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Using Space-time in scientific research.

In so-called "Standard" research only Special Relativistic 4D-spacetime is used. This happens mainly because to humans only 4D-spacetime is completely imaginable.

Albert Einstein used the beautiful mathematical work of Bernard Riemann, to solve his theory of General Relativity with curvature of space-time as a result of spin2 gravitation in a higher dimensional Riemann-space. Here he used a number of coordinates given by an index $n \geq 8$, so that all final equations obtained by contractions of all Riemann variables result in easy imaginable 4D-space-time. All needed equations of motion of GR can be given completely in easy imaginable 4D-spacetime after contractions. As a result the more dimensional Riemann-space is only used mathematically in between the final results. For all final results from which conclusions can be drawn, the multi-dimensional Riemann-space can always be contracted to 4D-spacetime.

However, always occurring change, or "***flow***", of space-time always requires a mathematical analysis in higher dimensional Riemann-space using integrals.

As long as the final results are 4D-spacetime like usage of higher dimensional Riemann-space is completely acceptable.
But, this mathematical analysis, is a simple "***linear***" analysis without an overview of correct mathematical analysis! Therefore, a completely understandable mathematical overview will be given below.

Karl Schwarzschild was the first physicist who used Albert Einstein his equations of motion of GR to describe the orbits of the planets of our solar system around the attracting massive sun. He analyzed the sun as a non-rotating point-mass because outside the sun itself this yields a very good first approximation. Occurring angular-momentum and electrical charge of the sun are on statistical grounds higher order effects and not relevant for a first analysis of the orbits of the planets.

What is striking in this analysis of curvature in GR is the fact that only curvature of the direction of motion is analyzed and that the analyzed objects were always described with mathematical points without dimensions. This is of course because this is the most logical analysis of an analyzed physical system. Objects are always described as points undergoing motions in 3D-space of the corresponding analyzed 4D-spacetime. And this analysis is mathematically always analyzed from a suitable chosen inertial-frame (not force-field experiencing linear, not-accelerated, moving frame).

Every possible universe has just two different kinds of elementary particles: "matter"-particles, the primary sources of force-fields, i.e. fermions with half-integer spins, and the force-fields composed of bosons with integer spins. According to Einstein his Comprehensive Action Principle curvature of space-time should always be implemented in all 4 independent components of the 4D-spacetime. This therefore results in $2 \times 4 = 8$ independent space-time coordinates, i.e. it explains $n \geq 8$ in Riemann-space.
Curvature of space-time has to be applied on all available coordinates. And this "***curvature***" implies for all coordinates the change from 1D-linear lines to curved lines mathematically, i.e. "***linear***", described in a 2D-plane which has to be selected very carefully!

Schwarzschild only analyzed curvature in the direction of motion of planets. For elementary particles curvature must be taken into account in all possible 3D-spacelike directions (and of course also in the timelike direction).

Choose an inertial-frame with origin at the average position of the harmonic oscillating elementary particle and choose the positive z-axis in the direction of motion. From this frame z = z' = 0. Right now, it is obvious that also "***curvature***" in the 2D-plane orthogonal to the chosen z-axis and of course also orthogonal to the mathematical "***imaginary***" time-coordinate must be taken into account. Both the z-axis and the time-coordinate must be solved macroscopic GR, while the solutions in the orthogonal 2D-plane can only be solved microscopic for elementary particles "***linear***" with a SR analysis. So, there is a fundamental difference between macroscopic spin2 only attractive gravitational effects and therefore mathematically also occurring microscopic "***curvature***" which explains why all elementary particles possess "***intrinsic***" energy proportional to a frequency. The harmonic oscillation in the 2D-plane orthogonal to the direction of motion (z-axis) results in a conserved angular-momentum > 0. This is the result of describing the harmonic oscillation in the 2D-plane mathematical with a point carrying momentum due to a central force $F = -k \cdot \rho$ (given in polar-coordinates) acting on this point and directed towards the origin of the used inertial-frame. In this way the microscopic analyzed gravitational field explains spin of all possible elementary particles completely and also why the QM always has to be described in complex Hilbert-space.

If we assume that the only possible space-time for the mathematical representation of elementary particles is the easy imaginable 4D-spacetime, it appears that all possible "Theories Of Everything" can be extracted from a complete non-reducible 4D-spacetime symmetries analysis.

The only thing left that still has to be proven is why only a 4D-spacetime analysis is possible to analyze physical problems.

Describe the equations of motion of elementary particles always from the inertial-frame with origin at the average position of the harmonic oscillating particle (i.e. SR-worldline) moving with the particle in the positive z-axis. The Differential Equations of the harmonical oscillation in the 2D-plane orthogonal to the direction of motion can only be solved completely with Boundary Conditions. Bosons have to be described by closed-BC, while fermions have to be described with open-BC.

On mathematical grounds the following characteristics of CAP extended harmonic oscillating elementary particles are explained completely:

- All elementary fermions always interact in all spatial directions. Therefore they have to interact with the spin2 gravitational field, i.e. all fermions must have rest-masses > 0!

- Electrical charged elementary particles interact in all spatial directions with the spin1 EM-field. This is why all electrically charged particles must have rest-masses > 0.

- Open-BC allow more solutions with only different rest-masses in the form of harmonic oscillators. Therefore it is better to talk about fermion-families, instead of always misunderstood used "***particle-families***".

- Only elementary bosons are possible with zero rest-mass, because without charge they can only interact with other particles in the direction of motion. This follows from the closed-BC. Only the spin2 graviton and the spin1 photon of respectively the 10 degrees of freedom symmetrical gravitational-field and the 6 degrees of freedom anti-symmetrical EM-field appear to have zero rest-mass on mathematical grounds.

Elementary fermions are always massive harmonical oscillators with open-BC in the 2D-plane orthogonal to the direction of motion. Therefore, the massive traveled path of the oscillating point allows mathematical (i.e. closed) knots, even though each elementary fermion both has a starting-point and an end-point.

Somewhere between 2003 and 2004 Grigori Perelman under supervision of Prof. Dr. Richard Hamilton (at the Stony Brook university New York) proved that mathematical knots can ónly be described in 3D-space, i.e. SR 4D-spacetime. My own proof followed from an easy symmetry analysis. In 3D-space the Cartesian coordinates can transform into one-another (x ⟶ y, y ⟶ z en z ⟶ x is a symmetry transformation). With this simple symmetry analysis the amount of "***visible***", non-compacted, coordinates is not a constant in a model with more than 3 spatial coordinates, i.e. knots are only possible in 4D-spacetime. Exactly the space-time that anyone can imagine so easily because it's just our every day experienced reality. This also shows that all SuperString theories with 10D-spacetime, of which 6 are compacted to the Planck-length greater than the mathematic required zero in a so-called Calabi-Yau manifold, do not allow mathematical knots.

In the only possible 4D-spacetime all possible Theories Of Everything are the result of a complete non-reducible symmetries analysis. Exactly the same analysis which also explains all possible elementary particles together with all their required characteristics.

This at once demonstrates the impact of a correct multi-dimensional space-time analysis. The primary sources of "everything" appear to be always massive half-integer spin fermions described as harmonic oscillating waves in the 2D-plane orthogonal to the direction of motion. One is enforced to describe elementary particles extended to make the description comply to the CAP. Fermions have to be described mathematically with open-BC and this explains why more possible families of fermions are possible. Our universe just has 3 different fermion-families. The only difference between the "families" is interaction with the gravitational field, i.e. only the rest-masses of the different families are different. All fermions must have non-zero rest-masses. This allows knots in their harmonic oscillating paths. It now follows directly, that the only possible correct analysis for physics research must be a 4D-spacetime analysis. An analysis with extra space-time dimensions is only possible in the limit where the infinitesimal sizes really reach zero or if all contributions cancel one-another exactly. However, curvature in GR can also be included in the only possible 4D-spacetime analysis. The only possible 4D-spacetime has 4 independent coordinates and for each of these coordinates curvature can be added making the coordinate curve in a 2D-plane, instead of describing it with a 1D-linear line. So, curvature in a 2D-plane is always possible for the four different 4D-spacetime coordinates also in the only possible 4D-spacetime itself.

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