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4. All elementary particles with all their characteristics follow completely from a full symmetry analysis (Poincaré-group extended to comply to the symmetrical CAP combined with a complete anti-symmetrical U(1)xSU(2)xSU(3) gauge symmetry).

This is a not yet finished first written explanation!!!

First one should realize that the only possible space to describe our universe must be 4D, see almost finished Point 1.

Fermions described, as extended harmonic oscillating exact points in the 2D plane orthogonal to the observed direction of motion, must be solved with open BC. As a result of this fact all fermions have mass, i.e. interact with the spin2 gravitational field. This implies that their maximum possible speeds with respect to any observer v < (lightspeed) c. As a direct result of this fact, any relativistic analysis of the path of the (harmonic oscillating) point, that represents the center of energy of the extended particle allows knots in this path. Grisha Perelman did show in 2003 that the only possible mathematical space which allows knots, must be 3D spacelike, i.e. 4D-spacetime like.

So, all physical transformation analysis, must be a mathematical (i.e. linear) analysis in 4D-spacetime.
This implies for the most general transformation tensor of any analyzed 4-vector a total of only 16 degrees of freedom. In this mathematical view, one should not forget the required 2D-extendedness in the plane orthogonal to the observed direction of motion (worldline).
Any possible transformation tensor always is expressible as a unique sum of a symmetric tensor and an anti-symmetric tensor. As a result the symmetrical and anti-symmetrical transformation tensors are independent.
Define an arbitrary possible transformation tensor $T_{\mu\nu}$ as the following 4x4 tensor:

$$T_{\mu\nu} = S_{\mu\nu} + A_{\mu\nu} \qquad (4.1)$$

With $S_{\mu\nu} = S_{\nu\mu}$ the symmetrical transformation tensor and $A_{\mu\nu} = - A_{\nu\mu}$ the anti-symmetrical transformation tensor.
The symmetrical and anti-symmetrical transformation tensors have respectively 10 and 6 degrees of freedom.

In 1989 I assumed the following: All possible elementary particles and all their possible characteristics follow completely from geometrical rules. All geometrical rules follow from the complete (***only*** valid non-reducible) relativistic symmetry analysis of any possible, i.e. 4D-spacetime, universe. In fact, this assumption is the answer to David Hilbert's 6th problem [1] of his 23 mathematical problems proposed in 1900 at a Mathematical Congress in Paris. Writing out this assumption mathematically, in a completely relativistic manner, indeed shows that a complete symmetry analysis of our 4D-universe explains all observed elementary particles and all their required characteristics in a non-reducible 4D-description.

The 10 degrees of the symmetrical transformations are represented by the spin2 x spin½ representation.
The spin2 represents the gravitational field, which is caused by stable spin½ masses. In GR the gravitational action is represented by the symmetrical Ricci tensor.
The 6 degrees of freedom of the anti-symmetrical transformations are identically represented by spin1 x spin½.
The spin1 represents the anti-symmetrical EM-field, which is caused by stable spin½ electric charges.
The EM-field requires so-called gauge symmetry to be solved completely. In our 4D-spacetime universe the maximum allowed gauge-symmetry is the well known U(1)xSU(2)xSU(3) gauge symmetry used in the standard QFT.
U(1)xSU(2) describe the EM-force (photon) and the weak nuclear forces (Z and $W^{\pm}$ gauge bosons) mixed by the so-called Weinberg angle. Finally, the SU(3) gauge symmetry describes all intrinsic unstable quarks.
But in this SR analysis one should realize that the standard model of QFT does not comply with Einstein's CAP!

From the last paragraph, the following non-reducible complete symmetry group can be given:

The total symmetry group to be analyzed to explain which elementary particles represent our universe is:

1. (spin2 ⊗ spin½) ⊕ (spin1 ⊗ spin½) spacelike or momentum-like symmetry group. This symmetry group explains why we observe stable spin½ fermions with mass > 0 and possible electric charge with resulting magnetic momentum. The spin½ masses interact through the spin2 gravitational field and the spin½ charges interact by the EM-field.
2. The complete gauge-symmetry group: U(1)xSU(2)xSU(3). This symmetry group explains (again) the photon and the weak nuclear forces and all so-called hadronic processes. The U(1)xSU(2) gauge symmetry describes the photon and the Z-boson mixed by the so-called Weinberg angle and the charged $W^{\pm}$-gauge-bosons. The SU(3)

gauge-symmetry describes all intrinsic unstable spin1½ quarks, which combine in stable baryons (fermions, protons and neutrons of the 3 families) and the so-called gluons and mesons (bosons, build from even amounts of quarks, most often very stable sets of 2). The so-called gluons bind together quarks of a baryon through the so-called strong nuclear force. Each quark always has a sea of gluons and mesons around it, because quarks can't exist as stable entities on their own due to their spins being 1½! This is why quarks always clot together.

All possible 4D-spacetime transformations are specified with groups 1 and 2 in a non-reducible manner. I.e. all characteristics of all possible elementary particles must follow mathematically from these two symmetry groups.

The first noted characteristic is the fact that the only stable spins of elementary particles are: $s \in \{½, 1, 2\}$ (4.2)

Please note that spinless elementary particles with only one degree of freedom contradict Einstein's CAP!

The degrees of freedom of a spin s particle are $(2s+1) \Rightarrow$ The allowed spins ≤ 2 are $s \in \{½, 1, 1½, 2\}$ (4.3)

From this simple symmetry group analysis I became convinced in 1998 that so-called quarks aren't spin½ particles with so-called additional isospin, but are unstable elementary particles with spin1½. Quarks are bound together by combined sets of two quarks, which represent so-called gluons. The standard model of QCD must be rewritten with quarks described as spin1½ fermions, without isospin, as 2D-extended particles with open BC in the 2D-plane orthogonal to the observed direction of motion (worldline). In this way it is explained correctly why quarks cannot be observed on their own, i.e. why they are intrinsic unstable. Any quark always carries both mass (the solutions are described with open BC) ánd charge. This is why a chargeless neutron still is a source of a small EM-field. All possible combined hadrons carry with them oscillating EM-fields, also the neutrons and gluons. The fact that quarks are spin1½ fermions, is the cause of the fact that quarks are always together in uncountable large amounts. The only possible chargeless fermions are the elementary so-called neutrinos. The neutrinos are the chargeless particles of the 3-lepton families (electron, electron neutrino, positron, muon, muon neutrino, anti-muon, tauon, tau neutrino, anti-tauon).
To me, a very dense neutrino background forms the densest availability of elementary particles, and this density explains all hidden mass of our universe. All so-called hadron interactions are source of created and also absorbed so-called lepton chargeless (elementary) neutrinos.

Three different so-called particle families characterize our universe. Mathematically, I observe GR Black Holes and Big Bangs mathematically related. The source of our universe is our Big Bang. Mathematically I concluded in 1999 that a Black Hole continually collects energy, until a mathematical singularity is reached. At that moment all existing energy is at once transformed into "exploding" energy, i.e. new created elementary particles, with different physical constants, like total angular momentum, lightspeed, Planck's constant, constant of Boltzmann, Bohr magneton, etc.. The only conserved constant is the total energy of this new universe. Our Big Bang implies evaporation of a Black Hole in another universe, which cannot interact with our universe anymore, due to a different lightspeed. Up to this day, imagining another universe with more energy, i.e. for example a larger Planck constant or larger lightspeed or more particle families, still is difficult to me! But the conclusion follows from easy, i.e. linear, mathematical analysis, and up to this day I couldn't proof this analysis as wrong!

Used work:

1. http://quantumuniverse.eu/Tom/Hilberts%2023%20Mathematische%20Probleme.pdf