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Constraints from the CMB temperature and other common observational data-sets on variable dark energy density models

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The thermodynamic and dynamical properties of a variable dark energy model with density scaling as rho_x \propto (1+z)^m, z being the redshift, are discussed following the outline of Jetzer et al. This kind of models are proven to lead to the creation/disruption of matter and radiation, which affect the cosmic evolution of both matter and radiation components in the Universe. In particular, we have concentrated on the temperature-redshift relation of radiation, which has been constrained using a very recent collection of cosmic microwave background (CMB) temperature measurements up to z ~ 3. For the first time, we have combined this observational probe with a set of independent measurements (Supernovae Ia distance moduli, CMB anisotropy, large-scale structure and observational data for the Hubble parameter), which are commonly adopted to constrain dark energy models. We find that, within the uncertainties, the model is indistinguishable from a cosmological constant which does not exchange any particles with other components. Anyway, while temperature measurements and Supernovae Ia tend to predict slightly decaying models, the contrary happens if CMB data are included. Future observations, in particular measurements of CMB temperature at large redshift, will allow to give firmer bounds on the effective equation of state parameter w_eff of this kind of dark energy models.

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