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Structure formation with causal bulk viscosity

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The inclusion of dissipative effects in cosmic fluids modifies their clustering properties and could have observable effects on the formation of large-scale structures. We analyze the evolution of density perturbations of cold dark matter endowed with causal bulk viscosity. The perturbative analysis is carried out in the Newtonian approximation and the bulk viscosity is described by the causal Israel-Stewart (IS) theory. In contrast to the noncausal Eckart theory, we obtain a third-order evolution equation for the density contrast that depends on three free parameters. For certain parameter values, the density contrast and growth factor in IS mimic their behavior in ΛCDM when z≥1. Interestingly, and contrary to intuition, certain sets of parameters lead to an increase of the clustering.

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