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Cascading Dark Energy

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We introduce the Cascading Dark Energy (CDE) scenario, in which one or some of the fields that contribute cooperatively to the recent cosmic acceleration, leave the band (cascade) and start acting on their own by oscillating around their minima. This process, in particular, could happen due to the different initial conditions of the field(s). Due to this dropout and energy injection, the Hubble parameter today increases in comparison with what is expected from the vanilla single field dark energy and CDM. We illustrate the idea through an $N+1$-field model that effectively reduces to a two-field model of CDE. In this work, we assume that the potentials of both fields take the quartic monomial form. We use the publicly available code CosmoMC to constrain our model in the light of the observational data from different sources.} We exactly and numerically solve for the equations of motion for the fields without resorting to the fluid approximations used in the literature. We show that our model fits the data better than the ΛCDM model, and also the single-field scenario with a quartic potential. Our model gives today's Hubble parameter as $H_0 = 70.95^{+0.62}_{-0.85}$ km/s/Mpc at 1σ, which is more consistent with the Riess 2019 measurement $H_0 = 73.03 \pm 1.42$ km/s/Mpc, in comparison with the predictions of the ΛCDM and single-field dark energy models, which are ($H_0 = 68.60 \pm 0.41$ km/s/Mpc). $\Delta\chi^2_{tot}$ gets reduced relative to ΛCDM and single-field dark energy, respectively by 6.51 and 5.8. We conclude that our model can ameliorate the H_0 existing tensions among the cosmological data from different sources.

Primary author: Dr ASHOORIOON, Amjad (Institute for Research in Fundamental Sciences (IPM))

Presenter: Dr ASHOORIOON, Amjad (Institute for Research in Fundamental Sciences (IPM))

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