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Weak field and full GR cosmological simulations

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In this talk I will describe progresses in considering GR effects in the dynamics of structure formation. First I will present results of a nonlinear post-Friedman approximation, a kind of post-Newtonian formalism. Then I will focus on recent fully nonlinear numerical relativity simulations. Numerical relativity is a fundamental tool in the modelling of gravitational waves sources, but its application to cosmology is in its infancy. As more interdisciplinary work between the gravitational waves and the cosmology communities will develop, in the next few years numerical relativity may become a fundamental tool for understanding the extent to which we can trust standard newtonian N-body simulations on the largest scales. First results of simulations representing the full GR nonlinear evolution of initial perturbations in a Einstein de Sitter background are: 1) back-reaction effects on the overall expansion of the model are very small; 2) voids expansion rate is significantly higher than that of the background; 3) over-densities can reach turn-around much earlier than predicted by the standard top-hat model. To establish the significance of these results is the goal of future work.

Summary

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