

The photon is the building-block of the EM-field:

[Elementary particles](#) must comply to the [Comprehensive Action Principle](#). This implies that all fields, i.e. the $U(1) \times SU(2) \times SU(3)$ anti-symmetrical gauge-fields, the symmetrical spin2 graviton and all possible [Fermi-fields](#), must *always* be described using a gravitational-curved mathematical analysis! [Albert Einstein](#) proved necessary compliance to the [CAP](#) during the time he was solving his equations of [General Relativity](#). And this compliance can only be taken into account by including curvature of 4D-spacetime in the mathematical analysis: Describe [elementary particles](#) as harmonic oscillating waves in the 2D-plane orthogonal to the direction of movement. As a result, [elementary particles](#) cannot be point-particles which carry a field, but they themselves are mathematically the full non-reducible representation of this field. From this perspective, the photon mathematically is the complete irreducible representation of the [EM-field](#) and its oscillation represents all characteristics of this so-called pure linear, i.e. “[mathematical easy](#)” imaginable [EM-field](#) in a “curved background”.

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 (τ, ρ, φ, 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 2π 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 theoretical 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 (τ, ρ, φ, z) seem the best coordinates to solve the [Differential Equations](#) exactly.

The time τ 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 of motion 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 τ . The resulting [DE](#) are to a higher order in ρ than the maximum order that permits exact solutions.

However, the [DE](#) for ρ 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 ρ .

The 2nd 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](#) $\varphi = \frac{1}{2}(\sqrt{5} + 1) = 1 + 1/\varphi$. 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 fundamental different** 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 degree of freedom of the 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:

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

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

Compliance to the [CAP](#) can be imagined very easily. The well-known [Feynman-diagrams](#) used in High Energy Physics show elementary particles moving along 1D-worldlines and shows possible interactions between [elementary particles](#) using 1D-interaction-points called vertices. These very easy imaginable diagrams will have to be re-read with another meaning of the shown 1D-worldlines. The [CAP](#) results in extended [elementary particles](#) described as harmonic oscillating waves in the 2D-plane orthogonal to the average path given by the SR worldline in the [Feynman-diagrams](#).

This can be imagined with the following picture:

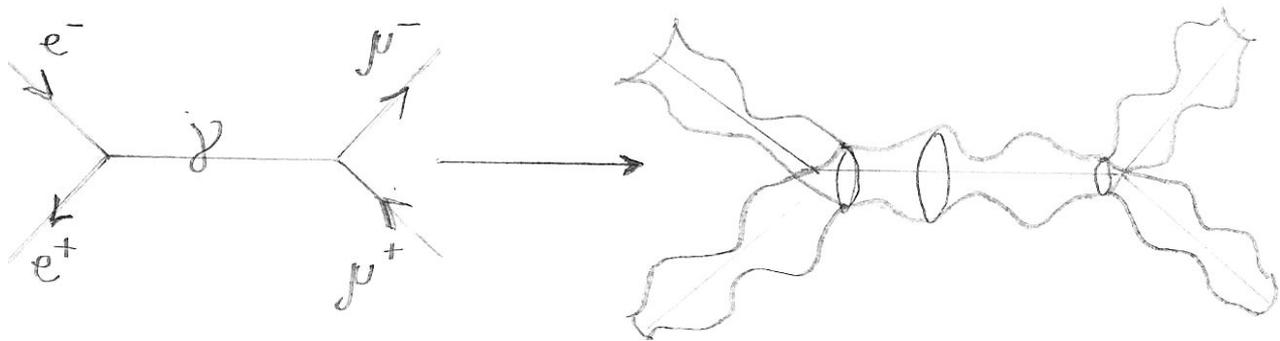


Figure 1 A Feynman-graph of an electron-positron collision into a spin1 photon resulting in a final muon anti-muon pair and its CAP required replacement by extended harmonic-oscillating wave-particles. The fermions have to be imagined as open-oscillating rags which melt together into a closed oscillating tube representing the spin1 photon. In this way the conserved sum of all interacting spins can be connected to the open- and closed-oscillating fermions and bosons respectively.

An electron and a positron are able to melt together into a photon, which after a little time break-up again in for example a [muon](#) and it's anti-muon, i.e. a set of two fermions again with a total charge equal to the zero-charge of the spin1 photon. The two clashing [fermions](#) have to be described with open-BC and as a result of that can be imagined as two harmonic oscillating and thus waving rags with open-ends on both sides. In the melting together of the two [fermions](#) the open ends get connected and result in a closed-oscillating tube with a conserved spin1 [helicity](#).

In the same way, one can also observe the process of an harmonic-oscillating photon breaking-up into an electron-positron pair which annihilates itself into a photon again after a “little” time. These processes in the “background” of-course also require a so-called [aether](#).

Our “[Aether](#)” came to life with the [Big Bang](#) of our universe. This background is expanding with speeds up to the light-speed for massless particles, i.e. the only two [elementary bosons](#), the spin1 [photon](#) and (EM-invisible) spin2 [graviton](#). This is the main reason why most energy of our [universe](#) is invisible: It must be invisible [gravitational energy](#).

[Mathematics](#) is a simple linear analysis and compliance to the [CAP](#) implies a mathematical analysis in all possible and also required 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 *beautiful* 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-(z,ct) 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 mathematical **NOT-understood** [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!?!** The answer is **NO**, because this “simple” mathematical analysis is incorrect because it cannot describe mathematical knots (i.e. can **NOT** describe massive [fermions](#)) and secondly also doesn't allow a mathematical imaginable view on our own existence!

[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} seconds. So, even if this [Higgs-boson](#) travels with the [lightspeed](#) c it can't reach the surrounding electron of an hydrogen nucleus.

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, a so-called Higgs-“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.

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 rest-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 4×4 matrix to yield GR-transformation invariant expressions). 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 generally NOT understood**, $U(1) \times SU(2) \times SU(3)$ 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 (**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 representable 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. A straight forward analysis of the SU(3)-symmetry-group shows that quarks are “intrinsic” unstable spin $1\frac{1}{2}$ fermions without so-called iso-spin. Formula (3) shows that only the spin-values $\{\frac{1}{2}, 1, 2\}$ are able to represent our reality, so quarks can only exist in sets of at least two quarks.

One last recapitulation of the spin2 massless and uncharged elementary graviton:

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 (i.e. $ic\tau$), 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 direct result of mass-space and mass-speed distribution surrounding the described elementary particle. 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. 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 “*i.e. non*-intrinsic” energy proportional to an imaginable 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.

But, the reader must not forget that the **ONLY** mathematical analyses *must* use a mathematical (knots allowing) 4D-SpaceTime analysis to be able to describe fermions in this EASY mathematical analysis!

Please also visit my website!?!

From these easily proven mathematical requirements it is at once clear why only a knot-enabling “mathematical” spacetime analysis is possible to analyze our everyday experienced reality!

And this easy “mathematical” fact is on physical grounds completely ready to be able to derive the **ONLY** possible Theories Of Everything with as only differing characteristic the amount of different Fermi-families!

The amount of different elementary particles is given by: $\sum = 5 + 7 \times n$, with n the amount of fermion-families. The possible half-integer and integer spin-values are $s \in \{\frac{1}{2}, 1, 1\frac{1}{2}, 2\}$. (4)

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