Written questions of COST WG3 discussion session – Sep 5, 2013, Bern

What is quantum gravity? I mean, what correct answer is the theory community able to give, as of today?

Is a BH a BEC of gravitons? What is the status of Dvali and Gomez recent papers?

1. What is the status about finiteness of N=8 supergravity?
2. Suppose this will be shown to be finite. What the consequences would be?

Is N=8 supergravity finite?

Is a quantum theory of gravity necessarily non-local? Put differently, is holography the only way to go?

What types of new phases do you expect? (*probably refers to ads/cmt*)

Do black holes Lorentz contract?

1. Is classical gravity emergent?
2. Is quantum gravity emergent?
3. What is the distinction?

What are the interesting new unexplored problems in (supersymmetric) quantum gravity for a young person to work on?

1. What does space-time look like at the Planck scale?
2. Can I count black hole microstates away from extremality?
3. Is it possible to formulate string theory non-perturbatively and in a background independent manner?
4. Is string theory finite to all orders so that I can call it a consistent theory of quantum gravity?
5. Shouldn't techniques used in loop quantum gravity and asymptotic safety be incorporated in string theory in order to deal with space-time at the Planck scale?
6. Can I use AdS/CFT to understand space-time at the Planck scale?
7. How is the Hawking information paradox resolved in AdS/CFT?

Quantum gravity: How to calculate backreaction in string theory on totally compact backgrounds? E.g. consider type IIB on T^9xR. The string theory is plagues by IR divergence – loop amplitudes diverge in thin/long handle limits. The issue of making sense of string theory on such backgrounds is relevant to e.g. Brandenberger-Vafa cosmological scenario.

Why is it not possible to apply localization to quantum gravity? Or-maybe the better question: is it possible?

AdS3/CFT2: What is known about Farey tails for higher genus g? E.g. what classical BH solutons with given genus 2 boundary do you sum over in the gravity path integral? (cf Xi Yin's paper -> handlebodies?)

1. How to describe scattering of transplanckian gravitons?
2. What is an UV remnant of the BH evaporation process?
3. How does the classical spacetime emerge from QG?

For extremal black holes, well, for small susy 2-charge ones, string theory (fuzzball conjecture) would say that the scale of quantum fluctuations is $R_{Scwharzschild}$. Do these fluctuations exist till the outer horizon when there is a space separating the outer and inner horizons? OR: Is there any understanding of how info about microstates resides on the outer horizon as opposed to the region between the 2 horizons?

What is the "stretched horizon" of a black hole?

BH entropy: what would be the most promising way to explain it? String theory, AdS/CFT, Product of area law (still alive?). What about realistic (non-BPS..) BH?

Are there firewalls? EPR=ER?

Implementation of no boundary proposal in higher spin gravity? (I mean to define NB wave function) Since hs gauge transformations can probably spoil the no boundary just as it can transform away in a black hole horizon…

What is the physical intuition behind higher spin fields? And how exactly can we use higher spin theories to learn more about the nature of quantum gravity?

Is non-equilibrium quantum dynamics important for firewalls and cosmology?

Thermalization in LHC experimental community is important. Can we study in gauge/gravity duality if anisotropies in QG plasmas speed up thermalization? (as it happens in weak coupling)

1. Vacuum for field theory on time-dependent backgrounds (de Sitter, FRW, …)
2. Is subtracted geometry the "natural" box (environment) for a black hole?
3. Local bulk description from the boundary perspective?

What it the relation between thermal and entanglement entropy for different observers? E.g. what is the interpretation of the entropy seen by an accelerated observer in AdS? Through a change of coordinates this maps to a hyperbolic black hole at $M=0$, $T\neq 0$. So Hyperbolic black hole/thermal S $\leftrightarrow$ accelerated obs/entanglement S ???

Do we need (quantum) gravity in order to describe (understand) entangled states?