TGD and GRT

1. Questions:

   (a) Is it really possible to obtain a realistic theory of gravitation if general space-time metric is replaced with induced metric depending on 8 imbedding space coordinates (actually only 4 by general coordinate invariance.

   (b) What happens to Einstein equations?

   (c) What about breaking of Poincare invariance. which seems to be real in cosmological scales? Can TGD cope with it?

   (d) What about Equivalence Principle (EP)?

   (e) Can one predict the value of gravitational constant?

   (f) Does one obtain TGD counterpart of blackhole?

2. Possible answers to the questions 1-3

   (a) The replacement of superposition of fields with superposition of their effects means replacing superposition of fields with the set-theoretic union of space-time surfaces. Particle experiences sum of the effects caused by the classical fields at the space-time sheets.

   (b) This is true also for the classical gravitational field defined by the deviation from flat Minkowski metric instandard M^4 coordinates for the space-time sheets. One could define effective metric as sum of M^4 metric and deviations. This effective metric would correspond to that of General Relativity. This resolves long standing issues relating to the interpretation of TGD.

   (c) Einstein's equations could hold true for the effective metric. They are motivated by the underlying Poincare invariance which cannot be realized as global conservation laws for the effective metric.

   (d) The breaking of Poincare invariance could have interpretation as effective breaking in zero energy ontology (ZEO), in which various conserved charges are length dependent and defined separately for each causal diamond (CD).

3. Possible answers to the questions 4-5.

   (a) EP at classical level would hold true if Einstein's equations hold true for the effective metric.

   (b) The value of gravitational constant is in principle a prediction of theory containing only CP_2 radius as fundamental scale and Kähler coupling strength as only coupling constant analogous to critical temperature.

   (c) In GRT inspired quantum theory of gravitation Planck length scale given by $L_P = \sqrt{\hbar_{eff} \times G}$ is the fundamental length scale. In TGD CP_2 size R defines it and it is independent of h_{eff}. The predicti- on for gravitational constant is as the TGD counterpart of L_P: $L_P^2 = R^2/n$, n dimensionless constant. The prediction for G would be $G = R^2/n \times \hbar_{eff}$.

   (d) This could have important implications if the hierarchy of Planck constants is realized. In particular, Planck mass becomes $M_P = \hbar_{eff}/\sqrt{n}R$ rather than $M_P = \sqrt{\hbar_{eff}/G}$. For instance, if blackhole entropy is given by $S \propto GM^2/h_{eff}$, it would scale as R^2M^2/h_{eff}^2 and approach zero for large values of h_{eff}. If formula $h_{eff} = h_{gr} = GM^2/v_0$, v_0 of order rotation velocity of blackhole holds true, one has $S = v_0/c < 1$ would true: blackhole would be purely quantal object. $h_{gr} = h_{eff}$ is supported by the anomalously high value of gravimagnetic moment of rotating super-conductor

4. Blackholes and TGD.

   (a) Blackhole metric as such is quite possible as effective metric of M^4 . It is however imbeddable in $M^4 \times CP_2$ partially.

(b) The direct imbedding of blackhole metric fails at some radius which can be smaller than Schwarschild radius. This is due to the compactness of CP_2. A general result is that the embedding carriers nonvanishing gauge charge say em charge. This need not (but could!) have physical significance if the met- ric of GRT corresponds to the effective metric obtained by the proposed recipe.

(c) TGD forces to challenge the standard view about black holes. For instance, could it be that blackhole interior corresponds to Euclidian space time region? Could holography hold true in the sense that blackhole horizon would be replaced with a partonic 2-surface with astrophysical size and having light-like orbit as also black-hole horizon has. If the radial component of metric is required to be finite one indeed obtains metric with vanishing determinant at horizon.

5. Entropic gravity and TGD. Does temperature have spacetime correlate?

(a) Entropic gravity was a buzz world for few years ago.

(b) The basic objection is standard QM against it is that gravitational interaction of neutrons with Earth's gravitational field is describable by Schrdinger equation and this does not fit with thermodynamical description.

(c) In Zero Energy Ontology quantum theory can be seen as a square root of thermodynamics formally and this raises the question whether ordinary temperature could parametrize wave functions having interpretation as square roots of thermal distributions in ZEO. The model for cell membrane gives support for this idea. If this were the case temperature would have by quantum classical correspondence direct space-time correlate.

(d) A less radical view is that temperature can be associated with the effective spacetime metric only.