S-matrix masterformula in Topological Geometro-Dynamics framework

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Abstract

The aim of the talk is to provide an overall view about recent progress in Topological Geometro-Dynamics (TGD).

a) The infinite-dimensional Clifford algebra (CLA) generated by the gamma matrices of infinite-dimensional space of 3-surfaces in $H = M^4 \times CP_2$ is a von Neumann algebra known as hyper-finite factor of type II_1 (HFF). The infinite-D CLA generalizes to an analog of a local gauge algebra only for $D = 8$ utilizing quantum counterparts of complexified octonions as quantal 8-coordinate. TGD emerges from this structure with dynamics dictated by the associativity condition.

b) The proposed physical interpretation for Jones inclusions of HFFs generalizes the notion of imbedding space and implies a quantization of Planck constants associated with M^4 and CP_2 degrees of freedom as integer multiples of integer n characterizing the quantum phase $q = \exp(i\pi/n)$ associated with the Jones inclusion. Large n phases correspond macroscopically quantum coherent dark matter expected to be of special importance in biology.

c) The quantum measurement theory based on Jones inclusions emerges. Zero energy ontology (ZEO) means that physical states have vanishing net quantum numbers. Positive/negative energy components are interpreted as incoming/outgoing particles of particle reaction. S-matrix defines entanglement coefficients between positive and negative energy components of the state with Tr(Id)=1 condition (true for HFFs) guaranteing unit norm of these states. Quantum measurement can never lead to a pure state but only reduces the entanglement (hologram property). The almost triviality of the scattering between zero energy states (higher level process) guarantees that the conventional positive energy ontology is a good approximation in time scales of sensory perception.

d) S-matrix elements are expressible in terms n-point functions for a conformal field theory (CFT) at partonic 2-surfaces analogous to shock wave fronts and carrying elementary particle quantum numbers. The interior degrees of freedom of space-time surface provide classical correlates for quantum dynamics essential for quantum measurement theory. N=4 super-conformal symmetry due to the covariantly constant right handed neutrino and its conjugate holds true in leptonic sector.

e) There is a connection with M-theory: the Cartan algebra of Kac-Moody algebra, appearing in the vertex operator construction of n-point functions identified as higher-dimensional space-time in string models, has also now 8 "physical" dimensions (11 including longitudinal dimensions).