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Article

Importance of a Solid, Neutral Object as a Measuring Device for the Unification of Quantum Theory and General Relativity via Polynomials $P(2\pi)$

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Abstract: For each measurement, at least three objects are needed: a solid, neutral object as a measuring instrument and two objects for comparison. This system of three spatial dimensions per object has a common time. All measurements are based on orbits relative to the firmament and coincidences of the spatial coordinates of the objects after rotations with π and provide the energy of the system. These results in the most suitable coordinate system with dimensions of powers of π in which the radius is curved, as are the longitude and latitude. Polynomials $P(2\pi)$ correspond to neutral objects, in addition to $P(\pi)$ for charge, spin, isospin. In addition, it is assumed that the cosmos consists of a single type of particle with a speed of light c. Normalizing to the rest mass of the electron, the neutrinos are $\nu_\tau = \pi$, $\nu_\mu = 1$, and $\nu_e = 1/\pi$. The energy of an electron is: $E_e = g_{freq}(\pi) + 1 - 1/\pi$. An algorithm is derived from a Christoffel symbol and similar to a lattice gauge calculation. It provides exact residual masses for neutrons, protons, muons, tauons, quarks u, d, and pions. The theory can be applied to the inner planetary system and the cosmos and explains the hierarchy problem.

Keywords: neutron mass; proton mass; muon mass; tau mass; inner planetary system; cosmos; hierarchy problem

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1. Introduction

Since Newton, physics has been based on forces and the center of gravity. An alternative is to consider a system of 3 objects, each with 3 spatial coordinates and the time of an observer. This corresponds to Einstein's idea of explaining matter from the metric of space-time. The 10 independent equations of the general theory of relativity (GR) are the parameters of the system [1,2]. Bohr postulated angular momentum through quanta with $L = nh/(2\pi)$ [3]. Since then, wave–particle duality has been a fundamental problem in elementary particle physics. This problem does not exist in astronomy. This leads to the concept of a universe with ur-particles with speed c. Point-like leptons are composed of several ur-particles.

The quantum theory of ur-objects or ur-alternatives proposed by C. F. von Weizsäcker was based on a two-dimensional Hilbert space with the universal symmetry group SU(2) or bits [4,5] and led to quantum information. In the following, a distinction is made between ur-particles, dimensions, objects and energy (Figure 1). The number of ur-particles adds up to s according to the objects i and the different dimensions (t, φ, r, θ) to E. E contains all possible formulas of physics with energies and objects from the set of natural numbers with past to future. The no-go theorem, **all possible symmetries of the S matrix [6], is satisfied**.

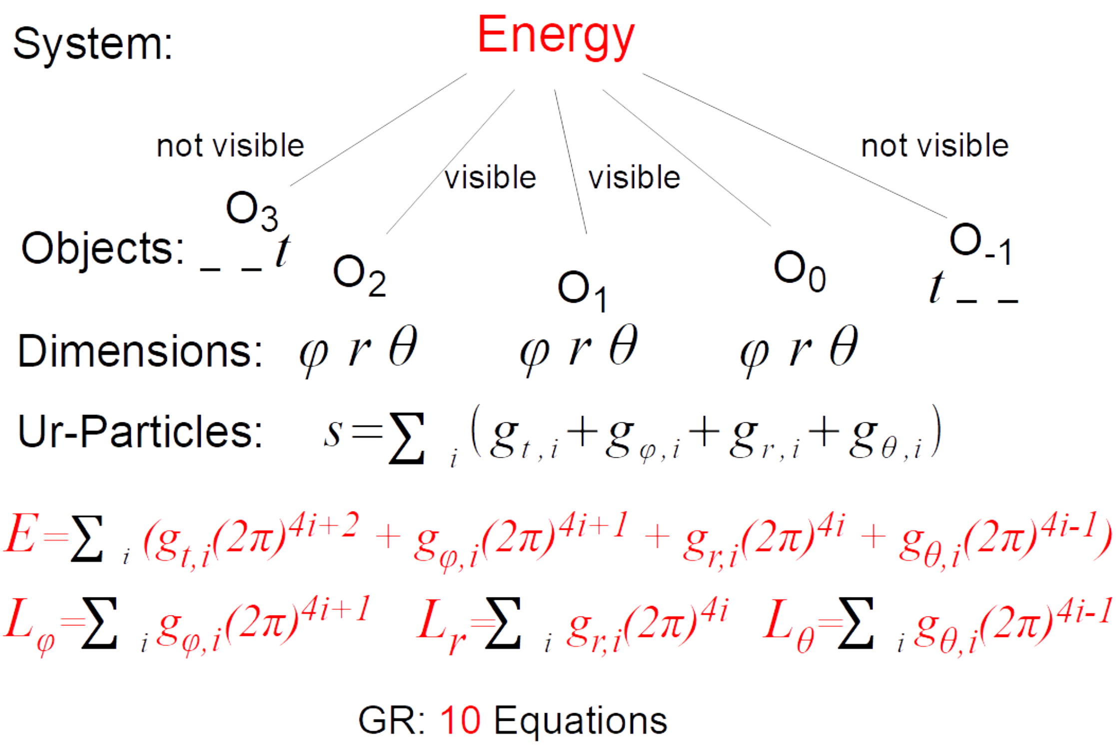

Figure 1. Cosmos of ur-alternatives with energy E/c^2

The task of theoretical physics is to predict the final result of a measuring device in meters and a common point in time from the initial conditions of the meter and day. Forces with the units kg or coulombs are only intermediate steps. c indicates the spatial–temporal relationship. Measurements are always relative to the firmament and result from coincidences of revolutions, i.e. rational numbers of π or epicycles. $\mathbb{Q}$ contains the ur-particles of all visible and invisible objects with a past and a future. Only the past without zero ($\mathbb{Q}^+$) is computable and leads to a positive geometry. The energies are polynomials $P(\pi)$, where each dimension corresponds to a power of π.

The Schrödinger equation can be reformulated without additional normalization to polynomials $P(2\pi)$, which results in an energy E/c^2. With the constancy of the ur-particles g_d for each of the spatial dimensions d, the conservation of the angular momentum L_d (as a dimensionless unit) follows. g_d are the prefactors in the polynomials. The number of ur-particles in the 3 objects i of a system results in ratios $\mathbb{Q}$ between the spatial coordinates of the objects $g_{d,i}$.

A central point is therefore the introduction of the most efficient coordinate system for the metric of the cosmos from polynomials $P(2\pi)$ for neutral objects and $P(\pi)$ for charged objects [7,8].

2. Physics of ur-Particles

2.1. Ur-Alternatives: ur-Particles - Dimensions - Objects - System

A system consists of at least 3 visible or invisible objects O_i, each with 3 spatial coordinates. Standardization is performed on the Earth's surface with a meter and a second (object O_0).

$$O_i \; i \in \{...,0,1,2,...\} \tag{2.1}$$

The number of ur-particles with dimension d $q_{d,i} \in \mathbb{Z}$ refers to the local spatial coordinates and time:

$$q_{t,i} \quad q_{\varphi,i} \quad q_{r,i} \quad q_{\theta,i}$$

The number s of ur-particles starts in the center of the system.

$$s_i = q_{t,i} + q_{\varphi,i} + q_{r,i} + q_{\theta,i} \quad s = \sum_{d,i} q_{d,i} \tag{2.2}$$

At the end of $q_{\varphi,i}$ the object is complete and corresponds to its surface and rest mass.

The distributions of $q_{\varphi,i}$, $q_{r,i}$ and $q_{\theta,i}$ lead to different states (elementary particles, atoms and molecules) with different densities and orbits (planets, lunar resonances and eccentric orbits). For example, in the interior of the sun, due to nuclear fusion, neutrino production is $q_{\varphi,i} \neq q_{r,i} \neq q_{\theta,i}$ (see 2.7. Muon). **For objects at rest or within elementary particles the time $q_{t,i} = 0$ is allowed**.

Coincidences can be measured after revolutions of π. In the following, the coordinate system for $Orbit_i(s)$ is referred to as epicyclic coordinates. The dimensions $t = 2$, $\varphi = 1$, $r = 0$ and $\theta = -1$ are used in the exponent.

The coordinates $q_{k,i}$ in epicycles π constitute the metric.

$$Orbit_i(s) = E_i = q_{t,i}\pi^{t+4i} + q_{\varphi,i}\pi^{\varphi+4i} + q_{r,i}\pi^{r+4i} + q_{\theta,i}\pi^{\theta+4i} \tag{2.3}$$

A differentiation between angular momentum L, energy E and action S is not necessary. The meaning of E is indicated by the indices of the object and the dimensions. The difference between the moving and stationary location coordinates of objects is insignificant for the energy ratios E_i. The radius itself is curved, which allows a simple formulation of general relativity, i.e. $E_{r,i} = q_{r,i}\pi^{r+4i}$ is no different from the circular arcs $E_{\varphi,i}$ and $E_{\theta,i}$. In a system, the spatial coordinates of objects move in a spiral in the direction of time, analogous to geodesic lines.

Neutral objects (Neutron, Photon or Earth) consist of complete revolutions of 2π

$$Orbit_i(s) = E_i = q_{t,i}(2\pi)^{t+3i} + q_{\varphi,i}(2\pi)^{\varphi+3i} + q_{r,i}(2\pi)^{r+3i} + q_{\theta,i}(2\pi)^{\theta+3i} \tag{2.4}$$

A measuring device is a neutral, solid object with a surface as a sensor to vacuum. A vacuum can consist of invisible objects (e.g. photons/gluons) or, for comparison, two immediately adjacent objects O_2 and O_1.

Since the angular momentum is conserved for each of the dimensions, there can be no algebraic function between the dimensions. Thus, π, 1 and π^{-1} are the epicyclic coordinates of the ur-particles and correspond to the neutrinos ν_τ, ν_μ and ν_e respectively. The electron is the first object with 3 spatial coordinates:

$$\begin{aligned}\text{Elektron: } Orbit_e(s) &= E_e = g_{\varphi,e}\pi + 1 - \pi^{-1} + E_0 \\ \text{Positron: } Orbit_p(s) &= E_p = g_{\varphi,e}\pi - 1 - \pi^{-1} + E_0\end{aligned} \tag{2.5}$$

The term $E_\theta = -\pi^{-1}$ is negative and causes attraction in the gravitational field to a neighboring object. In quantum theory, $-1/\pi$ corresponds to spin 1/2 and explains the interaction between objects. According to the theory, an electron consists of 2 ur-particles, or neutrinos, which move orthograde with c, with the combined energy c^2. Orthograde to this is $g_{\varphi,e}$ $g \in \mathbb{Q}$, which is the relative speed in the electric field and leads to the Lorenz gauge. Further decimal places are summarized with E_0 and only result together with another object or the measurement (see 2.4. Muon). A free electron moves in spacetime 4D with time $g_{t,e}(2\pi)^2$.

$$\text{free electron: } Orbit_e(s) = E_e = g_{t,e}(2\pi)^2 + g_{\varphi,e}\pi + 1 - \pi^{-1} + E_0 \tag{2.6}$$

A basic principle of the theory is that the number of ur-particles is countable. The energies are always transcendental powers of π. $(2\pi)^d$ are orthogonal and unique for the dimensions d. If the rest mass of the electron is normalized to 1, the spin is always a rational number of $1/\pi$. $g_f(\pi)$ is a frequency, e.g. for the electron $E_e = g_f(\pi) + 1 - 1/\pi$. All calculations for neutrons, protons or atoms involve at least $(2\pi)^4$. The question of dimensions in space is secondary in this theory. The rest mass of a neutron $P(2\pi)$ can be formulated in 10 dimensions (see 2.5 Neutron) or, in our imagination in 4 dimensions (t, φ, r, θ , Poincare group $\mathbb{R}^{3+1}$) or one dimension in our brain network. The increase of dimensions i by $P(\pi)$ for the binding energy is consistent with the no-go theorem "all possible symmetries of the S matrix" [6].

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2.2. Photon - Speed of Light

2.2.1. Normalization of c with the Earth's Surface and Day - Thought Experiment

The system Sun, Earth with the bound Moon is unique in the planetary system. Imagine a laboratory table at the North Pole. On the laboratory table is an interference experiment (Michelson) set up with a laser and a mirror. A foucault pendulum describes an epicycloid and rotates once a day. The light beam from the laser to the mirror and back is also bent and results in a very narrow area. After one day, a circle with 2π is full. For a single photon this corresponds to spin 1. The light beam is attracted to the earth and can be described mit der syndischen Periode with the formula c m day for the area A. c is the only required parameter as substitute for the number of unknown particles N_{Earth}. The area A $\Delta_{\vec{area}} = \Delta_{\vec{q+}} \times \Delta_{\vec{q-}}$ rotates $\propto h\nu$ with rotation time in 4-dimensional space (see *Quarks u and d* 2.42), where the angular momentum between Earth and photon is conserved. The opposite pole to the photon is the earth with an area D^2_{Earth}. The ratio is $1/(2\pi)$, similar to the lever law.

$$c\ m\ 86400s/D^2_{equatorial} = 1/(2\pi) \tag{2.7}$$

This formula could be exact when the contour line is above zero 489 (e.g. the 1000 km wide Congo Basin is just under 500 m opposite the Pacific).
It allows a simple, new interpretation of forces, which is based solely on the number of ur-particles in 4D space-time. The Foucault pendulum, orthograde to the Earth's axis, rotates with the minimum energy. General relativity explains the difference to the syndic period of the entire system of sun, moon, ecliptic, precession and nutation. The photon can be explained by a superposition of two electrons, or an even number of particles. Even if the epicycloid of a photon $P(2pi)$ intersects the center, the trajectory of its particles $P(\pi)$ from the laser to the mirror is half a wave. It never intersects the center! When c and m are standardized, the light beam is bent in the laboratory and this also applies to an electron around an atomic nucleus. This makes the wave-particle discussion obsolete.

All observation is based on orthograde spatial coordinates, whether x, y, z or φ, r, θ. The marking is usually done with a beam of light and is correct according to the theory of relativity and is done with the quadratic equations $(mc^2)^2 + \vec{p}^2c^2 = E^2$. Spin and Coriolis force have the same cause, namely the rotation of the laboratory table. Spin points in the direction of the gravity of a neighboring object.

For the connection between hG_Nc^5 see *2.11 Gravitational constant – Planck constant, (2.50)*

$$hG_Nc^5s^8/m^{10}\sqrt{\pi^4 - \pi^2 - \pi^{-1} - \pi^{-3}} = 0.999991 \tag{2.50}$$

2.3. Photon - Composed of Neutrinos

A photon are world lines of superimposed and entangled neutrinos (ν_τ, ν_μ ν_e and also corresponds to superimposed electrons e^- and e^+ with a minimum energy $E_\gamma > 0$. A photon can be calculated only as a system of emission (object O_2) and absorption O_1. For the spatial part of $Orbit_{1,2}$, E_γ can be used together with the prefactors $g_2 - g_1 \in \mathbb{Q}$ and $\varphi = 1$, $r = 0$ and $\theta = -1$. For simplification, a prefactor $g_2 - g_1 = g$ is used in the photon.

$$E_\gamma = p\ c = E_\varphi + E_r + E_\theta = g_\varphi(2\pi)^\varphi + g_r(2\pi)^r + g_\theta(2\pi)^\theta \tag{2.8}$$

The term $g_\varphi(2\pi)^\varphi > 0$ determines the frequency. The dimensionless formula is adjusted to $c/f/m$.

$$c/f/m = g_\varphi \quad E_\varphi = g_\varphi(2\pi)^\varphi > 0 \tag{2.9}$$

The radial component $g_r = (g_{r,1} - g_{r,2})(2\pi)^0$ is the length of the wave train and, depending on the polarization ψ, leads to two opposite components $g_{r,1}$ and $g_{r,2}$, which can be summarized as $g_r e^{-i2\pi c/f/m+\psi}$. For a wave, g_r and g_φ are reciprocal. $g_r = 1/g_\varphi$. For a complete wave train, the following applies:

$$n\lambda/m = n/g_\varphi e^{2\pi c/f/m+\psi} \quad n \in \mathbb{N} \tag{2.10}$$

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The energy component $E_r = 0$ of the photon is independent of the length of the wave train $n\lambda$.

The θ component has a negative energy and leads to an attraction in the gravitational field relative to a measuring device, with the smallest possible prefactor for a neutral object $g_\theta = -1$:

$$E_\theta = g_\theta/(2\pi) = -1/(2\pi) \quad spin\ 1 = -1/(2\pi) \tag{2.11}$$

2.3.1. Interpretation of the Compton Effect via Polynomials $P(\pi)$

For the Compton effect between photon, electron, and measuring device (O_0), the common momentum is zero. The increase $\lambda_{C,theory} = 1/\lambda' - 1/\lambda$ does not depend on the original photon energy, but on the absorption of the energy E_0. With the Compton wavelength $\Delta\lambda = \lambda_C = h/(m_e c)(1 - \cos\phi)$ there is a connection between $h/(m_e c)$ in quantum theory and the macro world with $m^2/(c\ day)$. The approach of the polynomials for the Compton effect between the electron, photon and recoil O_0 is as follows:

$$E_e = g_{\varphi,e}\pi + 1 - \pi^{-1}$$
$$E_{photon} = g_{\varphi,2}(2\pi)^1 + g_{r,2} - (2\pi)^{-1}$$
$$E_0 = g_{\varphi,2}(2\pi)^4 + g_{r,2}(2\pi)^3 + (2\pi)^2 - E_{0,-1}$$

For a resting electron, $g_{\varphi,e} = 0$ with $g_{r,e} = 1$. For the dimension r, the absorption is caused by the excitations of the term $g_{r,2}(2\pi)^3$. The minimum energy from this term is π^3 and results in the total energy term of $2\pi^3$.

Estimate for λ_C with the 3 required terms for a photon:

$$\lambda_{C,theory} = m^2/(c\ 86400s)(1 - \cos\phi)(2\pi^3 + 1 - (2\pi)^{-1}) = 2.4265784\ 10^{-12}m$$
$$\text{measurement } \lambda_C = 2.42631023538(76)10^{-12}m \tag{2.12}$$

This value is accurate to 4 decimal places. h cannot be replaced by this. The calculation is again dependent on the Planetary System. (see Chapter 3 Planetary System). Further research is needed for this purpose.

2.3.2. Fine structure constant α

Using the simple concept of the Bohr atomic model, $c\ \alpha$ is the speed of the electron in orbit. In the ground state, $g_{\varphi,e} = 0$. For the binding of the electron, $g_{r,e} = -1$. Approximation for $1/\alpha$:

$$1/\alpha = \pi^4 + \pi^3 + \pi^2 - 1 - \pi^{-1} + E_0 = 136.96$$
$$\text{Measurement } 1/\alpha = 137.035999177(21) \tag{2.13}$$

The calculation is accurate to ‰. It remains to be seen whether a further series expansion will produce a more accurate result or whether it is limited by the gravitational constant.

2.3.3. Neutrino Oscillation

The rotations of the neutrino world lines correspond to the energies.

$$Orbit_{\nu_\tau} = E_{\nu_\tau} = q_t\pi^t + g_\varphi\pi^\varphi = q_t\pi^t + g_\varphi\pi \quad \nu_\tau \tag{2.14}$$
$$Orbit_{\nu_\mu} = E_{\nu_\mu} = q_t\pi^t + g_r\pi^r = q_t\pi^t + g_r \quad \nu_\mu \quad Orbit_{\nu_e} = E_{\nu_e} = q_t\pi^t + g_\theta\pi^\theta = q_t\pi^t + g_\theta/\pi \quad \nu_e$$

Accordingly, in quantum theory, neutrino mass eigenstates ν_j are plane waves [9].

$$\hbar|\nu_j(t)\rangle = |\nu_j(0)\rangle e^{-i(Et - p_j x)/\hbar}$$

Neutrino oscillations are caused by the shift of the phase $Orbit_\nu$ compared with the measuring device with base 2π and, in other words, a consequence of the gravitational field.

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The measurements of the neutrion energies are only possible in a system of emission/decay and absorption in the detector: $\mu \rightarrow e + \nu_\mu + \overline{\nu}_e$. The calculation of the muon mass from $P(2\pi)$ and $P(\pi)$ via the algorithm (see 2.7 Muon) leads to ν_μ with mass pi^0, where normalization is related to the electron mass $(2\pi)^0 = 0.510998\ MeV$. For the spatial dimensions r, the following would be assumed for ν_μ:

$$m_{\nu_\mu} \approx 0.510998/\pi = 0.162 < 0.17 MeV/c^2 \quad \text{Measurement} < 0.17 MeV/c^2 \tag{2.15}$$

An important decay of the Tau into leptons is $\tau \rightarrow e + \nu_\tau + \overline{\nu}_e$. Other decay channels lead to hadrons, such as pions and kaons. The largest term of the tau mass is $2(2\pi)^4 + 2(2\pi)^3 - 3(2\pi)^2 - (2\pi)^1 - 2 + (2\pi)^{-1} - \pi - \pi^{-3} m_e = 3477.34 m_e$ (see 2.8 Tau). The term $(2\pi)^4$ is crucial for neutrino ν_τ. For a single ν_τ with pi^4, the relationship to the electron $(2\pi)^0$ is analogous to ν_μ:

$$m_{\nu_\tau} \approx 0.510998\pi^4/\pi = 15.8 \quad \text{Measurement} < 18.2\ MeV/c^2 \tag{2.16}$$

When muons and Taus decay, an antineutrino $\overline{\nu}_e$ is created. ν_e is the $spin 1/2 = -1/pi$ and causes gravity. The rest mass of ν_e is theoretically negative, but contradicts the principle that the longitudinal velocity $v <= c$.

2.4. Neutral Objects

The surface of every object rotates with a frequency f_i. Only a system of at least 3 objects provides conclusions about frequencies f_i and radii $q_{r,i}$.

$$Orbit_i(s) = E_i = q_{\varphi,i}(2\pi)^{\varphi+4i} + q_{r,i}(2\pi)^{r+4i} + q_{\theta,i}(2\pi)^{\theta+4i} \tag{2.17}$$

$$E_{\varphi,i} = c/m\ t_i = c/m\ /f_i = q_{\varphi,i}(2\pi)^{\varphi+4i}$$

$$1/f_{1,2} = 1/f_1 - 1/f_2 \tag{2.18}$$

$$E_{r,i} = q_{r,i}(2\pi)^{r+4i}$$

The frequency $1/f_{1,2}$ and the phase are unique relative to object O_0. In a measuring device O_0 the common time $q_{t,0} > 0$ is determined and can also be given as a measured value in spatial coordinates. The curved surface of O_0 can be considered a sensor (see Figure 2). For each of the three spatial dimensions there are three focal points of O_1 and O_2 below the curved surface of O_0:

$$r_{f,1,2}, \varphi_{f,1,2}, \theta_{f,1,2} \text{ with energies } E_{f,\varphi}\ E_{f,r}\ E_{f,\theta} \tag{2.19}$$

The energies of the spatial coordinates are summarized as $E_{f,space}$:

$$E_{f,space} = E_{f,\varphi} + E_{f,r} - E_{f,\theta} \tag{2.20}$$

$E_{f,space}$ leads to the common time $E_{f,time}$ and gives the total energy in the measuring device.

$$E_f = E_{f,space} + E_{f,time} \tag{2.21}$$

This gives an algorithm to calculate E_f step by step from high to low energies, with two loops for O_1 and O_2. In detail, the dimensions φ, r, θ for objects O_2 and O_1 are marked with the parameters $\lambda \in$ {4,3,2} and $\nu \in$ {1,0,-1}. According to the law of gravitation $F = (m_1 m_2) r^{-2}$, F decreases with the second power of r. Similarly, $E_{f,space}$ decreases for neutral objects with $(2\pi)^{-\lambda-\nu}$.

$$
\begin{aligned}
&for\ \lambda = \varphi_2\ to\ \theta_2\ step\ -1 \qquad (2.22)\\
&\quad for\ \nu = \varphi_1\ to\ \theta_1\ step\ -1\\
&\qquad if\ g_{2,\lambda} > 0\ then\ E_{f,-\lambda-\nu-1} = -sgn(\nu) g_{2,\lambda} g_{1,\nu} (2\pi)^{-\lambda-\nu}/\pi\\
&\qquad if\ g_{2,\lambda} < 0\ then\ E_{f,-\lambda-\nu} \quad = -sgn(\nu) g_{2,\lambda} g_{1,\nu} (2\pi)^{-\lambda-\nu}\ 2\\
&\qquad E_{f,t} = |g_{2,\lambda} g_{1,\nu}| (2\pi)^{-2\varphi_2}\\
&\quad next\\
&next
\end{aligned}
$$

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The starting values are those of objects 1 and 2 and are calculated for object 0 with the reciprocal of the corresponding dimension, the exponent $-\lambda - \nu$. This geometric mean also contains the factor $1/\pi$ or 2. If this factor was 1, there would be straight lines in the cosmos. For a curved space, the factor $1/\pi$ is minimal.

The equation $E_{f,-\lambda-\nu-1} = -sgn(\nu)g_{2,\lambda}g_{1,\nu}(2\pi)^{-\lambda-\nu}/\pi$ is the core of the algorithm. The structure corresponds to a Christoffel symbol from GR:

$$\Gamma^{\mu}_{\lambda\nu} = g^{\mu\rho}(\partial_{\lambda}g_{\nu\rho} + \partial_{\nu}g_{\lambda\rho} - \partial_{\rho}g_{\lambda\nu}) \tag{2.23}$$

The essential point is to replace the partial derivatives with respect to the dimensions by the quanta $\partial_d = 1/\pi$ and apply this to matter. The equation $E_{f,-\lambda-\nu} = -sgn(\nu)g_{2,\lambda}g_{1,\nu}(2\pi)^{-\lambda-\nu}$ includes negative energies of E_2, i.e. antimatter. This also allows other elementary particles such as muons, Taus and pions to be calculated. If $g_{2,\lambda}(2\pi)^{\lambda} = 0$, a pair of neutrino and antineutrino can be created (see 2.7. Muon). Another interpretation of a system by $P(2\pi)$ is the reflection / inversion of the external worlds of O_2 and O_1 into the internal world O_0 of the observer at the unit circle $e^{i2\pi+\Psi}$ (see 2.9. Quarks u and d).

The algorithm is similar to a lattice gauge calculation and is based on the specifications of two objects that are compared in the measuring device. This comparison is carried out step by step with 2 loops to speak into the depth of the measuring device until the result is processed at the common point in time (see Figures 2 and 3 for neutrons and protons). In lattice gauge theory, this common point in time corresponds to the minimum distance with a cut-off in momentum space, i.e., the point at which no more divergence occurs. In lattice gauge theory, the effect S is also summed via loops (Wilson loops). The normalization for the lattice gauge theory is based on the coupling constants, whereas the algorithm is based on powers of π.

2.5. Neutron

The starting point for calculating the rest mass of the neutron is a comparison of the simplest polynomials $P(2\pi)$ E_2 and E_1 with the parity operator - for an attraction. For a visible object, the energy $E = E_2 - E_1 > 0$. For a resting object, $g_{t,2} = g_{t,1} = 0$.

$$E_2 = (2\pi)^4 + (2\pi)^3 + (2\pi)^2 \qquad E_1 = -((2\pi)^1 + (2\pi)^0 + (2\pi)^{-1}) \tag{2.24}$$

From the energies $E_{2,1}$ it follows that with 2.11 to 2.15 $E_0 = E_{f,space} + E_{f,time}$

$$\begin{aligned} E_{f,space} &= 2(2\pi)^{-2} + 2(2\pi)^{-4} - 2(2\pi)^{-6} \\ E_{f,time} &= 6(2\pi)^{-8} \end{aligned} \tag{2.25}$$

$$m_{Neutron}/m_e = (2\pi)^4 + (2\pi)^3 + (2\pi)^2 - (2\pi)^1 - (2\pi)^0 - (2\pi)^{-1} + 2(2\pi)^{-2} + 2(2\pi)^{-4} - 2(2\pi)^{-6} + 6(2\pi)^{-8} = 1838.6836611 \tag{2.26}$$

Theory: 1838.6836611 m_e Measurement: 1838.68366173(89) m_e [10]

The decimal places of $m_{neutron}/m_e$ extend to $(2\pi)^{-8} = 4\,10^{-7}$ and are within a standard deviation of 1838.68366173(89).

The calculation requires only 10 terms and is therefore the most efficient method for determing $m_{neutron}/m_e$. This result is unique because of to the transcendental numbers π^d.

In Figure 2, φ, r and θ are arranged in a half wave. The algorithm is a Fourier transformation from the outer wave (6 terms) into the quantum information of the inner world (6 prefactors).

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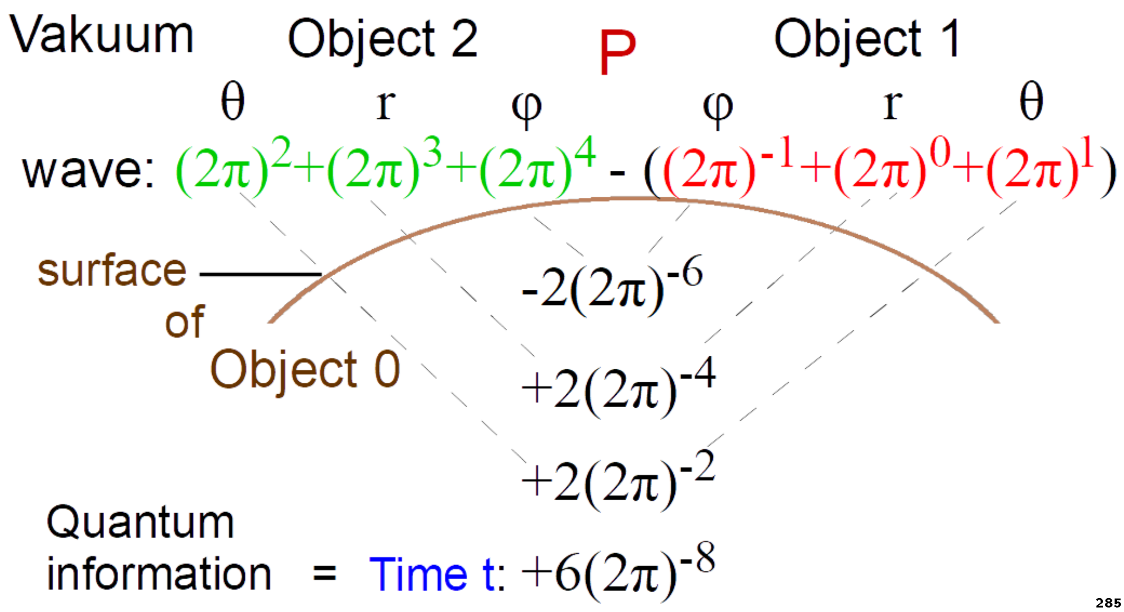

Figure 2. $m_{Neutron}/m_e$ as a polynomial $P(2\pi)$

2.6. Proton

The electric charge should correspond to three neutrions, with a mass difference between neutrons and protons. The approach for the energy of the charge E_{C+} is itself a system of 3 objects $(E_{C,2}, E_{C,1}, E_{C,0})$. π^{φ} and π^{θ} rotate around the center $\pi^r = 1$, with the minimum energy $E_{C,2,1}$ similar to the Coriolis force:

$$E_{C,2,1} = -\pi^1 + 2\pi^{-1} < 0 \qquad (2.26).$$

The decimal places $E_{C,0} = E_{C,0,space} + E_{C,0,time}$ result from a series expansion of π^d. The decimal places of the neutron $E_f = 2(2\pi)^{-2} + 2(2\pi)^{-4} - 2(2\pi)^{-6} + 6(2\pi)^{-8}$ contain only even powers. $E_{C,0}$ fills the odd powers. A further explanation for this is speculative. It is assumed that after 4 spatial dimensions the type of neutrinos remains the same with $\nu_{\varphi}{}^{-4}$ and $\nu_{\theta}{}^{-4}$:

$$E_{C,0,space} = -\pi^{-3} + 2\pi^{-5} \qquad (2.27)$$

Similarly, in $E_{C,0,time}$ the phase of the third neutrino π^{θ} changes to $\nu_{\mu}{}^{-12}$ in the gravitational field with a neutrino oscillation.

$$E_{C,0,time} = -\pi^{-7} + \pi^{-9} - \pi^{-12} \qquad (2.28)$$

Together with the neutron mass, this gives the proton mass:

$$E_{C+} = -\pi^1 + 2\pi^{-1} - \pi^{-3} + 2\pi^{-5} - \pi^{-7} + \pi^{-9} - \pi^{-12}$$
$$m_{Proton} = m_{Neutron} + E_c m_e = 1836.15267363 \ m_e \qquad (2.29)$$

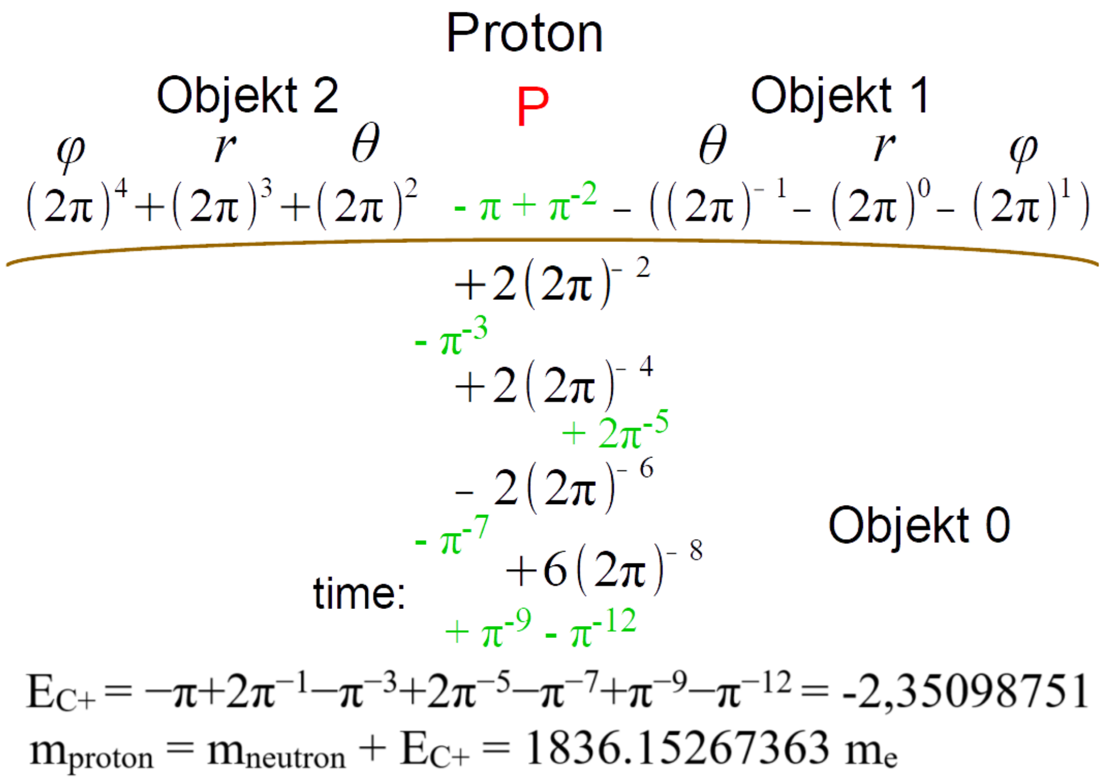

Figure 3. m_{Proton}/m_e as a polynomial $P(2\pi)$

$$m_{Proton}/m_e = (2\pi)^4 + (2\pi)^3 + (2\pi)^2 - (2\pi)^1 - (2\pi)^0 - (2\pi)^{-1} + 2(2\pi)^{-2} + 2(2\pi)^{-4} - 2(2\pi)^{-6} + 6(2\pi)^{-8} + (-\pi + 2\pi^{-1} - \pi^{-3} + 2\pi^{-5} - \pi^{-7} + \pi^{-9} - \pi^{-12}) = 1836.15267363 \quad (2.30)$$

Theory: 1836.15267363 m_e **Measurement: 1836.15267343(11)** m_e [10]

2.7. Muon

First estimate for the rest mass:

$$E_{\mu,1,2} = (2\pi)^3 - (2\pi)^2 - \pi + (2\pi)^0 + 1/\pi = 206.748 \quad (2.31)$$

measurement: $206.7682830(46)\ m_e$

This follows from a minimum energy with a frequency $(2\pi)^3 > 0$ and a radial component $(2\pi)^r = 1 > 0$. It is assumed that the negative and positive charges are related:

$$\begin{aligned} E_{C-} &= (2\pi)^1 - \pi^{-1} + E_{C+} \\ E_{C+} &= -\pi^1 + 2\pi^{-1} - \pi^{-3} + 2\pi^{-5} - \pi^{-7} + \pi^{-9} - \pi^{-12} \\ E_{C-} &= \pi^1 + \pi^{-1} - \pi^{-3} + 2\pi^{-5} - \pi^{-7} + \pi^{-9} - \pi^{-12} \end{aligned} \quad (2.32)$$

The neutral part can be separated from E_{C-}:

$$E_{\mu,1,2} - E_{C-} = (2\pi)^3 - (2\pi)^2 - (2\pi)^1 + (2\pi)^0 \quad (2.33)$$

The calculation of the energy $E_{0,f}$ in O_0 is carried out step by step according to algorithm (2.22). Depending on the signs in E_2 and E_1, multiplication is carried out by $1/\pi$ for matter or by 2 for antimatter:

$$\begin{aligned} &E_{1,2} = (2\pi)^3 - (2\pi)^2 - (2\pi)^1 + (2\pi)^0 \quad (2.34) \\ &\quad \text{Matter } +E_\theta >> (2\pi)^3(-(2\pi)^1) >> E_{0,f,1} = -(2\pi)^{-4}/\pi = -2(2\pi)^{-5} \\ &\quad E_{0,f,t} = |2(2\pi)^{-8}| \end{aligned}$$

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$$E_{1,2,-1} = -(2\pi)^2 + (2\pi)^0 \tag{2.35}$$
$$\text{Antimatter } -E_r >> (-(2\pi)^2)(2\pi)^0 >> E_{0,f,2} = 2(2\pi)^{-2}$$
$$E_{0,f,t}+ = |2(2\pi)^{-8}| \qquad E_{0,f,t} = 4(2\pi)^{-8}$$

To fully calculate E_0, the placeholder $0(2\pi)^4$ must be included. According to the Heisenberg uncertainty principle, the decay of muon $\mu \rightarrow e + \nu_\mu + \overline{\nu}_e$ is possible with an energy of $0(2\pi)^4 = (2\pi)^4 - (2\pi)^4$:

Production from $\nu_\mu = \pi^0$

$$-(2\pi)^4 >> E_{nu,f,3} = -(2\pi)^{-4} + \pi^0 \tag{2.36}$$

Production of $\overline{\nu}_e = -\pi^{-1}$

$$+(2\pi)^4 >> E_{nu,f,3} = -(2\pi)^{-3} - \pi^{-1} \tag{2.37}$$

In summary, the rest mass of the muon is:

$$m_\mu/m_e = (2\pi)^3 - (2\pi)^2 - (2\pi)^1 + (2\pi)^0 + \\ +2(2\pi)^{-2} - (2\pi)^{-3} - (2\pi)^{-4} - 2(2\pi)^{-5} + 4(2\pi)^{-8} + E_{C-} = 206.7682833 \tag{2.38}$$

Theory: 206.7682833 m_e **Measurement: 206.7682830(46)** m_e [10]

The decay results from the division of the energies m_μ/m_e into 3 new objects with kinetic energy E_φ.

$$E_\varphi = (2\pi)^3 - (2\pi)^2 = E_{\varphi,\nu_\mu} + E_{\varphi,\overline{\nu}_e} + E_{\varphi,e} \tag{2.39}$$

Figure 4 corresponds to a Feynman diagram. The probabilities for the energies and momenta are given by the QT.

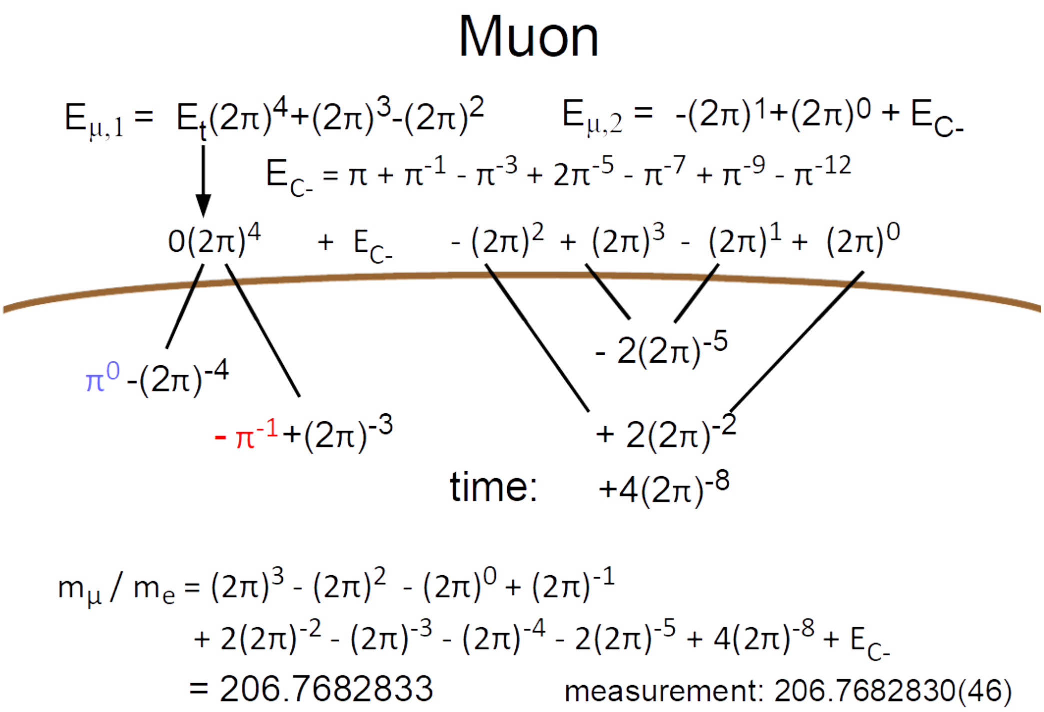

Figure 4. m_{muon}/m_e as a polynomial $P(2\pi)$ with the decays in ν_μ and $\overline{\nu}_e$

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2.8. Tau

The first particle with a factor of $(2\pi)^4$ is the proton. Tau has a factor of $2(2\pi)^4$ and can be explained by the superposition of 3 elementary particles:

$$E_{\tau,3} = 2(2\pi)^4 + 2(2\pi)^3 - 2(2\pi)^2 \qquad E_{\tau,2} = -(2\pi)^2 - (2\pi)^1 - 1$$
$$E_{\tau,1} = -2\pi - 1 - (2\pi)^{-1} \tag{2.40}$$

The requirements are $E_\varphi = 2(2\pi)^4 > 0$ and $E_r = 2(2\pi)^3 > 0$.
$E_\theta = -3(2\pi)^2 - 2(2\pi)^1 - 2 - (2\pi)^{-1}$ with negative energy explaining gravity.
Together with $E_{C-} = \pi^1 + \pi^{-1} - \pi^{-3} + ...$ the first estimate is:

$$m_\tau = 2(2\pi)^4 + 2(2\pi)^3 - 3(2\pi)^2 - 2(2\pi)^1 - 2 - (2\pi)^{-1} + (\pi^1 + \pi^{-1} - \pi^{-3} + ...)m_e =$$
$$= 2(2\pi)^4 + 2(2\pi)^3 - 3(2\pi)^2 - (2\pi)^1 - 2 + (2\pi)^{-1} - \pi - \pi^{-3} m_e = 3477.34 m_e$$

Theory: 3477.34 m_e **measurement: 3477.23(23) m_e** [10] (2.41)

2.9. Quarks u and d

Table 1 lists the quarks [11] with rest masses from the mean $\overline{m_q}$ and standard deviation in MeV [10]. The first estimate of E_q in m_e is the highest power d $(2\pi)^d$ with E_q/m_e (Table 1). The standard deviations in powers of π are estimated as $\overline{m_q}/(\Delta_{q-} + \Delta_{q+})$:

Table 1. quarks with rest masses from the mean m_q and standard deviation in MeV.

Quark	$\overline{m_q}$ in MeV	Δ_{q-}	Δ_{q+}	estimate E_q in m_e	E_q/m_e	$\overline{m_q}/(\Delta_{q-} + \Delta_{q+})$
u	2.16	-0.26	0.49	$2/3(2\pi)$	1.0091	$1/4\pi^2 = 1.167$
d	4.67	-0.17	0.48	$3/2(2\pi)$	0.9696	$1/4\pi^3 = 0.926$
s	93.4	-3.4	8.6	$2/3(2\pi)^3$	1.1052	$1/4\pi^3 = 1.004$
c	1270	-20	20	$3/2(2\pi)^4$	1.0630	$\pi^3 = 1.023$
b	4180	-20	30	$3/4(2\pi)^5$	1.1137	$2^3/3\pi^3 = 1.011$
t	172760	-300	300	$3/4(2\pi)^7$	0.9947	$2^4\pi^3 = 1.160$
Higgs	125110	-110	110	$4(2\pi)^6$ boson	1.1660	$2^3\pi^3 = 1.146$
Atom				$> 2(2\pi)^4$		

The charges of quarks u, s and b are -1/3, and those of quarks d, c and t are +2/3 and can be measured only relative to the environment. Only the energies of the quarks whose measurement ranges are within one standard deviation are relevant.

In first order, the energy difference between neutrons (udd) and protons (uud) results from the three ur-particles $\pi - 2/\pi$. By swapping $\pi, 1/\pi, 2/\pi$ between O_2, O_1 and O_0, the third charges $\pm 1/3$ and $\pm 2/3$ of the quarks result. Quarks u and d have frequencies $f_u = 2/3(2\pi)$ and $f_d = 3/2(2\pi)$.

Assuming that the prefactors $g_r \in$ -1, -1/2, 0, 1/2, 1 and $g_\theta \in -1, 0, 1$, the energies are $E_q = f_q + g_r + g_\theta/\pi$. For various combinations of g_r and g_θ, the mean $\overline{E_q}$ and standard deviation of Δ_{d-} and Δ_{d+} follow (Table 2):

Table 2. Quarks and d. Comparison between theory $g_f + g_r + g_\theta$ and the measurement.

u	f_u	$+ g_r$	$+ g_\theta$	=	Theory $1/m_e$	Measurement
$\overline{E_u}$	$2/3(2\pi)$	+ 0	$+0/\pi$	4.19	2.14	2.16 MeV
$\overline{E_u} + \Delta_{u+}$	$2/3(2\pi)$	+ 1	$+0/\pi$	5.19	2.66	2.65 MeV
$\overline{E_u} + \Delta_{u-}$	$2/3(2\pi)$	- 1/2	$+0/\pi$	3.69	1.89	1.90 MeV
d	f_u	$+ g_r$	$+ g_\theta$	=	Theory $1/m_e$	Measurement
$\overline{E_d}$	$3/2(2\pi)$	+ 0	$-1/\pi$	9.106	4.65	4.67 MeV
$\overline{E_d} + \Delta_{d+}$	$3/2(2\pi)$	+ 1	$-1/\pi$	10.11	5.16	5.15 MeV
$\overline{E_d} + \Delta_{d-}$	$3/2(2\pi)$	- 1	$+1/\pi$	8.74	4.47	4.50 MeV

The energy results from the 3-dimensional components of the particles on the orbit. From the maximum range of energies $\Delta_+ - \Delta_-$, a common constant Δ_{area} can be derived, which corresponds to

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an area. The area $\vec{\Delta_{area}} = \vec{\Delta_{q+}} \times \vec{\Delta_{q-}}$ around the center $\overline{E_d}$ results in the area $\vec{\Delta_{area}} = \vec{\Delta_{q+}} \times \vec{\Delta_{q-}}$ and rotates $\propto h\nu$ with the rotation time in 4-dimensional space, i.e. taking gravity into account.

$$\Delta_{q+} + i\Delta_{q-} = e^{-i2\pi ct+g_r} + 1/\pi e^{-i2\pi ct+g_\theta} \tag{2.42}$$

The ranges of E_u and E_d with limits g_r and g_θ depend not only on O_2 and O_1 in the interior, but also on the environment and thus on the measurements. The limits change with the distance a of the quarks with the required time $c\ t = 2a$. The closer the quarks are, the more common angular momentum is determined by the prefactors g_r and g_θ with quanta and the minimum energy. The inversion at the unit circle $e^{-i2\pi ct+g_r}$ and $1/\pi e^{-i2\pi ct+g_\theta}$ reflects the objects O_2 and O_1 in the measuring device O_0. The number of ur-particles remains constant. The theory requires c as the only parameter and is standardized with units of meters (m). The circumference $c\ m\ t/\Delta_{area} = 1/(2\pi)$ is the smallest possible string for a complete rotation from the multitude of strings according to string theory.
The charge, iso, spin, mean and standard deviation result from the symmetry in the unit circle with multiples z of 30° with $z \in \mathbb{Z}$

Prefactor	charge in π	g_r	g_θ in $1/\pi$ for the spin
$z/3 = sin(60°\ z) = e^{i\pi z/3}$	1/3 z		
$z/2 = sin(90°\ z) = e^{i\pi z/2}$		1/2 z	
$z = cos(180°\ z) = e^{i\pi z}$			z

Quarks u:

$$E_u = 2/3(2\pi) + e^{-i2\pi ct+g_{u,r}} + 1/\pi e^{-i2\pi ct+g_{u,\theta}}$$
$$\overline{E_u} = 2/3(2\pi) + e^{-i2\pi ct-g_{u,r}} + 1/\pi e^{-i2\pi ct-g_{u,\theta}} \tag{2.43}$$

Quarks d:

$$E_d = 3/2(2\pi) + e^{-i2\pi ct+g_{d,r}} + 1/\pi e^{-i2\pi ct+g_{d,\theta}}$$
$$\overline{E_d} = 3/2(2\pi) + e^{-i2\pi ct-g_{d,r}} + 1/\pi e^{-i2\pi ct-g_{d,\theta}} \tag{2.44}$$

2.10. Pion

The approach for the rest mass of the pions requires bosons/gluons in O_2 with $(2\pi)^3$ for the frequency $f > 0$ and $(2\pi)^2$ for the majority of the rest mass $m > 0$:

$$E_2 = (2\pi)^3 + (2\pi)^2$$

Pions: $\pi^+\ \ u\overline{d}$ **and** $\pi^-\ \ \overline{u}d$**:**
E_1 results from the addition of the energies of the quarks:

$$E_1 = -2/3(2\pi)^1 + g_{u,r} + g_{u,\theta}/\pi - 3/2(2\pi)^1 + g_{\overline{d},r} + g_{\overline{d},\theta}/\pi =$$
$$-(2/3+3/2)(2\pi)^1 + g_{u,r} - g_{d,r} + g_{u,\theta}/\pi - g_{d,\theta}/\pi =$$

Minimum of the energy of g_r and g_θ (see table for u and d):

$$g_{u,r} - g_{d,r} = -1/2 \quad g_{u,\theta}/\pi - g_{d,\theta}/\pi = -1/\pi$$

$$E_1 = -(2/3+3/2)(2\pi)^1 - 1/2 - 1/\pi$$
$$E_2 + E_1 = (2\pi)^3 + (2\pi)^2 - (2/3+3/2)(2\pi)^1 - 1/2 - 1/\pi =$$
$$= (2\pi)^3 + (2\pi)^2 - 2(2\pi)^1 - 1/2 - 1/3\pi - 1/\pi \tag{2.45}$$

First estimate from $E_2 + E_1$:
273.096 m_e = 139.552 MeV Measurement: 139.57039(18)

For a more precise calculation of the decimal places, the powers $P(2\pi)$ are separated from $P(\pi)$:

$$E_{2,1,2\pi} = (2\pi)^3 + (2\pi)^2 - 2(2\pi)^1 - 1/2$$

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$E_{1,2,\pi} = \pi/3 - \pi^{-1} - ...$

With algorithm (2.15) and the symmetry point $r = 1/2$, it follows that:

$E_{0,2\pi} = (2\pi)^{-2} - 1/2(2\pi)^{-3} - 1/2(2\pi)^{-4}$

It can be assumed that the term $\pi/3$ is crucial for the symmetry of the charges. The entire term for charged pions is currently speculative:
$E_\pi = \pi/3 - \pi^{-1} - \pi^{-2} - \pi^{-3}$

$$E_{2,1,2\pi} + E_{0,2\pi} + E_{0,2\pi} = (2\pi)^3 + (2\pi)^2 - 2(2\pi)^1 - 1/2 + (2\pi)^{-1} \\ +2(2\pi)^{-2} - 1/2(2\pi)^{-3} - 1/2(2\pi)^{-4} + \pi/3 - \pi^{-1} - \pi^{-2} - \pi^{-3} \quad (2.46)$$

$E_{\pi^\pm}$ **= 139.5705 MeV measurement: 139.57039(18)** [10]

Pion π^0 $1/\sqrt{2}(u\bar{u} - d\bar{d})$:
$E_1 = -2^2(2\pi)^1 + g_{u,r} + g_{\bar{u},r} + g_{d,\theta}/\pi + g_{\bar{u},\theta}/\pi =$
Extremum of the energy of g_r and g_θ (see table for u and d):
$g_{u,r} + g_{u,\theta}/\pi = 1 + 0/\pi$
$g_{d,r} + g_{d,\theta}/\pi = 1 - 1/\pi$
$E_1 = -4(2\pi)^1 + 2 - \pi^{-1}$
$$E_2 + E_1 = (2\pi)^3 + (2\pi)^2 - 4(2\pi)^1 + 2 - \pi^{-1} \quad (2.47)$$

First estimate from $E_2 + E_1$: 134.94336 MeV Measurement: 134.9768(5)

The decay of the neutral pion occurs with stronger and faster electromagnetic interaction:
$\pi^0 \rightarrow 2\gamma$ (probability of 98.823(32)%) or
$\pi^0 \rightarrow e^+ + e^- + \gamma$ (probability of 1.174(35)%).

$-\pi^{-1}$ is the only term in $E_2 + E_1$ that holds the pion π^0 together before decay. It is the spin for the 2 entangled photons after decay. E_0 is thus a neutral polynomial $P(2\pi)$. According to the symmetry at r = 2, $E_{2,1} = (2\pi)^3 + (2\pi)^2 - 4(2\pi)^1 + 2$ follows with an extension of the algorithm (2.15):

$$E_0 = 2(2\pi)^{-2} + (4-1)(2\pi)^{-3} + 2(2\pi)^{-4} \\ E_2 + E_1 + E_0 = (2\pi)^3 + (2\pi)^2 - 4(2\pi)^1 + 2 - \pi^{-1} + \\ +2(2\pi)^{-2} + (4-1)(2\pi)^{-3} + 2(2\pi)^{-4} \quad (2.48)$$

E_{π^0} **= 134.9761 MeV Measurement : 134.9768(5)** [10]

Further research into the algorithm and calculations for quarks s, c, b and t and the Higgs-boson are needed.

2.11. Gravitational constant – Planck constant

The unit kg is not needed in this theory and $G_N h$ becomes a common constant. The Planck time $t_p = \sqrt{G_N \hbar / c^5}$ describes the smallest possible time interval according to quantum theory. The observation of the cosmos is the reference for the normalization of m, day and c and is based on atoms with powers of π^4. At the zenith the energy $g_{2,r} = 0$. The minimum rotation is $g_{2,\varphi} = 1$ and $g_{2,\theta} = -1$.

$$E_{G,2} = \pi^4 + 0\pi^3 - \pi^2$$

Using algorithm (2.22) we obtain $E_{G,0}$ and E_G:

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$$E_{G,0} = -\pi^{-1} - \pi^{-3} \quad E_G = \pi^4 - \pi^2 - \pi^{-1} - \pi^{-3} \tag{2.49}$$

E_G corresponds to a surface in the firmament. For the comparison with $G_N\hbar/c^5$, the root of E_G is as follows:

$$hG_Nc^5s^8/m^{10}\sqrt{\pi^4 - \pi^2 - \pi^{-1} - \pi^{-3}} = 0.999991 \tag{2.50}$$

The units meter and second must appear in this formula. The value of G_N is only known up to the fifth decimal place [10]. In this respect, the result can be assumed to be 1. h and c are already precisely defined. The only parameter that still has to be determined by measurement is G_N. The only force that holds the world together is the natural number of ur-particles with c.

3. Planetary System

3.1. Sun – Earth – Moon

The system of the Sun, Earth and Moon is unique in the planetary system. The bound moon has, relative to the Earth, largely the minimum energy in angular velocities ($\dot{\varphi}$, $\dot{\theta}$). The radial component of a photon is on average = 0: $E_{photon,r} = ng_re^{2\pi c/f/m+\psi} = 0$ (see 2.10). Seen from the Earth, the angle of view is on average the same and gives an extremum for the energy. In this sense, the system is in a ground state. Sun, Earth $R_{Earth} = 6356.75\ km$, and the bound Moon has a stable ratio of radii and orbits. For the three spatial dimensions, $2^3 = 8$ is the ratio between the rotations/orbital periods of the celestial bodies.

$$R_{Moon}/(R_{Earth} + R_{Moon}) = 8/(2\pi) = 4/\pi \quad R_{Earth}(4/\pi - 1) = 1736.9\ km \tag{3.2}$$

In terms of to the polar diameter, the deviation is only 0.00011.
The distance between the moon and the Earth $D_{Moon-Earth}$ increases by 38.2 mm per year:

$$d/dtD_{Moon-Earth} = 38.2\ mm/384400\ km/year = 3.1510^{-18}/s \tag{3.3}$$

$$\text{H0 [12]:} \quad H0 = (67.8 \pm 0.9)kms^{-1}Mpc^{-1} = 2.21810^{18}/s$$
$$d/dtD_{Moon-Earth}(1 - 1/pi) = 2.14710^{-18}/s \approx H0 \tag{3.4}$$

It is assumed that the distances between celestial bodies are also a consequence of the expansion H0 of the universe.

3.2. Orbits in the inner planetary system

The advantage of the solar system is that apoapsis and periapsis are directly observable, whereas in the atom some energy levels are degenerate. The observation of a celestial body is based on powers of $(2\pi)^4$. Between the celestial bodies, $G_Nc^5s^8/m^{10}\sqrt{\pi^4 - \pi^2 - \pi^{-1} - \pi^{-3}} = 0.999991$ applies. c^5 describes the invisible dimensions between the orbits. As with ladder operators, orbits can be constructed iteratively. It can therefore be assumed that the polynomials of the orbits begin with $(2\pi)^5$. Normalizing to $R_{sun} = 696342\ km$ gives the orbits and energies:

$$r^2_{apoapsis} + r^2_{periasis} = R^2_{sun}E_n$$
$$r_{apo/periasis} = R_{sun}\sqrt{g_\varphi(2\pi)^5 + g_r(2\pi)^4 + g_\theta(2\pi)^3} \tag{3.5}$$

The first three terms for φ, r and θ represent apoasis and periasis respectively with an accuracy of approximately 1‰ (Table 3):

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Table 3: Apoapsis and periapsis of Mercury and Venus (3.6)

Mercury

The minimum energy with the half-integer quantum number for the frequency gives the apoapsis

$$r_{apoapsis} = 696342km\sqrt{1/2(2\pi)^5 - 1/2(2\pi)^4 + (2\pi)^3} = 46006512km$$
$$Measurement: \ 46.002\ 10^6 km \ \ rel.Deviation = 0.0001$$

$$r_{periapsis} = 696342km\sqrt{(2\pi)^5 - 0(2\pi)^4 + (2\pi)^3} = 69775692km$$
$$Measurement: \ 69.81\ 10^6 km \ \ rel.Deviation = 0.0005$$

Venus

$$r_{apoapsis} = 696342km\sqrt{2(2\pi)^5 + 3(2\pi)^4 - (2\pi)^3} = 107905705km$$
$$Measurement: \ 107.4128\ 10^6 km \ \ rel.Deviation = 0.004$$

$$r_{periapsis} = 696342km\sqrt{2(2\pi)^5 + 3(2\pi)^4 + (2\pi)^3} = 109014662km$$
$$Measurement: \ 108.9088\ 10^6 km \ \ rel.Deviation = 0.001$$

$$r_{Venus}/r_{Mercury} = 6123.80/2448.57 = 2.50094 \quad (3.7)$$

The ratios of the radii of Mercury and Venus can be viewed as quantum numbers. These calculations constitutes only the first approach to transferring $P(2\pi)$ to the planetary system. An improvement in calculations for the Titus Bode series [12], resonances in the asteroid belt and lunar orbits [13], and exoplanets [14] would be possible.

3.3. H0 and Cosmic Microwave Background Radiation (CMBR)

The number of ur-particles $\mathbb{Q}$ determines the future expansion of the universe with $\mathbb{Q}^+$ and positive geometry. With the number of ur-particles $\mathbb{Q}$, for the past and future, the expansion of the universe is given with $\mathbb{Q}^+$ and a positive geometry. In 5-dimensional space with c^5, the number of ur-particles is constant on average.

In the equation of the gravitational constant (2.50), the term of mass $(hG_N s^3/m^5)$ can be separated from the photons $(c^5 s^5/m^5)$.

$$hG_N s^3/m^5 \ c^5 s^5/m^5 \ \sqrt{\pi^4 - \pi^2 - \pi^{-1} - \pi^{-3}} = 1 \tag{3.8}$$

The number of ur-particles in masses $N = 1/(hG_N)s^3/m^5$ can be equated with the photons $c^5 s^5/m^5$ and the curvature over time ρ/dt.

$$\rho/dt = \sqrt{\pi^4 - \pi^2 - \pi^{-1} - \pi^{-3}}/s = 9.337501/s.$$
$$N = 1/(hG_N)m^5/s^3/s = 2.2611962\ 10^{43}/s = c^5 s^5/m^5\ \rho/dt \tag{3.9}$$

For the expansion H0, the observation at the boundaries of the universe is two-dimensional, with photons $c^2 m^2/s^2$ and a curvature ρ/s. The factor $\sqrt{\pi}$ is given by the ratio to the radius $1/Mpc$.

$$H0_{Theory} = \sqrt{\pi}/c^2 m^2/s^2/\rho/s = 2.11\ 10^{-18}/s = 65.1\ km/s/Mpc \tag{3.10}$$
Measurement: $H0 = 67.8 \pm 0.9\ km/s/Mpc$ [12]

One possible interpretation is that over time, visible and invisible particles are added to each object. For isotropic photons in the background radiation and a space curvature of $1/\rho^3 m$, the wavelength is λ.

$$\lambda_{theory} = \sqrt{\pi}/2/\rho^3 m = 1.0885\ mm \tag{3.11}$$
Measurement: $\lambda = 1.063\ mm$ (peak value of the spectral radiance $dE\lambda/d\lambda$)

The factor $1/2$ results from the visible photons with energy $E_\gamma > 0$. The theory could thus explain a significant part of the CMBR monopole term [15].

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4. Summary and Conclusions

Ur-particles, dimensions (t, φ, r, θ), objects and systems are the necessary categories for the calculation of energies. It is crucial to introduce the most efficient coordinate system to describe the cosmos, using the polynomials $P(2\pi)$ for neutral objects and $P(\pi)$ for charged objects. The basics of general relativity are already contained in $P(2\pi)$, with a constancy of c and the assumption that the radius r of an object is curved in the same way as longitude and latitude. An algorithm is derived from a Christoffel symbol. The partial differential equations of general relativity are replaced by a differential quotient $1/\pi$, resulting in quanta. Calculating the $m_{neutron}/m_{electron}$ ratio with the required accuracy of 10 digits is the key to the ratio of the rest masses of all the elementary particles.

A basic principle of the theory is that the number of primary particles is countable; thus the wave–particle problem is obsolete. The energies are transcendental powers of π. $(2\pi)^d$ are orthogonal and unique for the dimensions d. If the rest mass of the electron is normalized to 1, the spin is always a rational number of $1/\pi$. $g\ \pi$ is a frequency. Every calculation for the neutron or proton begins with $(2\pi)^4$. The question of dimensions in space is secondary in this theory. The rest mass of a neutron $P(2\pi)^4$ can be formulated in 10 dimensions, or as we imagine, in 3 dimensions.

QT describes elementary particle physics with probabilities. This aspect is also adopted for the calculation of quarks, u, d and pions with the inversion on the unit circle. This means that the most efficient theory should be a combination of $P(2\pi)$ and QT. Neutrinos are ur- particles. The electron, positron and photon are the simplest, assembled elementary particles. From this, the rest masses of protons, neutrons, muons, taus, pions, and quarks u and d can be calculated exactly with the shortest possible polynomials.

$P(2\pi)$ contains more information than the time-symmetric, squared equations from QT and GR with constants. The calculations surpass the results of various variants of axiomatic quantum field theory [16-26] in terms of accuracy and brevity. Preons (subquarks) were discussed as hypothetical, point-like particles as an extension of quarks, but did not lead to a provable theory [27]. New approaches to emergence [28-35] through chance, selection and self-organization are emerging.

The system of the sun, earth and moon is unique to the planetary system. According to the polynomials $P(2\pi)$, the equatorial diameter of the Earth (489 m above sea level) is as follows:

$$c\ m\ day/{D_{Earth}}^2 = 1/(2\pi) \tag{3.1}$$

Here, hG_Nc^5 is a common constant:

$$hG_Nc^5s^8/m^{10}\sqrt{\pi^4 - \pi^2 - \pi^{-1} - \pi^{-3}} = 0.999991 \qquad (2.45$$

Apoasis and periasis of Mercury and Venus can be calculated with an accuracy of 1‰.

The first estimates of HO and background radiation are as follows:

$$\text{curvature of space-time: } \rho/dt = \sqrt{\pi^4 - \pi^2 - \pi^{-1} - \pi^{-3}}/s.$$
$$H0_{theory} = \sqrt{\pi}/c^2m^2/s^2/\rho/s = 65.1\ km/s/Mpc$$
$$\lambda_{theory} = \sqrt{\pi}/2/\rho^3 m = 1.0885\ mm$$
$$\text{Measurement: } \lambda = 1.063\ mm$$

The object to be measured is always located between the measuring device and the firmament or background radiation. The power of the ur-particles is countable, but without beginning and without end. Given the constancy of the speed of light c, it can be assumed that every observer is the center of his own universe. Emergence is only possible with a random increase in the number of ur-particles through the expansion of the universe. The outside world of the object is reflected into the interior at the surface of the measuring device. A neutral, solid measuring device is necessary for physics but is not sufficient. Observers also need interpretation through a highly complex network that can arise only in a stable Sun-Earth-Moon system. In 2005, it was shown that string theory dominates with the expansion of the universe, with 3-branes and 7-branes [35]. This is similar to the theory of polynomials $P(2\pi)$. Emergence is crucial for our conception of the world. We choose a 3D world with gravity and

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normalize it with m, day and c. The view of the world is the surface of a three-dimensional space, at the edge of the vacuum with the highest anisotropy and complexity.

This article provides a summary of many important results from $P(2\pi)$, some of which are still speculative. The theory $P(2\pi)$ is not yet complete. However, it has the potential to be a theory of everything.

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