Holography, Cosmology and Tachyons

Quantum theories of gravity have some unique features compared to ordinary quantum field theories. One such property is the unusual localisation of information. This can be seen even at the level of effective field theory by carefully taking into account the gravitational constraints. In this talk we will mainly discuss implications of gravitational constraints in the context of flat and de Sitter space-times. At the end I'll make some comments about tachyon dynamics on an unstable D-brane which also tells us about an "unusual" localisation of information.

I'll first talk about the simple case of Holography of information on a finite ball in 3+1 dimentional asymptotic flat space-time [1]. By simple field theory analysis of a scalar field coupled to gravity, we can show, working in linearised gravity, that the information of a quantum state available to an observer in the bulk of the ball is also available to an observer living on the surface of the ball.

Next, we will consider implications of the gravitational Gauss' law in de Sitter space-time. The Gauss' law here is more powerful as the spatial slices are compact. We compute cosmological correlators in gravitationally constrained states in de Sitter and show that they are different from the usual Hartle-Hawking correlations [2]. This is in accordance with Holography of information and we argue that one needs to consider an observer state and coarse grain the observables in order to get Hartle-Hawking like correlations.

I'll conclude with a brief discussion of a work in String theory, where we map the tachyon effective field theory to a subsector of Klein-Gordon theory [3]. The result is in agreement with earlier studies in the subject [4] which suggested that the open string theory on the unstable D-brane already knows about the closed string states onto which the D-brane is expected to decay into.

References

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