Re-writing Quantum Mechanics Compliant to the CAP explains exactly why QM must be solved in the infinite dimensional Complex Hilbert-Space :

Already 14 years ago, in 2003 Grigori Perelman helped Prof. Dr. Richard S. Hamilton at the Stony Brook University in New York in the Eastern USA proving the Poincaré conjecture with the following 3 papers. In these 3 papers he *at-once* also proved that mathematical (Closed-) Knots can only be described / analyzed in **Easy Imaginable 4D-Spacetime**!

In Albert Einstein his Comprehensive Action Principle he proved that any math. Model of Physics must always include the always dependent Gravitational-Field, i.e. the ***only*** spin 2 ***dual*** symmetrical (orthogonal to all electrical charge related *anti-symmetrical* actions in (*only possible*) 4D-spacetime described by the complete non-reducible Gauge-Symmetry of the (*still not-understood!*) Standard Model: U(1) x SU(2) x SU(3)) only possible spin 2 Symmetrical Graviton which represents the ***dual*** 2 x 10 = 20 degrees-of-freedom of the (*still not-understood!*) Gravitational field!

Compliant to the CAP Elementary Particles must be analyzed / described ***dual*** as:

Ideal Harmonic Oscillating (math.) Point-Waves in the 2D-Plane Perpendicular to the Direction-of-Motion (SR worldline) with CAP *dual* Closed- or Open- Boundary Conditions.

Closed-BC describe all stable Elementary and Compound Force-Particles called Bosons with conserved integer spin-values (multiplied by ħ Dirac's Constant h-bar). Elementary Bosons possess CAP-***dual*** only two different integer-spin values: **s** ∈ {1, 2}. Only if elementary bosons carry zero charge-density in their ideal harmonic oscillating paths they posses zero rest-mass. CAP-compliant only two orthogonal (elementary) bosons have zero rest-mass: The orthogonal Symmetrical spin 2 Graviton with 10 x 2 = 20 degrees-of-freedom and the Anti-Symmetrical spin 1 Photon representing the 6 x 1 = 6 degrees-of-freedom EM-field. This explains why the Gravitational field is invisible.

Open-BC describe all stable Elementary and Compound Matter-Particles called Fermions with conserved half-integer spin-values. Elementary Fermions possess CAP-***dual*** only two different half-integer spin values: **s** ∈ {½ , 1½} (multiplied by ħ). All Leptons posses conserved spin ½ in the direction-of-motion and all Quarks (described by the SU(3) Gauge-Symmetry) posses conserved spin 1½ in the direction-of-motion.

As a direct consequence, conserved Spin in the direction-of-motion should actually be described math. as '*Ideal Harmonic Oscillating Point-Waves in the 2D-Plane Orthogonal to the Direction-of-Motion*' as Explicitly described conserved Spin. These CAP-***dual*** compliant analyses at-once explain why all observed QM-Particles always posses Energy Proportional to a Frequency.

The average extensiveness described from the inertial-frame with origin moving at the average position of the oscillating wavelike-particle can be given in polar-coordinates by:

$$2\langle\rho\rangle = \rho_{max} + \rho_{min} = 1\tfrac{1}{2}\,\rho_{max} = 3\,\rho_{min} = \mathbf{s}\cdot \text{Golden-Ratio}\cdot \text{Planck-length}, \qquad (1)$$

with **s** the CAP-***dual*** half-integer conserved spin in the direction-of-motion **s** ∈ {½ , 1½} or integer conserved spin in the direction-of-motion **s** ∈ {1 , 2} multiplied by h-bar to obtain conserved angular-momentum [kg·m²/s].

The conserved spin in the direction-of-motion is the result of Circular-Symmetry of the wave-function when rotating it around its axis of motion by an angle $\delta\varphi = 2\pi/\mathbf{s}$ (2)

When rotating an elementary spin 2 Graviton one complete circle of 2π radians around its described direction-of-motion the wave-function repeats itself ***dual*** twice.

This explains the ***dual*** mathematical character of the spin 2 Graviton and why compliant to the CAP this ***dual*** characteristic must be included in the complete orthogonal sets of complete non-reducible symmetry analyses.

The complete irreducible anti-symmetrical 'spin 1' Gauge-Symmetry is: U(1) x SU(2) x SU(3) (3)
The U(1) x SU(2) describe mixed by the Weinberg angle the U(1) Photon and the weak-nuclear force elementary bosons {W+, W-, Z}. The SU(3) Gauge-Symmetry describes the 3 Fermi-Families of ***dual*** CAP-compliant Quarks as spin 3/2 Fermions without in-correct assumed 'isospin'.

Elementary spin ½ Fermions miss half of the degrees-of-freedom, because their wave-functions must be rotated over $2 \times 2\pi = 4\pi$ radians to obtain the same extended wave-function again. This explains why neutrino's with non-zero ideal harmonic oscillating charge-densities in the 2D-plane orthogonal to the direction-of-motion with conserved non-zero Bohr-magneton only posses left-handed Chirality while all anti-neutrino's only posses right-handed Chirality.

When analyzing the spin1½ quarks which are always surrounded by a so-called Quark-Sea because they can't exist on their own the wave-function of a quark repeats itself after $\delta\varphi = 1\frac{1}{3}\,\pi$ radians (almost equal to spin 1 bosons). All compound sets of quarks posses stable conserved spin-values.

However, Quarks are not stable on their own and always appear surrounded by a Quark-Sea as compound Bosons with spin 1 and compound Fermions with spin ½.

The most general non-reducible transformation-tensor $T^{\mu\nu}$ of a 4-vector is described as the sum of two orthogonal contributions: $T^{\mu\nu} = A^{\mu\nu} + S^{\mu\nu}$ (4)

The first transformation-tensor is the Anti-Symmetrical transformation-tensor $A^{\mu\nu}$ with 6 degrees-of-freedom and the second transformation-tensor $S^{\mu\nu}$ is the Symmetrical transformation-tensor with 10 degrees-of-freedom.

CAP-compliant Elementary Particles are described with explicitly described conserved angular-momentum in the direction-of-motion. This allows expressing the 2 orthogonal transformation tensors of (4) to be represented with spin-representations:

$$T^{\mu\nu} = A^{\mu\nu} + S^{\mu\nu} = \text{spin } \tfrac{1}{2} \times \text{spin } 1 + \text{spin } \tfrac{1}{2} \times \text{spin } 2 \quad (5)$$

This explains why the only observable conserved 'Angular-Momentum' called Spin values are:

$$\mathbf{s} \in \{\tfrac{1}{2}, 1, 2\} \text{ multiplied by h-bar} \quad (6)$$

This completely explains why anti-symmetrical SU(3) Gauge-Symmetry Quarks must be analyzed as always compound sets of spin 1½ quarks with as only possible compound conserved spin-values in the direction-of-motion: $\mathbf{s} \in \{\tfrac{1}{2}, 1\}$ multiplied by h-bar, (7)

of stable triple Baryon's and dual stable ***still not-understood*** so-called spin 1 anti-symmetrical Meson's and Gluon's.