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Fermions described with Open-BC and Bosons with Closed-BC:

In accordance to the **Comprehensive Action Principle**, i.e. when including the spin2 ("dual") gravitational action in any valid analysis of our daily experienced reality, not only the macroscopical paths of the planets around our sun move in curved paths (precessing elliptical orbits), but also the movement in the 2D-plane orthogonal to direction of elliptical motion must be taken into account. At macroscopical scale this Schwarzschild defect was soon included in the description of the elliptic oscillating orbits of our point-planets around a massive sun with a rotating massive sphere with a high mass-density.

However, this 2D-plane orthogonal to the direction of motion should also be taken into account in a "microscopic" **QM** analysis. And far from the macroscopical curvature-effects (precessing elliptical orbits) only the harmonic oscillating movement in the 2D-plane orthogonal to the direction of motion (SR-**worldline**) remains dominant in any SR **QFT** (finally resulting into the so-called **Standard-Model**).

The harmonic oscillatition can most easily be described from the inertial-frame with origin on the average-position of the harmonic-oscillating moving particle, i.e. its SR-**worldline**. And when assuming that the particle isn't accelerating on local-scales the speed along the SR-**worldline** will be a constant linear speed. The **DE** to describe the harmonic-oscillating motion in the 2D-plane orthogonal to the SR-**worldline** will one 2nd order **DE** in time measured from the origin of the chosen inertial-frame, or a set of two 1st order **DE**'s. The second option proves the most easy choice to solve directly. The best choice of coordinates to solve the two 1st order **DE** are polar-coordinates $(\rho, \varphi, z, ic\tau)$. Only the **DE** of the squared polar-distance $x = \rho^2$ can be solved exactly, but $\rho > 0$, so these solutions also specify ρ completely.

The **DE** possess circular-symmetry, which makes the polar-coordinates extremely useful in solving the **DE**. The harmonic-oscillating motion of all possible elementary-particles is necessary to comply to the **CAP**. So, this is a spin2 "dual" effect. This dual effect appears in all effects which can be appointed to the **CAP**.

The **Boundary Conditions** of the circular harmonic-oscillation around the direction of "observed" movement are either Open-**BC** or Closed-**BC**:

- **Open-**BC have the following characteristics:
  1. Describe elementary-particles which are always able to interact in all spacelike directions, so must be able to interact with the "invisible" spin2 gravitational-field. This implies that all solutions with open-BC must possess rest-masses > 0.
  2. Allow more so-called particle-families, our universe has 3 particle-families.
  3. Describe "matter"-particles, called fermions.
  4. Only so-called quarks and leptons are possible elementary-fermions, i.e. $(3 + 4) \times n$, with n the different amount of open-BC fermion-famies!
- **Closed-**BC describe elementary-particles which may also be massless.
  1. Describe elementary-particles which, when both charge- and mass-less, are only able to interact in their direction of motion, so in these two "dual" cases must be both massless and uncharged. Just two bosons are massless: Only the spin1 photon representing the EM-field and the spin2 boson representing the gravitational field have zero rest-mass.
  2. Only allow one type of elementary-particle for each degree-of-freedom for all possible symmetry-groups, and this fact shows directly why Super-Symmetry is nonsense!
  3. Describe "force"-particles, called bosons.
  4. The ***only*** 5 different elementary-bosons in *any universe* are: $\{\gamma, g(\text{raviton}), Z, W^{\pm}\}$

The **DE** of $x = \rho^2$ can be solved mathematical exactly. The solutions explain completely why **QM** must be solved in the infinite dimensional complex Hilbert-space. The average extensiveness of the harmonic oscillating particle from the origin of the inertial-frame (the position of the elementary-particle in the **Standard-Model**) of the analysed particle is given by:

$$2\cdot\langle\rho\rangle = \rho_{max} + \rho_{min} = 1½\rho_{max} = 3\rho_{min} = s\cdot\varphi\cdot l_h \quad (1)$$

With $\varphi = ½(5 + 1)$ the Golden-ratio > 1, l_h the Planck-length and s the constant angular-momentum of the harmonic-oscillating elementary-particle with energy proportional to a (almost always) detectable angular-frequency ω:

$$E = h\cdot f = \hbar\cdot\omega \quad (2)$$

With f the frequency, ω the angular-frequency, h the constant of Max Planck and constant of Paul A.M. Dirac, also called the "reduced" Planck-constant, $\hbar = h/(2\pi)$.

The **DE** of x also yield exact solutions of the polar-distance $\rho > 0$. In the cases of the two massless elementary-particles it at first-sight seems impossible to describe harmonic oscillating motion in the 2D-plane orthogonal to the direction of motion in which direction the speed now is the maximum speed-of-light c. However, because the oscillating motion always is perpendicular to this maximum-speed c, it's exactly possible. However, because the speed of the oscillating-point can now only be observed/analysed with c, the oscillating extendedness of massless elementary-particles will always be exactly zero. This is why spin s is usually called "intrinsic angular-momentum".

In 2003 Grigori Perelman proved the Poincaré-conjecture together with Richard Hamilton. While solving this, Grigori Perelman also showed that mathematical-knots can only be described in SR 4D-spacetime. All elementary fermions are massive, so their harmonic oscillating paths always allow knots by analysing the direction of movement forward, backward and forward again.

As a direct result fermions can only be analysed mathematically in 4D-spacetime!

And this always forgotten characteristic of easy "linear" mathematical analyses only allows easy imaginable 4D-spacetime analyses. I guess, Albert Einstein already discovered this when he, together with Wolfgang Pauli, discovered in 1943 that all appearing infinities in 5D-spacetime analyses of Kaluza-Klein could not be removed completely.

As a result Albert Einstein neglected all other than 4D-spacetime analyses, even though he still used more-dimensional Riemann-space. However, it now appears that even the 20D-Riemann-space can be completely re-written in a "dual" analysed 4D-spacetime which is completely capable to

Explain all possible Theories Of Everything!

So, in the end physics, especially the QM resulting into the Standard Model, can be completed by adding the spin2 gravitational field of the "invisible" graviton to all other possible elementary-particles of any possible TOE.

Please also visit: http://quantumuniverse.eu