Early massive clusters and the bouncing coupled dark energy

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The abundance of the most massive objects in the Universe at different epochs is a very sensitive probe of the cosmic background evolution and of the growth history of density perturbations, and could provide a powerful tool to distinguish between a cosmological constant and a dynamical dark energy field. In particular, the recent detection of very massive clusters of galaxies at high redshifts has attracted significant interest as a possible indication of a failure of the standard LCDM model. Several attempts have been made in order to explain such detections in the context of non-Gaussian scenarios or interacting dark energy models, showing that both these alternative cosmologies predict an enhanced number density of massive clusters at high redshifts, possibly alleviating the tension. However, all the models proposed so far also overpredict the abundance of massive clusters at the present epoch, and are therefore in contrast with observational bounds on the low-redshift halo mass function. In this paper we present for the first time a new class of interacting dark energy models that simultaneously account for an enhanced number density of massive clusters at high redshifts and for both the standard cluster abundance at the present time and the standard power spectrum normalization at CMB. The key feature of this new class of models is the "bounce" of the dark energy scalar field on the cosmological constant barrier at relatively recent epochs. We present the background and linear perturbations evolution of the model, showing that the standard amplitude of density perturbations is recovered both at CMB and at the present time, and we demonstrate by means of large N-body simulations that our scenario predicts an enhanced number of massive clusters at high redshifts without affecting the present halo abundance. (Abridged)

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