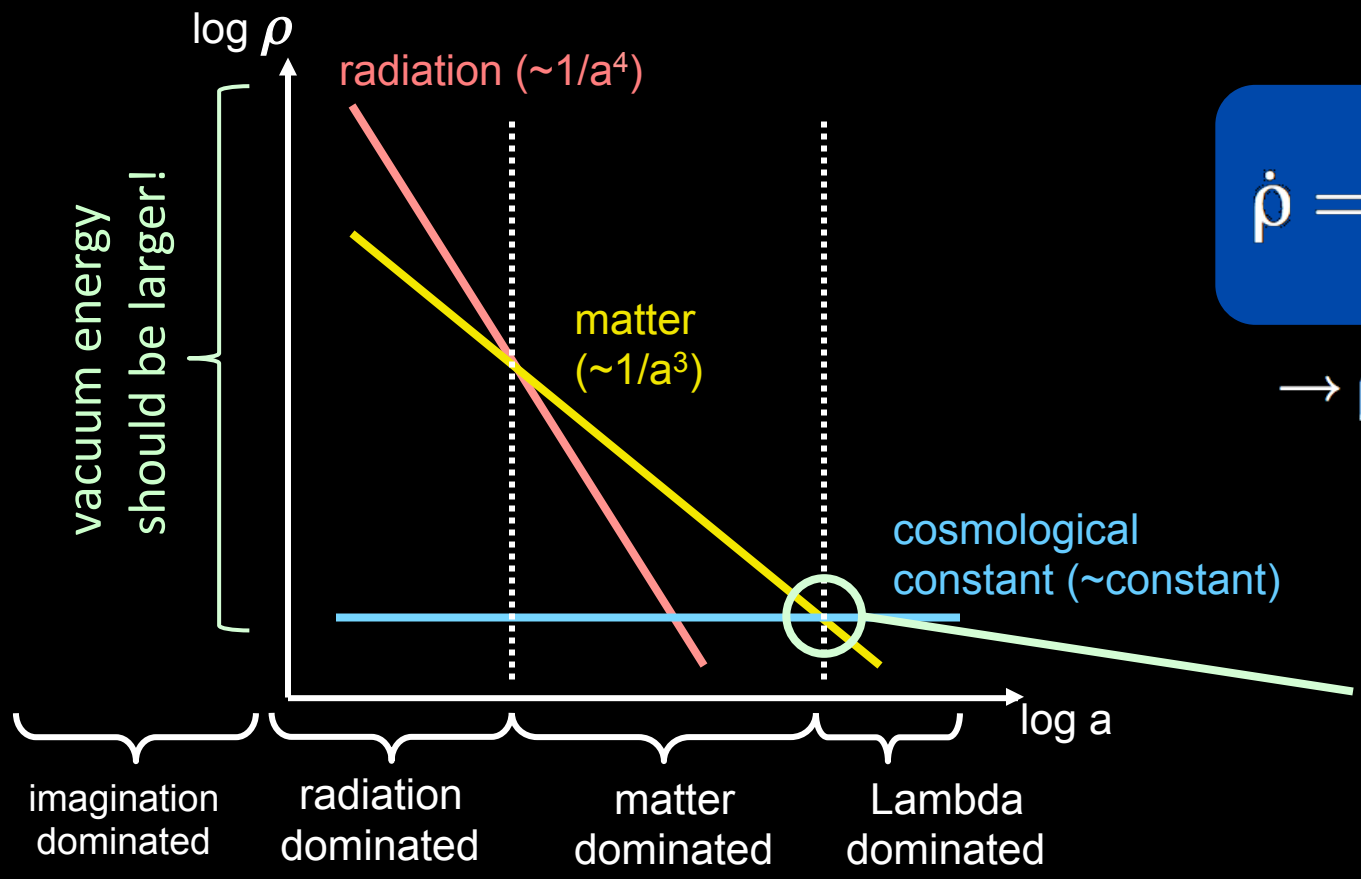
Dark Energy status & highlights

session convener: Martin Kunz (UniGE)

what is the problem?

- The expansion of the universe appears to be accelerating
- This requires something with negative pressure
- the cosmological constant (with p=-ρ) works, but …



$$\dot{\rho} = -3\frac{\dot{a}}{a}(\rho + p)$$

$$\rightarrow \rho(a) \propto a^{-3(1+w)}$$

short period when matter and DE density comparable!

executive summary

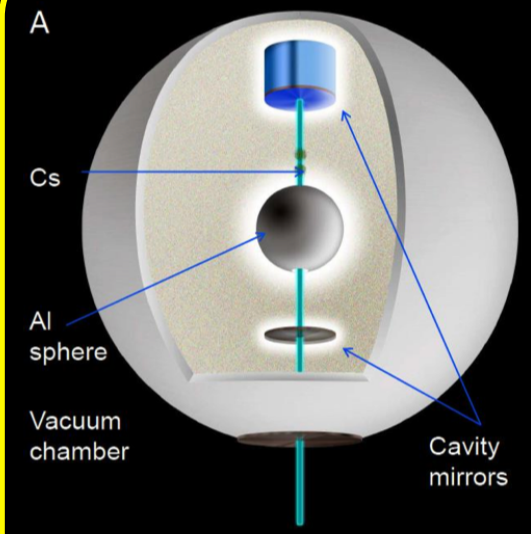
- precision cosmology has arrived
- dark energy (whatever it is) makes up ca 70% of today's energy density
- significance depends on data and modeling, but we need *something*
- a cosmological constant still fits all data, discrepancies O(2σ)*

* terms and conditions apply

summary & highlights: data

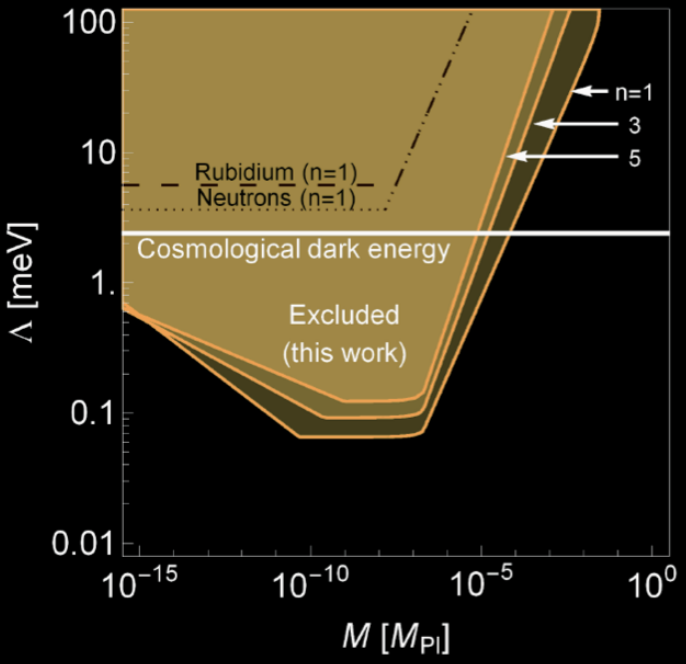
- T. Delubac, high-z BAO from BOSS
- J. Średzinska, tracing dark energy with quasars
- L. Amati, GRB as standard candles
- Ph. Helbig, luminosity distance in inhomogeneous universes
- C. Burrage, testing DE with atom interferometry

summary & highlights: data



Burrage et al 2015

Hamilton et al 2015



most DE models that modify GR need 'screening' or they are ruled out

only a handful screening mechanisms are known

one of them is called 'Chameleon mechanism', and the results presented by Clare Burrage exclude most of its parameter space

- C. Burrage, testing DE with atom interferometry

summary & highlights: theory

- I. Sawicki, sound cones and causality
- M. Rinaldi, Einstein Yang-Mills Higgs DE
- Y. Dirian, Non-local gravity
- and the posters!

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phantom dark energy (p < -ρ, violation of NEC) is en vogue:

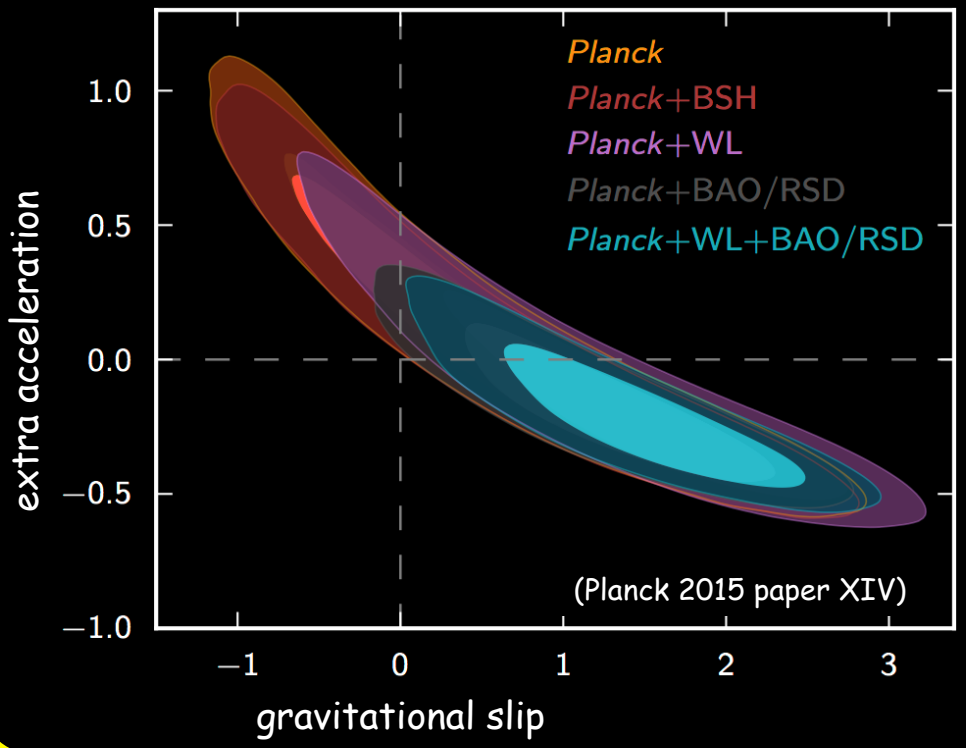
- Rinaldi: $\omega_{\rm eff} = -1 - \frac{w_0^2}{27} = -1 - \frac{g^2 f_0^2 \Phi_0^2}{3M^2 H_0^2}$
- Dirian:

RT: $w_0 \simeq -1.04$, $w_a \simeq -0.02$
RR: $w_0 \simeq -1.15$, $w_a \simeq 0.08$

summary & highlights: parameters

- M. Martinelli, Planck 2015 constraints on DE
- J. Dossett, tensions between CMB and weak lensing data
- M. Ballardini, constraints on scalar-tensor gravity
- C. Heneka, constraints on cold dark energy

summary & highlights: parameters



evolution of perturbations:

Martinelli & Dossett:

- some small discrepancies
- especially in weak lensing data
- (but WL is difficult)

all speakers (M, D, Ballardini, Heneka):

overall good agreement with ΛCDM