|$, where $|\mathbf{E}|$ is the electric field strength and $|\mathbf{H}|$ magnetic field strength. It has an exact irrational value, given approximately as 376.73031... ohms.[1]

The impedance of free space equals the product of the vacuum permeability or magnetic constant μ_0 and the speed of light in vacuum c_0. Since the numerical values of the magnetic constant and of the speed of light are fixed by the definitions of the ampere and the metre respectively, the exact value of the impedance of free space is likewise fixed by definition and is not subject to experimental error.

Planck mathematically exposed this missing common cube at zero interval as a quantum with density at the detectable level, but the state of mathematics did not encourage him to look into this cubic quantum activity within the instant cycle.

Wikipedia on the Planck Constant

The **Planck constant** (denoted h, also called **Planck's constant**) is a physical constant that is the quantum of action in quantum mechanics. The Planck constant was first described as the proportionality constant between the energy (E) of a photon and the frequency (ν) of its associated electromagnetic wave. This relation between the energy and frequency is called the **Planck relation**:

$$E = h\nu\,.$$

Since the frequency ν, wavelength λ, and speed of light c are related by $\lambda\nu = c$, the Planck relation for a photon can also be expressed as

$$E = \frac{hc}{\lambda}.$$

The above equation leads to another relationship involving the Planck constant. Given p for the linear momentum of a particle, the de Broglie wavelength λ of the particle is given by

$$\lambda = \frac{h}{p}.$$

In applications where frequency is expressed in terms of radians per second ("angular frequency") instead of cycles per second, it is often useful to absorb a factor of 2π into the Planck constant. The resulting constant is called the **reduced Planck constant** or **Dirac constant**. It is equal to the Planck constant divided by 2π, and is denoted $\hbar$ ("**h-bar**"):

$$\hbar = \frac{h}{2\pi}.$$

The energy of a photon with angular frequency ω, where $\omega = 2\pi\nu$, is given by

$$E = \hbar\omega.$$

The reduced Planck constant is the quantum of angular momentum in quantum mechanics.

The Planck constant is named after Max Planck, the founder of quantum theory, who discovered it in 1900, and who coined the term "Quantum". Classical statistical mechanics requires the existence of h (but does not define its value).[2] Planck discovered that physical action could not take on any indiscriminate value.

Instead, the action must be some multiple of a very small quantity (later to be named the "quantum of action" and now called Planck's constant). This inherent granularity is counter intuitive in the everyday world, where it is possible to "make things a little bit hotter" or "move things a little bit faster". This is because the quanta of action are very, very small in comparison to everyday macroscopic human experience. Hence, the granularity of nature appears smooth to us.

Thus, on the macroscopic scale, quantum mechanics and classical physics converge at the classical limit. Nevertheless, it is impossible, as Planck discovered, to explain some phenomena without accepting the fact that action is quantized. In many cases, such as for monochromatic light or for atoms, this quantum of action also implies that only certain energy levels are allowed, and values in-between are forbidden.[3]

In 1923, Louis de Broglie generalized the Planck relation by postulating that the Planck constant represents the proportionality between the momentum and the quantum wavelength of not just the photon, but the quantum wavelength of any particle. This was confirmed by experiments soon afterwards.

In Vedic terms, Planck's effort dealt with the Thaama and Sathwa states, but he failed to expose the Raja interactive state, which involves the gravity parameter G, hidden in the quanta as a simultaneous phenomenon that was unimaginably larger than the spectrum he had investigated, which was the Substratum of "black hole" material which makes up much of the Universe.

Einstein was able to conceptualize the total equivalence of electromagnetic and gravitation phenomena, which brought him close to a total unification by his intuitive but arbitrary inclusion of a cosmological constant.

Einstein’s cosmological constant provided the perfect conversion scale of time and space within the instant, but the Hubble parameter confounded his concept of mathematics and the structure of space, which imposed a logical void that he could not bridge.

That Einstein postulated the principle of equivalence brought him close to seeing the holographic nature of phenomena, but the power of Reimann‘s geometry overpowered Einstein. The principle of relativity leads naturally into an enigmatic ‘four’ dimensional space and to the holographic nature of reality.

One would be forced to describe a hologram in terms of an understandable 3 - dimensional space, in which the time - varying vibrations remain in the same locations, which produces the illusion of four dimensions.

The near ideal Hoyle-Narlikar theory, based on conformal invariance, eminently unifies the macro and micro fields at the observable level. Moreover, the attempt to bridge the internal shortfall in potential, by absorption of radiation, was ideologically correct, for it provided the necessary compensatory “mass” build up and the consequent phase shift in internal coherence.

The concept of absorption of radiation eliminated the Hubble parameter and its barrier towards greater development. However, the “instantaneous” mathematical barrier prevented Hoyle-Narlikar theory from predicting verifiable phenomena.

In terms of Vedic Physics, Hoyle-Narlikar investigates the Raja characteristics just outside the instant, the external metric of spatial “infinitesimal distance and zero time” which exist in the sequential Bhava domain, but fails to connect the Abhiman / Ahankar phase lying just alongside, inside the instant cycle.

Wikipedia on Hoyle – Narlikar Theory

The **Hoyle-Narlikar theory of gravity**[1] is a Machian theory of gravity proposed by Fred Hoyle and Jayant Narlikar that fits into the quasi steady state model of the universe.[2] The gravitational constant *G* is arbitrary and is determined by the mean density of matter in the universe. The theory was inspired by the Wheeler-Feynman absorber theory for electrodynamics.[3]

Currently the theory does not fit into WMAP data.[4] Narlikar and his followers are working on adding mini bangs with various creation fields to explain the anisotropy of the universe.[5][6]

Vedic Physics teaches the trick of peering over this "instant" barrier, by making humans mentally change the so - called horizontal axis 'velocity or Bhava' representation, onto its head, as a vertical axis 'potential-Linga-vector' as an Abhiman potential in instant time. The description of cubes stacked in the x and y axis depends very much on the observer's orientation.

Vedic Physics proves that both are exactly the same in a holographic, oscillatory, field of the Substratum, that is to say, in a coherent, synchronised, eternally dynamic, unmanifest state of total democratic, self-similar freedom called Kaivalya; which is the ultimate, yet the original, primordial state.

Vedic Physics contains an axiom which says "vibrations remain vibrations, despite all changes and manipulations" and "vibrations remaining in the same location give the appearance of solids".

Conclusion

This paper has ranged from the paradigm of Newtonian Physics to that of the contemporary Hoyle-Narlikar, with stops along the way with Maxwell, Einstein and Max Planck. On a few occasions, western scientists approached the concepts of Vedic Physics, without awareness of so doing. None of these scientists certainly suspected that the Universe consists of three types of matter, not merely one type.

In a paper previously published on Vixra, the author has stated that Time is not the Fourth Dimension, but is something independent of dimensional concepts altogether.

Yet the evidence has accompanied humanity for ages, without our realization of meaning. Liebneicz, for example, either learned of binary math from the I Ching, or else discovered the binary math within the I Ching, and this has led to the development of the personal computer and the Internet.

Marie – Louise von Franz, the Jungian analyst and scholar, recognized the isomorphic relationship between the 64 amino acids of DNA and the 64 hexagrams of the I Ching, but this astounding correlation met with little but rejection from establishment academics, who knew not how to handle this "more than coincidental" occurrence. At best, critics could ridicule Jung and his followers as crackpots, the traditional boy name – calling typical of western science.

How many notable sinologists have perused or assiduously studied the Dao De Jing if not the Tai Xuan Jing and the Huang Di Nei Jing (The Yellow Emperor's Medical Canon) and not wondered about the structure of 81 verses? Can even our greatest thinkers have been so blind? The latter represents the 9 x 9 = 81 type of matter, the former the 8 x 8 = 64 type of matter.

Plato's concept of blind men in a cave provides the proper paradigmatic perspective on the past 500 years of western "science," even with the clues offered by the ancient societies of India and China. When this author pointed out the reason why Tantra contains 64 yoginis, the response of a famous Berkeley astrophysicist was to cease communications.

This paper might meet with many unhappy faces, who have dedicated their lives to the concept that the universe contains four, eight, ten, eleven, fifty –

six or two hundred and fifty – six dimensions. Such men could not exist without the comfortable belief in their abstract worlds. Mathematicians speak of how their favorite algebras “live” in such and such a dimension.

Well, the emperor today strides down the streets in his much – anticipated parade, only to have the little boy proclaim his nudity. It is now high time for our scientists to get a grip on reality and come back to our world of three dimensions.

Appendix I

Here is continued the Wikipedia entry for impedance, begun above:

The analogous quantity for a plane wave travelling through a dielectric medium is called the *intrinsic impedance* of the medium, and designated η (eta). Hence Z_0 is sometimes referred to as the *intrinsic impedance of free space*,[2] and given the symbol η_0.[3] It has numerous other synonyms, including:

- *wave impedance of free space*,[4]
- *the vacuum impedance*,[5]
- *intrinsic impedance of vacuum*,[6]
- *characteristic impedance of vacuum*,[7]
- *wave resistance of free space*.[8]

Relation to other constants

From the above definition, and the plane wave solution to Maxwell's equations,

$$Z_0 = \frac{E}{H} = \mu_0 c_0 = \sqrt{\frac{\mu_0}{\varepsilon_0}} = \frac{1}{\varepsilon_0 c_0}$$

where

$\mu_0 =$ the magnetic constant
$\varepsilon_0 =$ the electric constant and
$c_0 =$ the speed of light in free space.[9][10]

The reciprocal of Z_0 is sometimes referred to as the *admittance of free space*, and represented by the symbol Y_0.

Exact value

Since 1948, the SI unit ampere has been defined by *choosing* the numerical value of μ_0 to be exactly $4\pi \times 10^{-7}$ H/m. Similarly, since 1983 the SI metre has been defined by *choosing* the value of c_0 to be 299 792 458 m/s. Consequently

$$Z_0 = \mu_0 c_0 = 119.9169832\,\pi\ \Omega_{exactly},$$

or

$$Z_0 \approx 376.730\,313\,461\,77\ldots\Omega.$$ This situation may change if the ampere is redefined in 2015. See New SI definitions.

120π-approximation

It is very common in textbooks and learned papers to substitute the approximate value 120π for Z_0. This is equivalent to taking the speed of light to be 3×10^8 m/s. For example, Cheng 1989 states[3] that the radiation resistance of a Hertzian dipole is

$$R_r \approx 80\pi^2 \left(\frac{\ell}{\lambda}\right)^2 [not\ exact]$$

This practice may be recognized from the resulting discrepancy in the units of the given formula. Consideration of the units, or more formally dimensional analysis, may be used to restore the formula to a more exact form—in this case to

$$R_r = \frac{2\pi}{3} Z_0 \left(\frac{\ell}{\lambda}\right)^2$$

Contact

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Some men see things as they are and say *why?* I dream things that never were and say *why not?*

Let's dedicate ourselves to what the Greeks wrote so many years ago:

to tame the savageness of man and make gentle the life of this world.

Robert Francis Kennedy