

## QM explained SR mathematically in compliance with the CAP:

Quantum Mechanics, i.e. the Special Relativistic Quantum Field Theories resulting in the Standard Model of elementary particle physics, will be derived and explained completely from an easy linear, i.e. mathematical, SR thorough analysis of Albert Einstein his in October 1914 described Comprehensive Action Principle.

The CAP is a mathematical requirement to also include the gravitational-field in any research. And including the gravitational-field demands including mathematically described curvature of the only possible 4D-spacetime analyses. N.B. The fact that knots are mathematically only possible in 3D-space, i.e. 4D-spacetime, was not understood at that time! A mathematical analysis is an easy imaginable linear analysis using an orthogonal, i.e. perpendicular, inertial-frame with 3 space-like straight 1D-coordinate axes. In relativity, 3D-space and 1D-time are not completely independent (Lorentz-contraction, Time-dilation). In a real description of the 4D-spacetime coordinates there is a difference between covariant  $x_\mu = (ct, -x, -y, -z)$  and contravariant 4-vectors  $x^\mu = (ct, x, y, z)$ . Relativistic in-variants from 4-tensors of any degree are obtained by contractions of all co-variant components by contravariant components and vice-verse. For example the so-called squared length of 4-vector  $x^\mu$  is  $x^\mu x_\mu = (c^2t^2 - x^2 - y^2 - z^2)$  and this must be a scalar, i.e. a relativistic constant independent of any 4D-spacetime indices, i.e. a relativistic invariant.

The co- and contravariant 4-vectors can only be given symmetrical on mathematical grounds with the square-root of minus one, i.e.  $i = \sqrt{-1}$ :  $x^\mu = x_\mu = (ct, ix, iy, iz)$ . In this way the co- and contravariant vectors are identical and all contractions can be described completely symmetrical. This appears to be the main reason why QM has to be solved in complex 4D-spacetime.

This symmetrical description of spacetime components of 4-vectors explains why the orthogonal 3D-space coordinates are all orthogonal to the time-coordinate  $ct$  as a result of the appearing “complex”  $i$ . This is why time and 3D-space are mathematical orthogonal, even though they are not actually independent as a result of the not-infinite light-speed  $0 \ll c (< 3 \times 10^8 \text{ [m/s]}) \ll \infty$ . A change of speed of an observer with respect to an analyzed object shows that space and time are indeed dependent. Light-speed is massless-speed, the speed of the only two massless elementary particles, i.e. the spin1 photon and invisible spin2 graviton.

Mathematics is a simple linear analysis and compliance to the CAP implies a mathematical analysis in all orthogonal 4D-spacetime coordinates with “microscopic” curvature described in the 2D-plane orthogonal to the described direction of motion. When choosing the direction of motion in the positive  $z$ -axis, the direction of the orthogonal time-coordinate may be imagined in the same direction, even though it is obvious that the time-coordinate is also orthogonal to the  $z$ -axis as a result of being real when the 3D-spacelike coordinates are chosen in the complex  $i = \sqrt{-1}$  direction. The complex-plane also just is a simple 2D-plane in which the dual “macroscopic” character of mathematical quantities can be analyzed.

When curvature, with its required doubling of degrees of freedom is being analyzed, one at once observes two different effects as a result of the “dual” characteristic of the spin2 character of the responsible massless and chargeless spin2 elementary graviton. The first effect is in the complex 2D-time- $z$ -axis plane and is a result of curvature of spacetime resulting from variable distribution of mass and mass-speed of elementary particles surrounding the described paths of analyzed objects. This was for the first time described by Karl Schwarzschild when he used Albert Einstein his equations of General Relativity to approximate the paths of the planets around the sun of our solar-system. Remember that the time-axis and the  $z$ -axis require a 2D-complex plane in the description. The second effect of demanded curvature must be in the 2D-plane orthogonal to the first effect: This spin2 “dual” effect of “curvature” requires the paths of elementary particles to be described as harmonic oscillating waves in the 2D- $(x, y)$ -plane orthogonal to the 2D-timespace-directions of motion. Consequently the fact that all elementary particles possess so-called “intrinsic” energy proportional to a frequency must also be a result of compliance to the CAP of the mathematical analysis. When realizing that on mathematical grounds the CAP requires a non-zero extensiveness of elementary particles in the 2D-plane orthogonal to the direction of motion, even if the particle is at rest with respect to the chosen descriptive inertial-frame the always used word “intrinsic” should actually be omitted in QM! After all, QM as it's now commonly used does not comply to the CAP!

When analyzing any physical problem mathematically it is mostly assumed that spacetime is 4D because this is the space-time we experience in our daily life. But [string theorists](#) require a higher dimensional spacetime, i.e. 10D-spacetime and even 11D-spacetime in [M-theory](#). However, the so-called [Super-String](#) theories, have up to this very day still not been verified experimentally in *any possible* way! So, the question one might ask is, are [String-theories](#) **mathematically actually correct!?!** My answer is NO, because this “simple” mathematical analysis is mathematical incorrect because it cannot describe mathematical knots and also doesn't allow a mathematical imaginable view on our own existence! And as a direct result of that remains a not understood mathematical analysis of our still not understood reality!

In [QM](#) the wave-function has a symmetry related to the carried spin of the wave-function. Choose the direction of motion of the particle represented by the wave-function in the positive z-axis and use cylindrical coordinates  $(c\tau, \rho, \varphi, z)$ . From the inertial-frame moving with origin at the average position of the particle moving with the particle along the z-axis we have the following spin related symmetry:

$$\Delta\varphi = 2\pi/s, \text{ with } s \text{ the (half-)integer spin of the described } \textit{fermion} \text{ or } \textit{boson}. \quad (1)$$

As a result the wave-function of a spin2 graviton repeats itself twice during a complete rotation of  $2\pi$  radians, i.e. spin2 particles possess a mathematical “dual” character. On the other hand, spin $1/2$  electrons and other leptons have to be rotated two complete circles to obtain the same wave-function again. This is a well-known fact for all physicists.

[Elementary particles](#), possess a “dual” character (1) as a result of compliance to the spin2 [CAP](#). [Elementary particles](#) must be described “microscopic” as harmonic oscillating waves in the 2D-plane perpendicular to the direction of motion. I.e. this explicitly explains the particle-wave duality of [elementary particles](#). This oscillation is easily described with “linear” mathematical tools. Cylindrical-coordinates  $(c\tau, \rho, \varphi, z)$  seem the best coordinates to solve the [Differential Equations](#) exactly. The time  $\tau$  is the time described from the origin of the inertial-frame moving with the particle, i.e. it's the [proper-time](#) as used in the [SM](#). Choose the positive z-axis as the direction of motion (even if the speed is actually zero in this chosen inertial-frame). The harmonic oscillation in the 2D-plane requires acceleration, i.e. two consecutive first-order time derivative [DE](#) with respect to  $\tau$ . The resulting [DE](#) are to a higher order in  $\rho$  than the maximum order that permits mathematically exact solutions. However, the [DE](#) for  $\rho$  can be rewritten exactly for  $x = \rho^2$ , to end up with [DE](#) for  $x$  which can be solved exactly. And because  $\rho > 0$ , the solution of  $x$  also results into a complete solution of  $\rho$ .

The 2<sup>nd</sup> order [DE](#) of  $x(\tau)$  require two integration constants to end up with complete solutions. The first constant is the well-known [Planck-length](#)  $l_p$  and the second constant appears to be the [Golden Ratio](#)  $\varphi = 1/2(\sqrt{5}+1) = 1 + 1/\varphi$ . As a result of circular symmetry resulting from harmonic oscillation in a circular motion around the z-axis, i.e. the chosen direction of motion, the [DE](#) yield 2 kinds of solutions, i.e. are “*spin2 dual*”: One kind of solutions has to be solved with closed [Boundary Conditions](#) and the second kind of solutions has to be solved with open-[BC](#). Closed-[BC](#) describe [elementary particles](#) of which only one kind for every possible symmetry-group exists, while open-[BC](#) allow more so-called “families” of [elementary particles](#) with only different [rest-masses](#).

The harmonic oscillating mathematical described point complies to symmetry-laws with resulting constants of motion. All solutions of the [DE](#) must possess a non-zero constant angular-momentum to describe the harmonic oscillation as a constant without any “losses”. This constant describes the [spin](#) of the described [elementary particle](#) explicitly: A description of elementary particles in compliance with the [CAP](#) explains all aspects of [spin](#) completely. For example, of elementary massless particles only the [helicity](#) is conserved. The average extensiveness of elementary particles in the 2D-plane orthogonal to the direction of motion can be given mathematically from the inertial-frame with origin at the average position of the oscillating point-particle with the following expression:

$$\text{Constant average extensiveness} = 2\langle\rho\rangle = \rho_{\max} + \rho_{\min} = 1\frac{1}{2}\rho_{\max} = 3\rho_{\min} = \underline{s} \times \varphi \times \underline{l}_p \quad (2)$$

With  $\underline{s}$  the half-integer spin of elementary [fermions](#) or positive integer spin of elementary [bosons](#).

**[This explains why no spinless elementary particles have ever been observed in any experiment!](#)**

N.B. In July 2012 it was assumed that a spinless [Higgs-boson](#) was discovered at an invariant rest-energy of about 125.6 GeV in the first run of the [LHC](#). However, the average decay-time of this detected Higgs-boson is of the order of  $10^{-22}$  sec.. So, even if this [Higgs-boson](#) travels with the [lightspeed](#)  $c$  it can't reach the surrounding electron of an hydrogen atom.

Right now it is assumed that the [Higgs-field](#) is a field in the background which slows down the speed of masses as a result of interaction with the masses of [elementary particles](#). But the [rest-mass](#) of the (very unstable) [Higgs-boson](#) is of the order of 5/7 of the mass of the heaviest elementary particle, the [top-quark](#). As a result different speeds with respect to the [Higgs-field](#) should result in deviations in the experienced rest-masses of elementary particles. In other words, based on relativity the idea of a so-called “background” is experimentally proven incorrect because in this case invariant [rest-mass](#) would not be a constant anymore.

So, a very massive elementary spinless [Higgs-boson](#) resulting in an **EXTREME** unstable so-called [Higgs-field](#) assumed to be present in the “background” is not possible according to [Albert Einstein](#) his 100% correct beautiful Theories Of Relativity of more than a century ago!

In 2004 [Grigori Perelman](#), under guidance of [Prof. Dr. Richard Hamilton](#) at the [Stony Brook university](#) in New York, [had shown](#) that mathematical knots are only possible in 3D-space, i.e. relativistic 4D-spacetime. He did this in his investigation of [Ricci-flow](#) as developed, among others, by Richard Hamilton. Always massive [fermions](#) described as harmonic oscillating waves in the 2D-plane orthogonal to the direction of motion allow knots in their traveled paths. As a result of this “simple” mathematical fact, **only** 4D-spacetime is possible to describe [fermions](#), the primary sources of all possible force, i.e. [boson](#),-fields.

As a direct result of [Perelman's](#) discovery, all correct analysis of physics can **only** be correct using an easy imaginable 4D-spacetime analysis. Because all primary sources of forces are [fermions](#), which have to be described with open-[BC](#) and as a result of that must all possess non-zero masses. And as a result of that curvature to comply to the [CAP](#) can **ONLY** be analyzed in this easy imaginable 4D-spacetime!

And this is just the well-known easy-imaginable space-time used in SR. All possible GR invariant expressions are so-called ( $4^n$ -Dimensional) tensors of any non-negative integer degree  $n$ . For example a scalar has degree 0, a 4-vector has degree 1, a transformation-tensor has degree 2 and the [Riemann-Christoffel](#) tensor has degree 4. Remember that not all matrices of any degree  $n > 1$  are also GR tensors! All Einstein his final results of GR where 4D-spacetime expressions because the higher dimensional Riemann-space did not seem imaginable. However, it now appears that the additional Riemann-degrees of freedom to describe “curvature” can only be described in the easy imaginable complex 4D-spacetime itself.

The **only possible mathematical** treatment, with **VERY easy** (i.e. **LINEAR**) mathematical tools, to analyze still assumed difficult “**PHYSICS**”, i.e. [QM](#), **MUST** be analyzed with the

## **ONLY ALLOWED 4D-SpaceTime**

analysis! And these easy imaginable **ONLY** allowed mathematical Space-Time analyses can “mathematically” **ONLY** be solved with an easy [SR](#), that is **linear**, 4D-spacetime analysis!

**With this knowledge, we are now able to derive a complete non-reducible TOE:**

In 4D-spacetime all kinds of 4-vectors and higher dimensional matrices and, of-course, invariant tensors may be transformed at [SR](#), i.e. infinitesimal, level with an easy to understand mathematical  $4 \times 4 = 16$  degrees of freedom transformation-tensor (i.e. not an arbitrary  $4 \times 4$  matrix to yield GR-transformation invariant expressions). The most general expression of this transformation-tensor is a  $4 \times 4 = 16$  independent degrees of freedom tensor and this tensor  $T_{\mu\nu}$  can be written in just one unique way as the sum of a symmetrical  $S_{\mu\nu}$  transformation-tensor and an orthogonal anti-symmetrical  $A_{\mu\nu}$  transformation-tensor:

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

Besides (4D-)Space-Time symmetries we of-course also have complementary reciprocal-(i.e. Momentum-Energy) symmetries and other necessary  $\leq 4D$ -symmetries, like the 4D-**complete non-reducible** well-known **beautiful but still NOT understood**, [U\(1\) x SU\(2\) x SU\(3\)](#) gauge-symmetry of the [SR SM](#).

The CAP demanded extensiveness of elementary particles results into mathematical interpretative SR representations of spin, i.e. spin-representations. This is why we are able to represent all possible 4D-spacetime transformations (3) with extended mathematical spin-representations.

The symmetrical tensor  $S_{\mu\nu}$  can, according to the CAP mathematically also be represented by  $\text{spin}2 \times \text{spin}1/2$ . The  $\text{spin}2$  action represents the symmetrical gravitational-field and the  $\text{spin}1/2$  represent all the masses of compound (meson (also gluon), baryon) and elementary (lepton) particles. All masses of elementary particles depend on arbitrary mass-averages in (the only possible) 4D-spacetime. As a result of this mathematical fact masses of elementary particles cannot be related to one-another on mathematical grounds. However, the masses of particles and anti-particles must ALWAYS be exactly the same, because the  $\text{spin}2$  and the  $\text{spin}1$  actions are mathematically completely orthogonal. The fermions must be CAP described as harmonic oscillating waves in the 2D-plane orthogonal to the observed direction of motion. Their DE have to be solved with open-BC and as a result of this mathematical fact only fermions allow more so-called “families” with only different rest-masses.

As a direct result of this fact the masses of fermion “families” must also be mathematically related, i.e. depend on each other on “easy” mathematical grounds.

The anti-symmetrical tensor  $A_{\mu\nu}$  is in the same way mathematically uniquely re-presentable by  $\text{spin}1 \times \text{spin}1/2$ . The  $\text{spin}1$  action represents the anti-symmetrical EM-field and the  $\text{spin}1/2$  represent the sources, that is the charges of compound (meson, baryon) and elementary (lepton) “stable” particles all in integer amounts  $\{-1, 0, 1\}$  of the so-called “stable” electron-charge e. Only “intrinsic” unstable particles can possess other non-integer charges, such as the “still NOT understood” QM SU(3) quarks, which experimentally always appear in couples of 2 quarks (mesons including gluons) or 3 quarks (baryons) in a so-called quark-sea.

Gravitation, i.e. compliance to the CAP, mathematically implies a duplication of degrees of freedom, because it is a “dual”  $\text{spin}2$  characteristic. This characteristic can of-course only be described in the only possible analyzable 4D-spacetime to mathematically allow knots! As a direct consequence, the “dual” character due to curvature must be described in

## *easy imaginable 4D-spacetime*

Yet again, choose the direction of motion of an analyzed elementary particle in the positive z-axis. When the space-like-axes are chosen real, the time-axis is pure complex ( $ict$ ), but can figurative still be imagined in the same positive z-axis direction of motion. Curvature in this complex 2D-plane is a so-called “macroscopic” effect of curvature and a result of mass-space and mass-speed distribution around the described elementary particle. As a result of enforced averaging among countless elementary particles this mathematical description results into easy Gaussian-like uncertainty. The “macroscopic” first effect of curvature was for the first time described in a logical approximation by Karl Schwarzschild to describe the orbits of the planets of our solar-system around the (approximated non-rotating point-like) sun. The second effect of curvature must be analyzed “microscopic”, i.e. by describing the paths of elementary particles as harmonic oscillating waves in the 2D-plane orthogonal to described direction of motion. This at once explains why all elementary particles must possess so-called “intrinsic” energy proportional to a frequency. Actually, this explains why this energy is not “intrinsic”, but that all possible elementary particles must possess a non-zero (always-assumed incorrect) “intrinsic”-size! The word “intrinsic” only reminds the reader of the fact that this size is too small to be observed in any possible experiment. When reading formula (2), it is at-once clear that “spinless” elementary particles are NOT extended in the mathematical completely analyzable 2D-plane orthogonal to the direction of motion, so can't carry energy proportional to a frequency. Such particles have been proven incorrect experimentally in all experiments up to this very day, because all detected elementary particles possess energy proportional to a not-always (graviton) detectable energy-frequency of accelerated motion

When describing physics in compliance with the [CAP](#) one can only use a *symmetrical-complex* (SR) 4D-spacetime analysis (*to be able to also describe knots mathematically*)! In this analysis all [elementary particles](#) must be described as perfect harmonic-oscillators in the 2D-plane orthogonal to the direction of motion. Circular symmetry around the axis of propagation implies that [fermions](#) must be described with open-BC (masses > 0 and possibly more, our universe has 3 different, “[fermion](#)”-families) and force-particles, i.e. [bosons](#), with mathematical necessary closed-BC. Only uncharged elementary particles may be massless and this explains completely why only the “invisible” spin2 graviton and always [EM-“visible” spin1 photon](#) force-carrier [bosons](#) are and also *must* be massless.

High respected Prof. Dr. [Jan de Boer](#), you have a demanding and to me very “interesting” job at the [University of Amsterdam](#), so it's obvious to me that you can't spare the time to visit me personally! However, after all the results of the re-started [LHC](#) will proof that my *easy* mathematical analysis of the *ONLY* possible [Theory Of Everything](#) is in fact proven 100% correct and unique you may always visit me at my home-address given below!

So, if you decide to enable yourself the time to discuss logical theoretical (i.e. easy imaginable only possible 4D-spacetime mathematical) physics, i.e. “completely logic understandable” QM with me, please contact me at the following address in beautiful [Zuid-Beveland](#) just above the small village [Oud-Sabbinge](#) with less than 300 inhabitants:

But despite our 100% different mathematical views, I still want to meet you, because I need logical feedback of my gained insight of the ONLY POSSIBLE 4D-spacetime analysis of the ONLY POSSIBLE and SIMPLE analyzable analysis of our everyday experienced reality, i.e. the [Theory Of Everything](#)!

Please also visit my website!?!)

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