# Testing unimodular gravity and diffusion with observational data

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Perez & Sudarsky 2019 showed that a discrete space-time structure beyond the Planck scale, could manifest in the form of small violations of the conservation of the matter energy-momentum tensor. To include such kind of violations, the theory of unimodular gravity might be invoked.
In the cosmological context, a direct consequence of such violations, might be viewed as a "diffusion process of matter " into an effective dark energy term, represented by the "modified" conservation equation :

$$\dot{\rho}_M + 3(\dot{a}/a)\rho_M = -\dot{\rho}_\Lambda \tag{1}$$

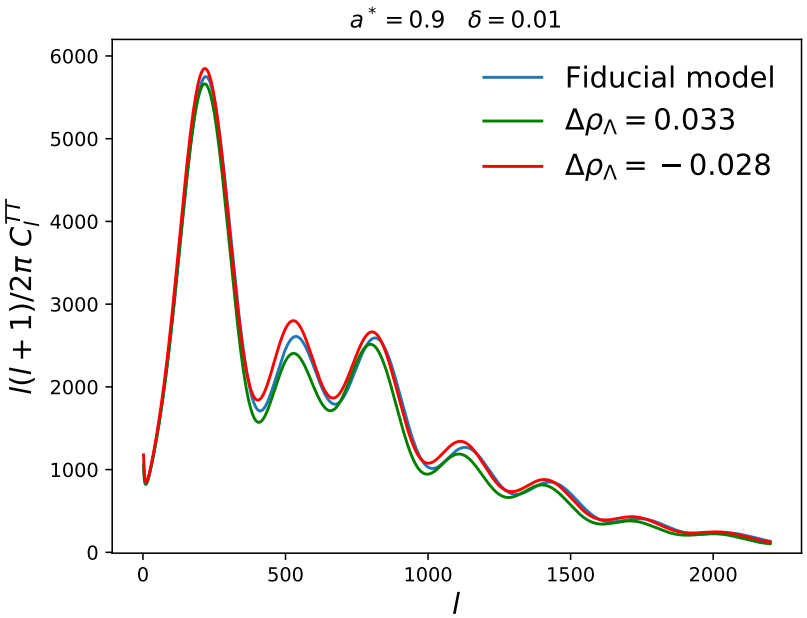
We consider a simple model for the dark energy density :

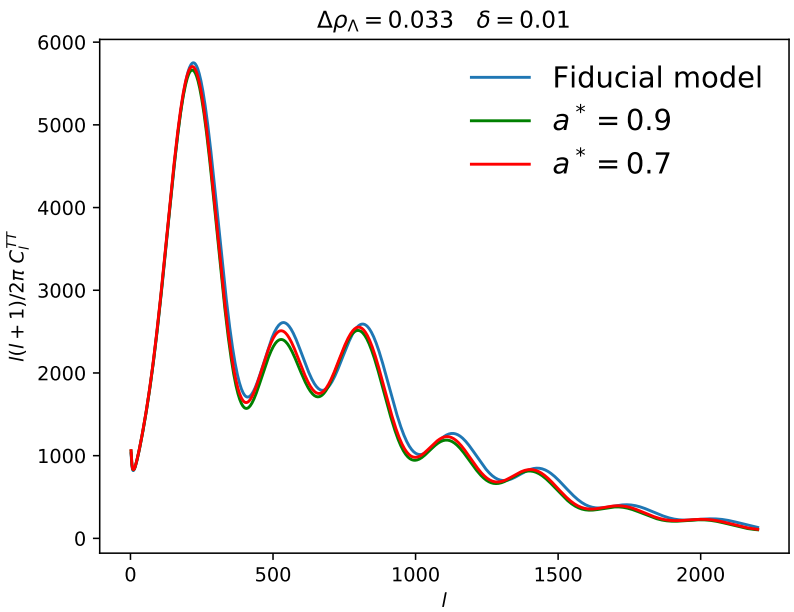
$$\rho_\Lambda(a) = \rho_\Lambda^0(1 + \Delta\rho_\Lambda\,[f(a) - 1]) \tag{2}$$

where:

$$f(a) \quad = \quad \begin{cases} 0 & a \quad \in \ (a_{\rm RAD}, a^* - \delta/2)\,, \\ (1/\delta)[a - a^* + \delta/2] & a \quad \in \ (a^* - \delta/2, a^* + \delta/2) \\ 1 & a \quad \in \ (a^* + \delta/2, a_0)\,, \end{cases} \quad . \tag{3}$$

We want to test this model with recent observational data from the Cosmic Microwave Background, Baryon Acoustic Oscillations, Cosmic Cronometers and Supernovae type Ia. In such way, we expect to obtain constraints on the free parameters of the model: $\Delta\rho_\Lambda$, $a^*$ and $\delta$.




**Fiducial Model: $\Lambda$CDM model with $\Omega_b h^2 = 0{,}0224$, $\Omega_{dm} h^2 = 0{,}119$, $H_0 = 67{,}66$, $\tau = 0{,}056$, $n_s = 0{,}9665$**