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An Almost-FLRW Universe as the Averaged Geometry in Macroscopic Gravity[1] ANISH AGASHE, MUSTAPHA ISHAK, University of Texas at Dallas — The dynamics of the universe are traditionally modelled by employing cosmological solutions to the Einstein field equations. In these solutions, the matter distribution is taken to be averaged over cosmological scales, and hence, the Einstein tensor needs to be averaged as well. To construct such an averaged theory of gravity, one needs a covariant averaging procedure for tensor fields. Macroscopic gravity (MG) is one such theory. It gives the macroscopic Einstein field equations where the effects due to averaging (the back-reaction) are encapsulated in a correction term to the matter distribution. We find solutions to these field equations assuming that the averaged geometry of the universe is modelled by a linearly perturbed FLRW metric. We find several solutions with different assumptions on the functional form and space/time dependencies of the perturbations. These solutions lead to different effective corrections. We write the field equations of MG in linearised form to get the generalised Poisson equation and the dynamical evolution equation for the density contrast. Both these equations now have backreaction terms. It is found that, in general, the effect of averaging is intertwined with the perturbations in a non-trivial manner. That is, the solutions with inhomogeneous perturbations do not reduce to the exact FLRW solutions simply by taking the perturbations to be zero. This highlights the non-linearity of the back-reaction in MG.

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