Theories Of Everything:

Elementary particles always appear to have a mathematically analyzed "dual" character: They are, for example, either "material"-particles called fermions or "force"-particles called bosons.

Any ***mathematical theory of physics*** must comply to the Comprehensive Action Principle. In other words, any theoretical analysis should always also include the spin2 gravitational field with its induced curvature of space-time resulting from mass and mass-speed distribution around any analyzed mathematical point. The mass and mass-speed distribution around an analyzed point actually are the General Relativistic "Aether" which is needed in the theory of GR.

The gravitational field is a spin2 field. As a result of this the invisible state-function of the spin2 graviton repeats itself twice by a complete rotation of 2π radians of the state-function around the axis of movement. As a result of this characteristic the resulting curvature of space-time should be described by 2 mathematical independent methods to include the "dual" spin2 characteristic on easy mathematical grounds.

This mathematical requirement can only be solved after the required dimensionality of space-time is known. On logical grounds the most logical choice appears to be a 4D-spacetime, as also used in Albert Einstein his simple linear Special Relativity.

In 2004 Grigori Perelman proved that mathematical knots can only be described in <u>4D-spacetime</u>. This at-once leads to the conclusion that <u>elementary particles</u> múst be described in the <u>ONLY POSSIBLE</u> 4D-spacetime, because always massive <u>fermions</u>, the primary sources of all <u>bosons</u>, must be described as extended harmonic oscillating waves in the 2D-plane orthogonal to the direction of motion to describe them "mathematical" in compliance to the CAP.

Spin2 "dual" curvature must be included in the mathematical description in two independent ways: The "macroscopic" curvature describes curvature in the direction of motion and must be combined with the complex, so orthogonal, time-coordinate ($c\tau$, iz). Here the direction of motion is chosen in the positive z-axis. The macroscopic effect was described for the first time by Karl Schwarzschild. The second mathematical effect of curvature must be included in the 2D-plane orthogonal to the direction of motion, i.e. must describe harmonic oscillation in the 2D-plane orthogonal to the direction of motion. This "microscopic" effect of curvature *explains ALL* Quantum Mechanical characteristics. The Differential Equations can be solved most conveniently using polar-coordinates (ρ, φ). The power in ρ appears to high to yield exact solutions, but the DE can be rewritten in $x = \rho^2$ and because $\rho > 0$ also gives óne exact unique solution of ρ.

The exact solution of ρ contains roots of incomplete elliptic integrals of the first and second kind and the exact solution of also needed φ contains incomplete elliptic integrals of the third kind with the same arguments that allow solutions for all possible elementary particles.

The average extensiveness, described from the inertial-frame moving with origin at the average position of the elementary particle is easily found to be:

$$\Sigma = 2 \cdot \langle \rho \rangle = 1\tfrac{1}{2}\rho_{max} = 3\rho_{min} = s \cdot \varphi \cdot l_h \tag{1}$$

With s the (half-)integer spin of the (Fermi-)Bose-particle in the direction of motion, i.e. the conserved helicity, $\varphi = \tfrac{1}{2}(\sqrt{5} + 1)$ the Golden Ratio and l_h the Planck-length which also includes the Dirac-constant.

The harmonic oscillating extensiveness in the 2D-plane orthogonal to the direction of motion possesses circular symmetry. It is a well-known symmetry in QM and can be given as in-variance of the (harmonic-oscillating) wave-function when rotated over an angle $\Delta\varphi$ around the axis of analyzed motion:

$$\Delta\varphi = 2\pi/s \tag{2}$$

This symmetry explains why the spin2 "invisible" graviton must be analyzed as a "***dual***" particle!

In GR the equations of motion possess invariant expressions called tensors and of-course also non-invariant matrices, like the very useful Christoffel-symbols. Tensors of any non-negative integer degree n are possible. For example a constant is an n = 0 degree tensor resulting from contractions of all covariant-indices with contravariant indices of tensors of higher degree than 0. A 4-vector is a relativistic tensor of degree n = 1, the most general transformation-tensor is a tensor of degree n = 2 and the famous Riemann-Christoffel curvature-tensor is a tensor of degree 4.

The most general transformation-tensor in GR is just a 4 x 4 = 16 degrees of freedom tensor of degree n = 2:

$$T_{\mu\nu} = A_{\mu\nu} + S_{\mu\nu} \tag{3}$$

The most general transformation-tensor $T_{\mu\nu}$ can be given uniquely as the direct sum of an anti-symmetrical tensor $A_{\mu\nu}$ and a symmetrical tensor $S_{\mu\nu}$. To make a mathematical analysis comply to the spin2 CAP elementary particles have to be described as harmonic oscillators in the 2D-plane orthogonal to the direction of motion with a constant angular-momentum in the direction of motion of the elementary particle. This explains the conserved spin s > 0 completely. Consequently, compliance to the CAP results in mathematical representations of explicitly described spins and the most general transformation-tensors of (3) can now be described with these mathematical spin-representations.

The symmetrical transformation-tensor $S_{\mu\nu}$ can mathematically also be represented with the following spin-representations:

$$S_{\mu\nu} \div \text{spin}\tfrac{1}{2} \otimes \text{spin2} \tag{4}$$

The mostly "stable" spin½ fermions, either elementary spin½ leptons or compound spin½ baryons, described as CAP enforced harmonic oscillators must be solved with open-Boundary Conditions. Open-BC explain why all different fermions must have non-zero rest-masses and also why only fermions allow more so-called particle-families. This is why I rather talk about Fermi-Families instead of "Particle-Families", our universe possesses 3 different Fermi-Families with only different (non-zero) rest-masses. All these fermions together with massive bosons form the Aether as source of the spin2 symmetrical gravitational-field described by invisible spin2 elementary massless and chargeless gravitons.

The anti-symmetrical transformation-tensor $A_{\mu\nu}$ can mathematically also be represented with the following spin-representations:

$$A_{\mu\nu} \div \text{spin}\tfrac{1}{2} \otimes \text{spin1} \tag{5}$$

The sources are the mostly "stable" spin½ fermions, either elementary spin½ leptons or compound spin½ baryons, described as CAP enforced harmonic oscillators. Open-BC explain why all different fermions must have non-zero rest-masses and also why only fermions allow more so-called particle-families. Elementary particles must be described mathematically as harmonic-oscillating waves in the 2D-plane orthogonal to the direction of motion. As a result of this simple mathematical, i.e. linear, fact all fermions must possess non-zero electrical charge in the surrounding area of the average position (SR-worldine) which is not accessible by the harmonic oscillating motion to comply to the CAP. This explains exactly why also the 3 different uncharged neutrinos posses an ***non-zero*** Bohr-magneton, even though it is very difficult to detect the Bohr-magneton experimentally! In any case, the spin½ sources here represent the non-zero charges of fermions, which are the primary source of the spin1 ElectroMagnetic-field.

This easy symmetry analysis resulting from a CAP compliant description of the only SR analyzed Standard Model will result in complete mathematical descriptions of all possible Theories Of Everything!

The most general transformation-tensor (3) with 16 degrees-of-freedom can be represented non-reducible

completely by the following mathematical spin-representations:

$$T_{\mu\nu} \div \quad spin\frac{1}{2} \otimes spin1 \quad \oplus \quad spin\frac{1}{2} \otimes spin2 \tag{6}$$

As a result of this mathematical "mapping" with spin-representations described as harmonic oscillating point-waves in the 2D-plane orthogonal to the direction of motion with fermions described with open-BC and bosons described with closed-BC at once explains why only the following somehow-stable particle-spins are observed in QM experiments:

$$\text{Stable } \underline{observable} \text{ spins of particles are given by: } \underline{s} \in \{2, 1, \tfrac{1}{2}\} \tag{7}$$

And this results in the only allowed spin-values of elementary particles: $\underline{s} \in \{2, 1\tfrac{1}{2}, 1, \tfrac{1}{2}\}$ (8)

This CAP compliant analysis at-once explains why quarks, which are only observed experimentally in a so-called quark-sea, i.e. never as stable particles on their own, must be spin1½ particles without so-called QCD iso-spin! This spin1½ of quarks explains why they cannot be observed on their own, because their spin is not represented in (6).

In the Standard Model all force-fields are described by gauge-symmetry. However, in the SM the symmetrical spin2 gravitational field is not included and as a result only anti-symmetrical electrical charge related force-fields are analyzed. This is exactly the reason why all force-fields examined in the SM can be analyzed with gauge-fields. In general it is assumed that the gravitational-field can also be described using a suitable gauge-field. However, this is a wrong assumption because the gravitational-field is a symmetrical spin2 "dual" force-field which cannot be described with an anti-symmetrical gauge-field!

As a result of this mathematical fact the used gauge-symmetry in the Standard Model just is the complete non-reducible gauge-symmetry of any possible mathematical analysis of our reality.

The only possible complete non-reducible gauge-fields of any mathematical model of our reality just is the gauge-symmetry of the Standard Model:

$$U(1) \times SU(2) \times SU(3) \tag{9}$$

The U(1) x SU(2) gauge-symmetry describes the massless spin1 photon of the EM-field mixed with the weak-nuclear, charged so also massive, spin1 force-field bosons $\{W^{\pm}, Z\}$ via the so-called Weinberg-angle. The SU(3) gauge-symmetry describes all spin1½ quarks as charged, so also massive, fermions. In the Standard Model quarks are described by Quantum Chromo Dynamics as spin½ particles with additional imagined dual so-called iso-spin. But this can be proven to be a mathematical incorrect assumption!

All conserved quantities are derived from symmetries. For example the energy-momentum 4-vector $p^{\mu} = (E/c, ip_x, ip_y, ip_z)$ is conserved as the contracted degree n = 0 tensor-scalar:

$$p^{\mu}p_{\mu} = E^2/c^2 - p^2_x - p^2_y - p^2_z = m^2 = m^2_0/(1 - v^2/c^2) = \boldsymbol{constant} \tag{10}$$

With m_0 the rest-mass of the described elementary particle. If the speed of the described particle is the massless light-speed c, we have v = c, so in this case the rest-mass m_0 ***must*** be zero and in this case $E = c|p| = \hbar\omega$, with the momentum $p_{x,y,z} = \hbar k_{x,y,z}$, with (k_x, k_y, k_z) the wave-vector of the harmonic-oscillating massless photon to comply to the CAP. This EM-wave 4-vector $k^{\mu} = (\omega, k_x, k_y, k_z)$ must describe the CAP enforced harmonic-oscillating extensiveness of the massless spin1 anti-symmetrical so-called "photon", which up-to-this-very-day is ***NOT*** really understood by almost all theoretical physicists!

This is why I'm sad that I will ***NEVER*** have the opportunity to talk with Albert Einstein about QM which is mathematical ***completely*** proven and also ***completely*** derivable from his mathematically discovered CAP!

But maybe Edward Witten and Robbert Dijkgraaf will grant me a visitation to Einstein's last home, i.e. the so-called IAS of Princeton University, to *FINALLY* explain QM to the Super-String community!?!

Because, first of all Super-Symmetry assumptions are proven incorrect, with severe consequences for all Super-String theories! And second spinless elementary particles *múst* be "simple-human-fiction", because they have never been detected as stable particles in any experiment and with a correct mathematical explanation of QM using a mathematical description in compliance with the CAP are also shown mathematically not to be able to possess energy proportional to a frequency. So, can also be shown to be simple "human-fiction" on easy linear "mathematical" grounds. And to explain these two points more explicitly, the massless spin1 photon representing the complete EM-field and the massless spin2 representing the symmetrical gravitational-field with required curvature, i.e. duplication of degrees of freedom in a mathematical analysis, are 100% stable, i.e. only react when interacting with other particles on their "extended" mathematical 2D-paths to be absorbed as "harmonic oscillating" energy!

All elementary particles must be described by mathematical harmonic oscillating waves in the 2D-plane orthogonal to the direction of motion. So, even when the overall charge can also be zero, all possible elementary particles MUST also posses electric charge and as a direct result of that cannot have a zero Bohr-magneton! This explains why chargeless elementary particles have to be discarded from any correct mathematical analysis of all possible Theories Of Everything!

Theoretical Physicists **REALLY NEED to RETURN to the FIRST PRINCIPLES** of SIMPLE "*ONLY LINEAR*" *ánd ONLY POSSIBLE 4D-SpaceTime analysis* with *EXTREMELY SYMPLE*, because 100% envisionable simple linear, *ONLY* possible "mathematical" 4D-spacetime analyses!

The ONLY possible elementary particles will now be given, together with the total number of elementary particles in any possible universe, i.e. with 100% certainty independent (not possible to detect, see, hear, smell, or detect otherwise) part of our cosmos as a result of the unique maximum-speed of massless particles in ALL possible different universes:

All possible elementary particles in our 3-Fermi families universe:

Fermions: *3 different families*	Bosons: *The elementary spin2 graviton and the U(1) x SU(2) x SU(3) gauge-bosons:*
leptons: electron, muon and tauon + anti-particles	graviton, a spin2 elementary massless boson
leptons: massive but chargeless neutrino's	photon, a spin1 elementary massless boson
quarks 1st family: up-quark and down-quark	weak-nuclear forces: spin1 elementary massive gauge-bosons $W^\pm, Z$
quarks 2nd family: charm-quark and strange-quark	strong-nuclear forces: spin1 colored quark+anti-quark gluons
quarks 3rd family: top-quark and bottom-quark	mesons: all non-gluon bose-quark combinations

All fermions have so-called **anti**-particles with changed charge sign of charged particles and opposite helicity in case of chargeless particles.
All leptons are spin½ particles and all non-separable quarks are spin1½ particles.

The total amount of elementary particles is given by the amount of Fermi-Families **n** by: $\Sigma = 5 + 7 \cdot n$ (11)
Here particle anti-particle characteristics of ALL elementary particles result in a duplication of degrees.

Any possible universe is created by a singularity of a Black-Hole in another universe through a collision of EVERYTHING into the "black-hole" and after this singularity starts to spread-out again as a "Big-Bang" of the new universe! In this way this creation-process of a new universe is of-course also energy neutral.