Viability of a quintessence model with inverse power law potential as a dark energy candidate

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The model

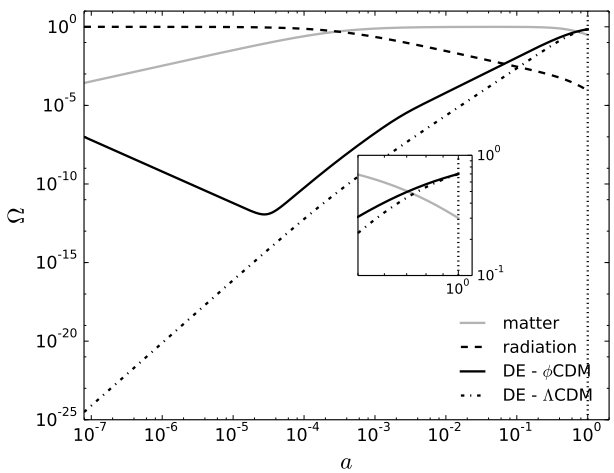
* Starting from the unification scale, the fields of the SM and those of a dark gauge group SU(N_c) redshift as radiation until a condensation scale Λ_c is reached. Below that threshold, the fields of the dark group are no longer free and have to be described by means of an effective field ϕ whose inverse power law potential $V = \kappa\Lambda^{4+\alpha}\phi^{-\alpha}$ can be obtained from the Affleck-Dine-Seiberg superpotential.

* Gauge coupling unification restriction + BBN bounds $\Rightarrow \alpha = 2/3$ & $\Lambda_c \sim 50$ eV.

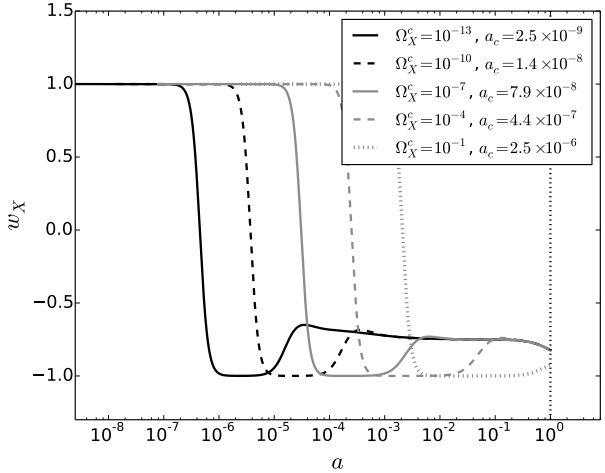
* Free parameters: $\Omega_X^c \rightarrow$ density parameter of the dark group at a_c
  $a_c \rightarrow$ scale factor of the field's condensation

Background evolution

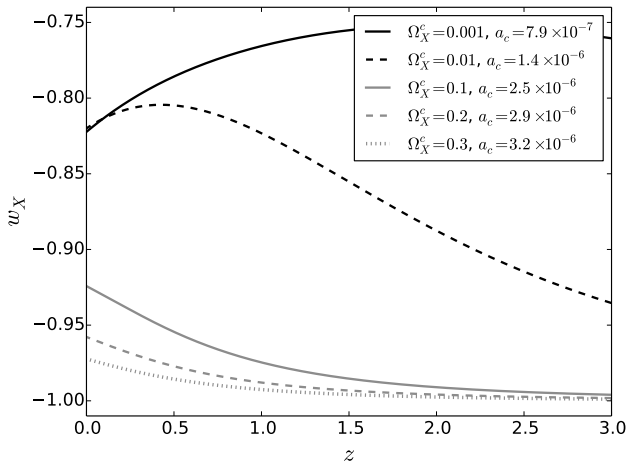
$$H^2 = \frac{8\pi G}{3}(\rho_r + \rho_m + \frac{1}{2}\dot{\phi}^2 + V) \qquad \& \qquad \ddot{\phi} + 3H\dot{\phi} + V' = 0$$



Density parameter

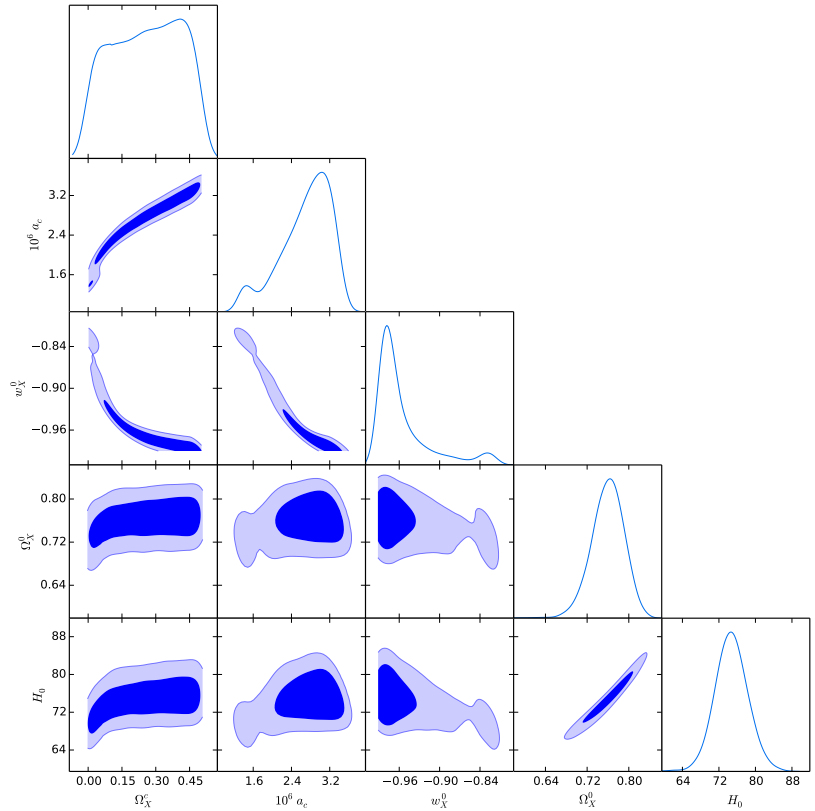


Equation of state



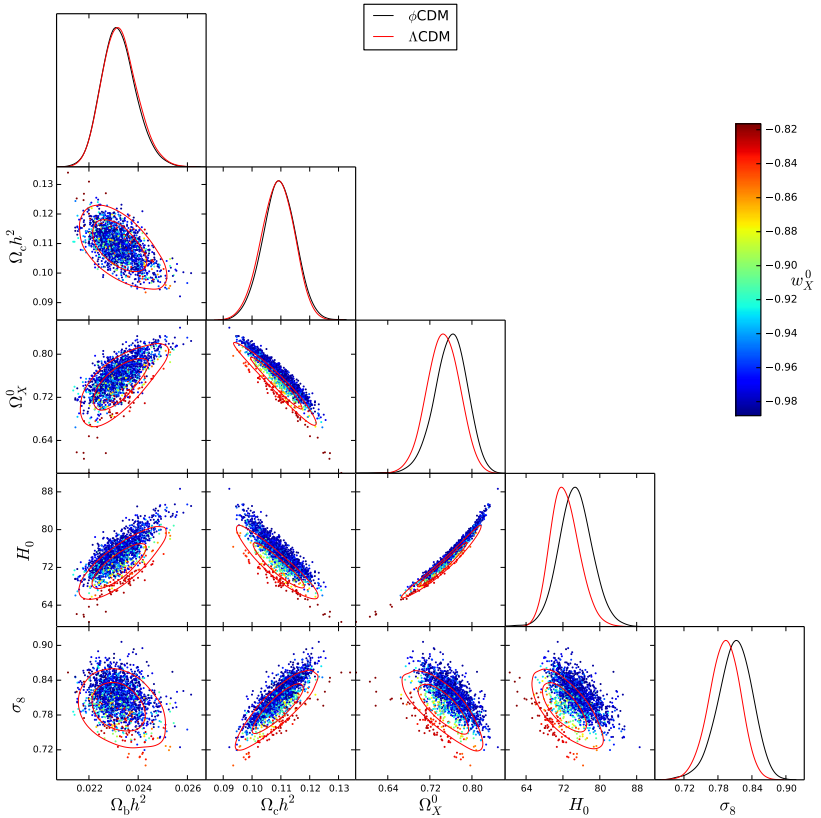
Late-time evolution

WMAP9yr constraints on quintessence parameters



Parameter	Mean $\pm$ Std
Ω_X^c	0.258 $\pm$ 0.146
$10^6 a_c$	2.69 $\pm$ 0.52
κ	1.082 $\pm$ 0.262
w_X^0	-0.964 $\pm$ 0.027
Ω_X^0	0.762 $\pm$ 0.029
H_0	75.18 $\pm$ 3.29

Comparison with ΛCDM



Forthcoming research

* Update to Planck-2013 and Planck-2015

* Inclusion of BAO and SNeIa measurements