A new Parametrization for Bulk Viscosity Cosmology as Extension of the ΛCDM Model

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Abstract

Bulk viscosity in cold dark matter is an appealing feature that introduces distinctive phenomenological effects in the cosmological setting as compared to the ΛCDM model. Under this view, we propose a general parametrization of the bulk viscosity of the form $\xi \sim H^{1-2s} \rho_m^{s}$, that covers intriguingly some well-known cases in the Eckart's theory. Some advantages of this novel parametrization are: first, it allows to write the resulting equations of cosmological evolution in the form of an autonomous system for any value of s, so a general treatment of the fixed points and stability can be done [1], and second, the bulk viscosity effect is consistently handled so that it naturally turns off when matter density vanishes. As a main result we find, based on detailed dynamical system analysis [2], one-parameter family of de-Sitter-like asymptotic solutions with non-vanishing bulk viscosity coefficient during different cosmological periods. Numerical computations are performed jointly along with analytical phase space analysis in order to assess more quantitatively the bulk viscosity effect on the cosmological background evolution. Finally, as a first contact with observation [3], we derive constraints on the free parameters of some bulk viscosity models with specific s-exponents from background data by using the Markov Chain Monte Carlo method.

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