Institut Henri Poincaré

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String Theory in Greater Paris

Rencontres Théoriciennes

“Supergravité, théorie des cordes et théorie M”

Jeudi 10 Janvier 2019, 10:00

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Niels Bohr Institute

Cosmology from the boundary

Our understanding of physical phenomena is intimately linked to the way we understand the relevant observables describing them. While a big deal of progress has been made for processes occurring in flat space-time, much less is known in cosmological settings. In this context, we have processes which happened in the past and which we can detect the remnants of at present time. Thus, the relevant observable is the late-time wavefunction of the universe. Questions such as "what properties they ought to satisfy in order to come from a consistent time evolution in cosmological space-times ?", are still unanswered, and are compelling given that in these quantities time is effectively integrated out. In this talk I will report on some recent progress in this direction, aiming towards the idea of a formulation of cosmology "without time". Amazingly enough, a new mathematical structure, we called "cosmological polytope", which has its own first principle definition, encodes the singularity structure we ascribe to the perturbative wavefunction of the universe, and makes explicit its (surprising) relation to the flat-space S-matrix. I will stress how the cosmological polytopes allow us to : compute the wavefunction of the universe at arbitrary points and arbitrary loops (with novel representations for it) ; interpret the residues of its poles in terms of flat-space processes ; provide a general geometrical proof for the flat-space cutting rules ; reconstruct the perturbative wavefunction from the knowledge of the flat-space S-matrix and a subset of symmetries enjoyed by the wavefunction.

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