Kähler-Dirac action

1. Kähler-Dirac (KD) action is supersymmetric concomi tant of Kähler action.

   (a) Modified gamma matrices replace induced gamma mat rices. Defined as contractions of canonical momentum cur rents with imbedding space gamma matrices.

   (b) Mixing of M^4 and CP_2 gamma matrices cause mix ing of M^4 chiralities and is a signature for massivation.

   (c) KD gamma matrices vanish for vacuum extremals with vanishing induced Kähler field.

   (d) Anticommutators of KD gammas define effective metric. Physical interpretation?

   (e) Kähler-Dirac equation internally consistent only if an extremal of Kähler action in question. Means super symmetry: one obtains infinite number of supercharge associated with the modes of the induced spinor field.

2. Well-definedness of em charge highly nontrivial condition.

   (a) Presence of induced W fields means that the modes of KD equation in general cannot have well-defined em charge.

   (b) In TGD one cannot locally redefine em charge by going to unitary gauge since the geometry of CP_2 fixes uniquely the direction of em charge as covariantly constant generator of electroweak gauge algebra.

   (c) For spinor modes in CP_2 it is possible to speak about well-defined em charge despite the mixing but it seems that this is not possible for induced spinor fields.

   (d) The problem disappears if the induced W gauge fields vanish. This does not yet guarantee that couplings to classical gauge fields are physical in long scales. Also classical Z^0 field should vanish so that couplings would be purely vectorial. This might be true in long enough scales only.

   (e) For instance, the condition $e^1 = a \times e^0$ and $e^2 = a \times e^3$ with $a^2 = 2$ also to satisfy the conditions. This implies that CP_2 projection is 2-dimensional. More general solutions with non-vanishing Z^0 field are al so possible: now a can depend on position.

   (f) The vanishing of the weak part of induced gauge field implies that the CP_2 projection of the region carrying spinor mode is 2D. Therefore the condition that the modes if induced spinor field are restricted to em neutral string world sheets guarantees well-definedness of em charge.

3. How string world sheets could emerge?

   (a) Additional consistency condition to neutrality of string world sheets is that Kähler-Dirac gamma matrices have no components orthogonal to the 2surface in question. Hence various fermionic would flow along string world sheet.

   (b) If the Kähler-Dirac gamma matrices at string world sheet are expressible in terms of two non-vanishing gamma matrices parallel to string world sheet and sheet and thus define an integrable distribution of tangent vectors, this is achieved. What is important that modified gamma matrices can indeed span lower than 4D space and often do so.

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5. In the proposed scenario string world sheets emerge rather than being postulated from beginning.

   (a) Em neutrality conditions allow also 4D spinor modes if they are true for entire spa time surface. This is true if the space-time surface has 2D CP_2 projection.

   (b) If CP_2 projection is homo logically nontrivial geodesic sphere, this is guaranteed. Are all homologically nontrivial geodesic spheres obtain ed by color rotations em neutral?

   (c) If CP_2 projection is complex manifold as it is for string like objects, this might be also achieved.

   (d) Does the phase of cosmic strings assumed to dominate primordial cosmology correspond to this phase. During radiation dominated phase 4D string like objects would transform to string world sheets!

6. Right handed neutrino is exceptional.

   (a) Electroweak gauge potentials do not couple to at all. Therefore em neutrality condition is unnecessary if the induced gamma matrices do not mix right handed neutrino with left-handed one. This is guaranteed if the M^4 and CP_2 parts of Kähler-Dirac operator annihilate separately right-handed neutrino spinor.

   (b) For covariantly constant right-handed neutrino mode defining a generator of super symmetries KD equation is certainly true. Are there also other solutions?