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Gauge-fixing and spacetime reconstruction in the Hamiltonian theory of cosmological perturbations

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We will present a general formalism for the Hamiltonian description of any spatially homogeneous spacetime in perturbation theory. We will employ and refine the Dirac method for constrained systems, which is very well-suited to cosmological perturbations. This approach includes a discussion of the gauge-invariant dynamics of perturbations as well as an analysis of gauge transformations, gauge-fixing, partial gauge-fixing and spacetime reconstruction. We will introduce the Kuchař parametrization of the kinematical phase space as a convenient tool for studying the gauge transformations. The key element of this approach is the reconstruction of spacetime based on gauge-fixing conditions. Some examples for selected gauges will be presented.

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