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A relativistic approach to large-scale structure

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As high-redshift galaxy surveys probe ever larger volumes with increasing accuracy there is renewed interest, and some concern, about how the standard results derived within the standard Newtonian approach to large-scale structure should be understood within a relativistic framework. How and when do Newtonian results need to be modified? Relativistic corrections arise in several ways. For instance, the nonlinear constraint equations of general relativity impose different non-Gaussian initial conditions on the primordial density field in specific gauges. However we need to define the spatial and temporal gauge being used in our theoretical models in order to make physical predictions on cosmological scales. As an example, I will show how we may interpret standard N-body simulations most simply as evolution in a specific “N-body gauge”, at least to first order in general relativity. I will also discuss some outstanding issues beyond linear perturbation theory.

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