TGD as almost topological QFT

1. What TQFTs are?

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   (a) TQFTs well-defined quantum field theories trivial from the point of view of conventional physics.

   (b) Only the topology of field configurations of the space in which it is defined matters, magnetic charge, instanton number, winding number holonomies of connection.

   (c) No length scales involved and thus the notion of mass and four-momentum crucial in conventional physics not involved.

   (d) A topological classifation of knots and 3-manifolds using invariants provided by 3D TQFT characterized by Chern-Simons action is an example about TQFT. Witten was the pio neer.

   (e) Important application: topological quantum computation (TQC).

2. Motivations for almost TQFT in TGD:

   (a) Weak form of electric magnetic duality (WFED) implies together with j.A=0 for Kähler action density implies the re reduction of Kähler action to Chern-Simons (CS) terms at the 3D ends of space time surface at boundaries of causal diamond (CD) and at the light-like 3-D orbits of wormhole throats (par ton orbits). CS action alone would define TQFT.

   (b) By super-conformal symmetry one expects similar reduction to occur for Kähler-Dirac action (KD) and give Chern Simons-Dirac action (CSD) at the boundaries or its reduction to a curve defining the boundary of string world sheet.

   (c) At boundaries CS and CSD contributions from Euclidian and Minkowskian regions should differ by a multiplication with imaginary unit coming from the square root of the determinant of induced 4-metric. Does TGD reduce to TQFT?

   (d) No! There are constraints bringing in length scale and coded by weak electric magnetic duality and one obtains only ATQFT.

3. Constraints bringing in induced metric making TGD ATQFT.

   (a) These constraints analogous to those appearing in thermo dynamics and fixing average energy, particle number etc. and bringing in temperature, chemical potential, etc... TGD is indeed "square root of thermo dynamics" in ZEO.

   (b) The Lagrange mul tiplies guaranteeing WFED depend on the induced 4metric.

   (c) The 3-D constraint guaranteeing that the eigenvalues of quantal four-momentum assignable to KD action is equal to Kähler 4-momentum depends on metric.

   (d) The constraint which reduces the boundary terms resulting from KD action to the ana log of M^4 Dirac action with derivatives replaced with 4momenta of fermion lines defined by string ends.

4. Does Kähler action define a topological invariant?

   (a) Kähler action has real part Kähler function coming from Euclidian regions representing lines of generalized Feynman diagrams and imaginary part Morse function coming from Minkowskian regions representing macroscopic space time as a deformation of M^4.

   (b) If preferred extremal depends on the 3-surfaces at the ends of CD or only on 2-D partonic 2 surfaces plus their 4-D tangent space data, then space-time surface with given topology and ends could be seen as a unique representative for space-time surfaces in this class a topological invariant. Kähler action reducing to Chern-Simons terms would represent also topological invariants.

   (c) This would not be new. In manifold topology one can assign to given manifold topology highly unique topology (say hyperbolic manifold) such that the volume in hyperbolic metric serves as topological invariant.

(d) In TGD the situation is much richer since one has sub-manifold topology. Strings can get knotted in 3-D sense and string world sheets can get knotted in 4-D sense. This might have direct applications to topological quantum computation in 4-D sense.