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Cosmological constraints on an exponential interaction in the dark sector
(2019) *Monthly Notices of the Royal Astronomical Society*, 482 (1), pp. 1007-1016. Cited 9 times.

Abstract
Cosmological models where dark matter (DM) and dark energy (DE) interact with each other are the general scenarios in compared to the non-interacting models. The interaction is usually motivated from the phenomenological ground and thus there is no such rule to prefer a particular interaction between DM and DE. Being motivated, in this work, allowing an exponential interaction between DM and DE in a spatially flat homogeneous and isotropic universe,we explore the dynamics of the universe through the constraints of the free parameters where the strength of the interaction is characterized by the dimensionless coupling parameter ξ and the equation of state (EoS) for DE, wx, is supposed to be a constant. The interaction scenario is fitted using the latest available observational data. Our analyses report that the observational data permit a non-zero value of ξ but it is very small and consistent with ξ = 0. From the constraints on wx, we find that both phantom (wx < -1) and quintessence (wx > -1) regimes are equally allowed but wx is very close to '-1'. The overall results indicate that at the background level, the interaction model cannot be distinguished from the base Γ cold dark matter model while from the perturbative analyses, the interaction model mildly deviates from the base model. We highlight that, even if we allow DM and DE to interact in an exponential manner, but according to the observational data, the evidence for a non-zero coupling is very small. © 2018 The Author(s). Published by Oxford University Press on behalf of the Royal Astronomical Society.

2-s2.0-85057197499
Document Type: Article
Publication Stage: Final
Source: Scopus