Title

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1 Objectives

For LCDM, interacting models, and CPL, calculate

- ξ range for varying EoS while fixing $\Omega m0$
- ξ range for varying $\Omega m0$ or r, while fixing ω
- Does $\xi < 0$ means energy transfer to dark energy in this method?

2 Background

Deceleration parameter reads

$$q(z) = -1 + \frac{1+z}{H}\frac{\mathrm{d}H}{\mathrm{d}z} \tag{1}$$

For interaction models, the Friedmann equaitons,

$$\dot{\rho}_c + 3H\rho_c = Q_c \tag{2a}$$
$$\dot{\rho}_d + 3H(1+w)\rho_d = -Q_c \tag{2b}$$

$Q_c = \xi H \rho_c$ Background equations,

$$\Omega m = \Omega m0(1+z)^{3-\xi} \tag{3a}$$
$$\Omega d = (\Omega d0 + \frac{\xi}{3w+\xi}\Omega m0)(1+z)^{3(1+w)} + \frac{-\xi}{\xi+3w}\Omega m = \bar{\Omega d}0(1+z)^3 + \frac{-\xi}{\xi+3w}\Omega m \tag{3b}$$

$Q_c = \xi H \rho_d$

$$\Omega m = (\Omega m0 + \frac{\xi}{\xi+3w}\Omega d0)(1+z)^3 + \frac{-\xi}{\xi+3w}\Omega d = \omega\bar{m}0(1+z)^3 + \frac{-\xi}{\xi+3w}\Omega d \tag{4a}$$
$$\Omega d = \Omega d0(1+z)^{3(1+w)+\xi} \tag{4b}$$

Eqn 3 and eqn 4 shows that the coupling constant has two effects,

1. Change the amplitude of the evolution of matter or dark energy energy density.
2. Transfer energy between DE and DM.

2.1 Some definitions

1. For short

$$r = \frac{\Omega m0}{\Omega d0}$$

3 Data & Method

3.1 Data

LCDM Parameters From WMAP, $\Omega m0 = 0.265$

Constraints $\Omega m0 = 0.247(+0.013, -0.013)$; Transition redshift 0.426 (+0.082, -0.050).(arXiv:1205.4688, arXiv:astro-ph/0611572).

In ($\Omega m0$, Transition redshift) plane, allowed region is a rectangle centred at (0.274, 0.426) with two diagonal points (0.261, 0.376) and (0.287, 0.508).

CPL $\Omega m0 = 0.269(+0.017, -0.008)$, $w0 = -0.97(+0.12, -0.07)$, $w1 = 0.03(+0.26, -0.75)$

4 Results

Check the files in files folder.