Physics in 5 Dimensions

What it's all about - Starting with the experimentally proven physics of prominent physicists

Classical Physics uses a Galilean coordinate system in which four coordinates \((x, y, z, t)\) determine an event, where the term \(an\ \object\ at\ rest\) is the view of an object by an observer when the velocity of the object appears to be zero in a Galilean frame of reference rigidly attached to the observer. In Physics in 5 Dimensions we ask: \(Can\ an\ observer\ ever\ be\ considered\ to\ be\ at\ rest?\) The answer is certainly \(no\) because we cannot imagine a situation where the observer is not moving in the universe in some way. For example, an observer on the surface of Earth has a motion arising from the sum of the following: - the Earth’s rotation, - the Earth orbiting the Sun, - the Sun moving in the Milky Way, - the Milky Way rotating and moving within the Universe. So certainly the observer and all matter (i.e. particles, bodies, measuring instruments) are moving in the universe with some accumulated relative velocity.

\(By\ defining\ this\ dynamic\ movement\ as\ a\ fifth\ dimension,\ in\ the\ same\ way\ as\ time\ \(t\)\ is\ the\ fourth\ dimension\ of\ a\ Galilean\ coordinate\ system,\ we\ convert\ Classical\ Physics\ in\ 4\ Dimensions\ into\ Physics\ in\ 5\ Dimensions\ and\ the\ book\ on\ Physics\ in\ 5\ Dimensions^1\ explains\ how\ (496\ pages).\)

Classical physics in 4 dimensions does not recognise this dynamic movement and is therefore based on the special case of viewing objects locally on earth inside a laboratory, and ignores the motion of the earth and the laboratory. However, the intrinsic motion of matter is important and has to be included in our theories of physics. By ignoring the dynamic movement, errors arise in the theory of classical physics and special theories have to be developed, often paradoxes^2, in order to account for the errors whenever they become obvious. Some examples are highlighted in the following text.

The following topics and fields of physics offer a very brief summary of some of the relevant \(advances/hypotheses\) of the theory of Physics in 5 Dimensions.

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^2 A paradox involves contradictory yet interrelated elements that exist simultaneously and persist over time.
Stable Matter and Angular Momentum

The theory of *Physics in 5 dimensions* is concerned with the physics of the *stable matter* of the universe including the atomic constituents of electrons, protons and neutrons and the larger bodies formed from them. The mean lifetimes of electrons and protons are $>10^{28}$ years and around 15 minutes for the neutron. Other elementary particles have very short mean lifetimes in the range from $10^{-6}$ to $10^{-25}$ seconds which makes experimental analysis difficult and unsuitable for developing a physically objective view of physics.

**Hypothesis:** - In order to exist as the stable matter of the universe, all stable matter (particles and solid bodies) move along closed paths with a common constant velocity $c$, the speed of light$^3$, and in general the shape of the path (orbit) of nominal radius $r$ will be an ellipse or, as a special case, a circle. Therefore all particles and bodies will have an intrinsic value of angular momentum arising from their motion along closed paths.

Matter always moving in closed paths with a common velocity gives a physically objective view to the laws of *conservation of energy* and *conservation of angular momentum*.

**Mass $m$**

**Hypothesis:** - The angular momentum and mass $m$ of a particle or body are constant and uniquely defines the energy and permitted motion of the body in 5-dimensional space.

With the addition of the 5th dimension the mass $m$ remains constant, whereas from *Einstein's Special Theory of Relativity* the mass $m$ of an object increases with velocity and the “rest” mass of an object is denoted by $m_0$. However, if the perspective of the 5th dimension is ignored, mass $m$ reverts back to Einstein's expression of variable mass. The difference of perspective between 4- and 5-dimensional physics is defined and you can switch between them.

**Universal Equations of Motion**

**Hypothesis:** - Universal Equations of Motion are valid for all moving particles and bodies in a 5-dimensional local space.

The theory of motion according to *Physics in 5 Dimensions* accounts for the behaviour of electrons in atoms, as well as nucleons forming nuclei and the planets orbiting the Sun. The universal equations of motion work in all cases and both the angular momentum and energy of all objects remain constant in their own frame of reference (closed path with common constant velocity $c$).

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$^3$ [https://www.nobelprize.org/nobel_prizes/physics/laureates/1933/dirac-lecture.pdf](https://www.nobelprize.org/nobel_prizes/physics/laureates/1933/dirac-lecture.pdf). As one example - Dirac commented in his Nobel Lecture ... It is found that an electron which seems to us to be moving slowly, must actually have a very high frequency oscillatory motion of small amplitude ... As a result of this oscillatory motion, the velocity of the electron at any time equals the velocity of light.
Velocity Components

For clarity, we use the parameter $v_4$ to denote the relative velocity between bodies as used daily in our 4-dimensional space of classical physics and $v_4$ retains the same meaning and value when used in Physics in 5 dimensions.

However an important aspect of Physics in 5 dimensions is that there are three velocity vectors to consider, consisting of the speed of light $c$, $v_4$ as defined above and a third velocity vector $v_5$. We note that from simple geometry we have the scalar relationship $c^2 = v_4^2 + v_5^2$ given the three velocity vectors associated with an object $O$.

While the velocity component $v_4$ is equivalent to the usual relative velocity of the object in classical physics, there is no equivalent velocity component $v_5$ in classical physics. However the velocity components $v_4$ and $v_5$ are of equal significance. Both have related components of momentum and energy, whereas in classical physics the elements of momentum and energy associated with $v_5$ are unknown. The variable mass is then a necessary condition in classical physics to compensate for this loss of $v_5$ information and the associated components of momentum and energy.

With object $O$ and observer $P$ following closed paths (orbits) with velocity $c$, the distance between an object and observer stays the same when both have identical orbits and velocities in adjacent parallel planes. In this special case, the object is at “rest” from the observer’s perspective, even though both object and observer are following their respective orbits with the speed of light.

Hypothesis: - If a force is applied to the object, the plane of orbit of the object $O$ rotates or tilts by an angle $\theta$ with respect to the plane of orbit of the observer $P$ and the object and observer continue to orbit in their respective planes with the speed of light $c$. With tilted planes, the distance between the object and observer is now changing and the object has components of velocity $v_4$ and $v_5$ with respect to the observer.

The relative velocity is not a fundamental property of the object because it is different for different observers.

The diagram above is a snapshot from above object $O$ and observer $P$ at the top of their orbits of velocity $c$ and illustrates the tilt angle $\theta$ and the corresponding velocity vectors $c$, $v_4$ and $v_5$.

In the snapshot, as observer $P$ moves parallel to the y-axis with velocity $c$, the equivalent component of velocity for the object $O$, parallel to the y-axis, is given by the vector $v_5$. So, in the direction of the y-axis, there is a relative velocity difference between the observer and object of $(c - v_5)$. It is this difference of velocity which makes the mass of an object have to change in classical physics in order to give the right total values of momentum and energy. To relate classical physics with Physics in 5 dimensions we find that the condition $m \cdot v_5 = m_o \cdot c$ applies. This can be shown to be equivalent to Einstein’s mass relationship of the Special Theory of Relativity. Eliminating $v_5$ from the expression $m \cdot v_5 = m_o \cdot c$, using the relationship $c^2 = v_4^2 + v_5^2$, gives Einstein’s mass relationship $m = m_o \sqrt{(1 - v_4^2/c^2)}$.
Another example that can be shown to match the scalar relationship $c^2 = v_4^2 + v_5^2$ is an object moving along a helical path with velocity $c$. A physically objective view of the object $O$ is given by its orbital velocity $v_4$ on the circumference of the circle formed by projecting the helical path of the object onto the $Z$-$X$ plane. Along the $y$-axis, the observer $P$ has the component of velocity $c$ and object $O$ has the component of velocity $v_5$. So along the $y$-axis, we have again the relative velocity difference between the observer and object of $(c - v_5)$.

We note that when $v_4 \ll c$ then $v_5 \approx c$ and $(c - v_5) \approx 0$. Therefore, under these conditions, the observer in the 4-dimensional space of classical physics will "see" the object moving with velocity $v_4$ but may overlook the very small velocity $(c - v_5)$ in the direction of the $y$-axis.

**Energy**

The prime energy relationship $E = K_5 + V$ applies to all matter (particles and bodies) in *Physics in 5 dimensions* and also appears in many fields of classical physics. $K_5$ is a kinetic energy term and $V$ is a relativistic potential energy term of Physics in 5 Dimensions.

In a Galilean frame of reference rigidly attached to the observer, the *Physics in 5 Dimensions* relativistic kinetic energy $K$ of a body and relativistic potential energy $V$ are defined as $K = m v_4 c$ and $V = m v_5 c$ where mass $m$ is a constant. The total energy $E = m c^2$ of the particle or body does not change for different relative velocities and the expression $E^2 = K^2 + V^2$ applies. This expression is different to the energy expression of Einstein's Special Theory of Relativity which takes the form in classical physics of $E^2 = K^2 + E_o^2$, where the object mass $m$ and the total energy $E = m c^2$ vary with velocity $v_4$ and $E_o = m_o c^2$ is the "rest" energy of the object.

From above: $K_5 = E - V = m c (c - v_5) = m c (c^2 - v_5^2)/(c + v_5) = m v_4^2/(1+v_5/c)$

For non-relativistic velocities, where $v_4 \ll c$ and $v_5 \approx c$, the kinetic energy term $K_5$ returns to the classical physics expression for kinetic energy of $K_5 \approx m v_4^2/2$.

Notably, the energy expression $E = K_5 + V$ of *Physics in 5 dimensions* has the same form and conditions as the energy expression used by Schrödinger in his very successful theory of quantum mechanics used with multi-electron atoms that is accurate enough to explain every important feature.

**Electromagnetic Radiation (emr): Hypothesis:** - The origin of all matter is electromagnetic radiation in the form of many waves of different wavelength producing groups of waves with particle-like-nature of mass $m$ and energy $E = m c^2$, each with their own intrinsic component of angular momentum.

This hypothesis evolved from reviewing the work of de Broglie and his theory of matter waves, where several waves combine to form complex wave patterns with discrete high energy peaks (wave group) forming core particles, e.g. the elementary particles, electrons, nucleons, etc. In *Physics in 5 dimensions*, the matter waves are electromagnetic radiation within closed paths, e.g. in the form of an ellipse or circle, giving the particles (wave groups) their intrinsic values of angular momentum, energy and momentum. The angular momentum and mass of a particle or body uniquely

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4 Because $c^2 = v_4^2 + v_5^2$
defines its energy and permitted motion in 5-dimension space. As a result, the universe is provided with building blocks of a very stable nature (See Stable Matter above).

**Local Space and de Broglie's Matter Waves:** Hypothesis: The de Broglie matter wave expressions produce a relationship of the same form as the coulomb and gravitational attractive forces of classical physics. We associate the velocity of the matter wave $w_4$ with an orbit of radius $R_5$ such that the angular momentum remains constant for both the body represented by the wave group, as well as the matter wave producing the wave group. So in both cases the product of radius and orbital velocity is a constant where $R_4 v_4 = R_5 w_4$.

With the orbit of a body of mass $m$ on radius $R_4$ with orbital velocity $v_4$, we define $h_5$ to be the general term for angular momentum in Physics in 5 dimensions, using the same form of expression that gives Planck’s constant $h$. So the general term for angular momentum of particles and larger bodies alike is given by $h_5 = 2 \pi m R_4 v_4$. The momentum in this general case is given by $p \equiv p_4 = m v_4$. The size of a local space is determined by the extent of the paths of the objects orbiting within the local space.

In his Nobel lecture on the wave nature of the electron in December 1929, de Broglie developed his ideas on wave-particle duality. His work included the expression called the de Broglie relation where $\lambda = h/p$ and predicts the de Broglie wavelength $\lambda$ of a matter wave to be associated with the motion of a material particle having a momentum $p$. de Broglie showed how several sinusoidal matter waves can combine to produce a short wave group that represents the particle or body with the momentum $p$. The matter wave velocity $w_4$ was associated with the wave group velocity $v_4$ such that the product of these two velocities equalled the square of the velocity of light ($w_4 v_4 = c^2$). In general terms $\lambda = h_5/p_4$, so that $\lambda = 2 \pi R_4$, the circumference of the orbit of radius $R_4$.

The above hypothesis proved to be the most objective and useful solution for the development of the theory of Physics in 5 dimensions. We have $h_5 = 2 \pi m R_4 v_4 = 2 \pi m R_5 w_4$ and so in both cases the product of radius and orbital velocity are constant where $R_4 v_4 = R_5 w_4$.

Using $w_4 v_4 = c^2$ to eliminate $w_4$ in the previous expression gives the relationship $R_4 v_4^2 = R_5 c^2$. So we find that the inclusion of the de Broglie matter wave expressions produces a relationship of the same form as the coulomb and gravitational attractive forces of classical physics. When drawing a figure relating the various parameters associated with the orbital velocities and radii, we find that the circle formed by the radius of the matter wave $R_5$ is of similar size and location as the central body $M_4$ associated with the attractive forces of classical physics.

Where classical physics has the Gravitational Constant $G$, the theory of Physics in 5 dimensions includes a local constant of dimensions $P$ which is a constant for any one local space but is variable between different local spaces. We find that $P M_4 = R_4 v_4^2 = R_5 c^2$ for local spaces and where $(P M_4)$ and $(R_5)$ are both constants for the local space. For example, the values of $R_5$ for all the planets and the Sun, based on current

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estimates of orbital radius $R_4$ and orbital velocity $v_4$, are in the range $R_5 = 1475.21 \pm 12.3$ m. The expression $P M_4 = R_4 v_4^2$ also applies to the electrons of an atom, with orbital radius $R_4$ and orbital velocity $v_4$, where $P$ is the local constant of dimensions and $M_4$ is the mass of the nucleus.

**Physical Constants of Nature**: - Many of the Physical Constants of Nature are clearly defined by the theory of Physics in 5 dimensions and have expressions that permit an accurate calculation of the value of the constant. Relationships linking different physical Constants of Nature are developed and also include expressions linking several of the electrostatic constants.

**Key Expressions**: - Key expressions of Physics in 5 dimensions are compared with the expressions of classical physics.

**Objective View of Physics**: - A key benefit of 5-dimensional space is that it retains a significant degree of physical objectivity. This objectivity permits figures to be drawn linking the parameters of the applicable physics with the key equations developed.

**Single Velocity Condition at the end of Stable Matter**: - An unexpected result of Physics in 5 dimensions is that the velocity condition $v_4 = v_5$ represents a special border condition because it is linked in quantum physics with the end of stable atoms appearing in nature (atomic number 92) and in cosmology with the condition of an object at the edge of a black hole with the Schwarzschild radius. Therefore this single condition marks the end of stable matter at the opposite extents of the universe.

**Built-in Redshift in 5-dimensional Space**: - The dynamics of matter in Physics in 5 dimensions implies a relative velocity between any two objects so that the light received from any object has a built-in redshift with respect to any other object or observer. Contrary to the current popular view of the Big Bang as a single starting event for all matter and an expanding universe, Physics in 5 dimensions offers an alternative theory where the built-in red-shift has nothing to do with an expanding universe and where electromagnetic radiation, acting as de Broglie’s matter waves, is the origin of matter. The value of red-shift inherent in 5-dimensional space is of the same order as the red shift measured for distant bodies in astronomy.

**Uncertainty Principle**: - For a particle represented by a wave group (see de Broglie’s matter waves above), where $\Delta x$ is the distance covered by the propagating wave in time $\Delta t$ (duration of the group), then an analysis of the difference of momentum $\Delta p$ and energy $\Delta E$ between 4-dimensional and 5-dimensional spaces surprisingly produces the general uncertainty principle expression: $\Delta E \Delta t = \Delta p \Delta x$. This result suggests that the uncertainty element may be associated with the difference in the values of momentum and energy calculated for 4-dimensional and 5-dimensional spaces, i.e. an uncertainty resulting from working with the wrong theory.

Astronomical/Cosmological Redshift: - In the expression for the Doppler Effect in 5-dimensional space, the change of wavelength is given by \( \Delta \lambda \) and \( \lambda_c \) is the wavelength of the photon emitted at the source (Star or Galaxy). Sometimes \( \lambda_c \) is referred to as the wavelength of interest measured in the laboratory (without Doppler Effect). \( \lambda_4 \) is the corresponding observed photon wavelength (with Doppler Effect). In 5-dimensional space we use the parameter \( z_5 \) to denote the redshift where: \( z_5 = (\lambda_4 - \lambda_c)/\lambda_c = \Delta \lambda/\lambda_c \). This is a relativistic expression in 5-dimensional space.

If we use \( z \) to denote the redshift for small values of velocity (where \( v < 10\% \) of \( c \)) then we show that: \( z_5 \approx z/(z-1) \). This is exactly the same result as the 4-dimensional expression developed using classical astronomical arguments, yet is based on the expression associated with the Mössbauer Effect. So we have a built-in redshift in 5-dimensional space that has nothing to do with an expanding universe.

Quantum Non-Locality and Entanglement: - Not only quantum physics as we know it, but also future, improved theories of nature, will have to be non-local if they are to account for the quantum non-locality and entanglement observations\(^9\). Most physicists now accept that quantum theory (including non-local interaction) is correct, and that local realism has to be abandoned. In *Physics in 5 dimensions* we have the concept of all electromagnetic radiation being equally available for interaction everywhere in 4-dimensional space up to the time of interaction at a single point when the wave collapses. This corresponds to the prediction of quantum non-locality & entanglement.

Mass becomes less detectable as particles approach the speed of light

The current interpretation of *Einstein’s Special Theory of Relativity* forecasts an unreachable infinite mass for objects approaching the speed of light, yet *Physics in 5 dimensions* has a different perspective where mass \( m \) is constant but becomes less detectable to the observer as particles approach the speed of light. An observer is restricted to assessing \( m \) via the potential energy \( V \) of a particle or body where \( V = m v^5 c \) and as \( v^4 \) approaches the speed of light, \( v^5 \) and therefore \( V \) approach zero (See Chapter 15.3 Reduction of mass - a fundamental feature of 5-D space theory in the book *Physics in 5 dimensions*). Also *Physics in 5 dimensions* allows particles to reach the speed of light and, vice versa, for photons to become particles with mass after they have given up energy in collisions with other particles, as described in the Compton Effect.

In this connection, particle accelerators are potential test beds for the theory of *Physics in 5 dimensions*. If initially slow moving target particles can be shown to accelerate to the speed of light (i.e. to become photons) by a single hit from an accelerated particle, then this will confirm the forecast of Physics in 5-dimensions when observing unexplained levels of light in place of the anticipated particles with mass.

Scaling Factors

Using \( R_5h \), the radius of orbit of the matter wave of the electron in a hydrogen atom, and \( \text{amu} \) (atomic mass unit) as prime references of length and mass in *Physics in 5 dimensions*, we define the Scaling Factor \( z \) to express length in units of \( R_5h \) where \( z = R_5 / R_5h \) and the Scaling Factor \( A \) to express mass in units of \( \text{amu} \) where \( A = M_4 / \text{amu} \) - see page 205 of the book *Physics in 5 dimensions*. This use of \( A \) is similar to the classical physics definition of the mass number of the nucleus of an atom, where \( A \) is an integer closest to the atomic weight of the atom containing the nucleus in question.

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In 5-dimensional space $A = \frac{M4}{amu}$ is used as a non-integer mass number for all objects including particles, atoms and bodies such as planets, alike.

Please refer to the index for a comprehensive list of all the topics of physics covered in the book Physics in 5 dimensions - Bye, bye Big Bang.

**The book Physics in 5 Dimensions**

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We wish you many hours of interesting thought with the perspectives of Physics in 5 dimensions.

Welcome to "What it's all about" and "Physics in 5 Dimensions"