Test and Implications of Two Type Ia Supernova Populations for Cosmological Measurements

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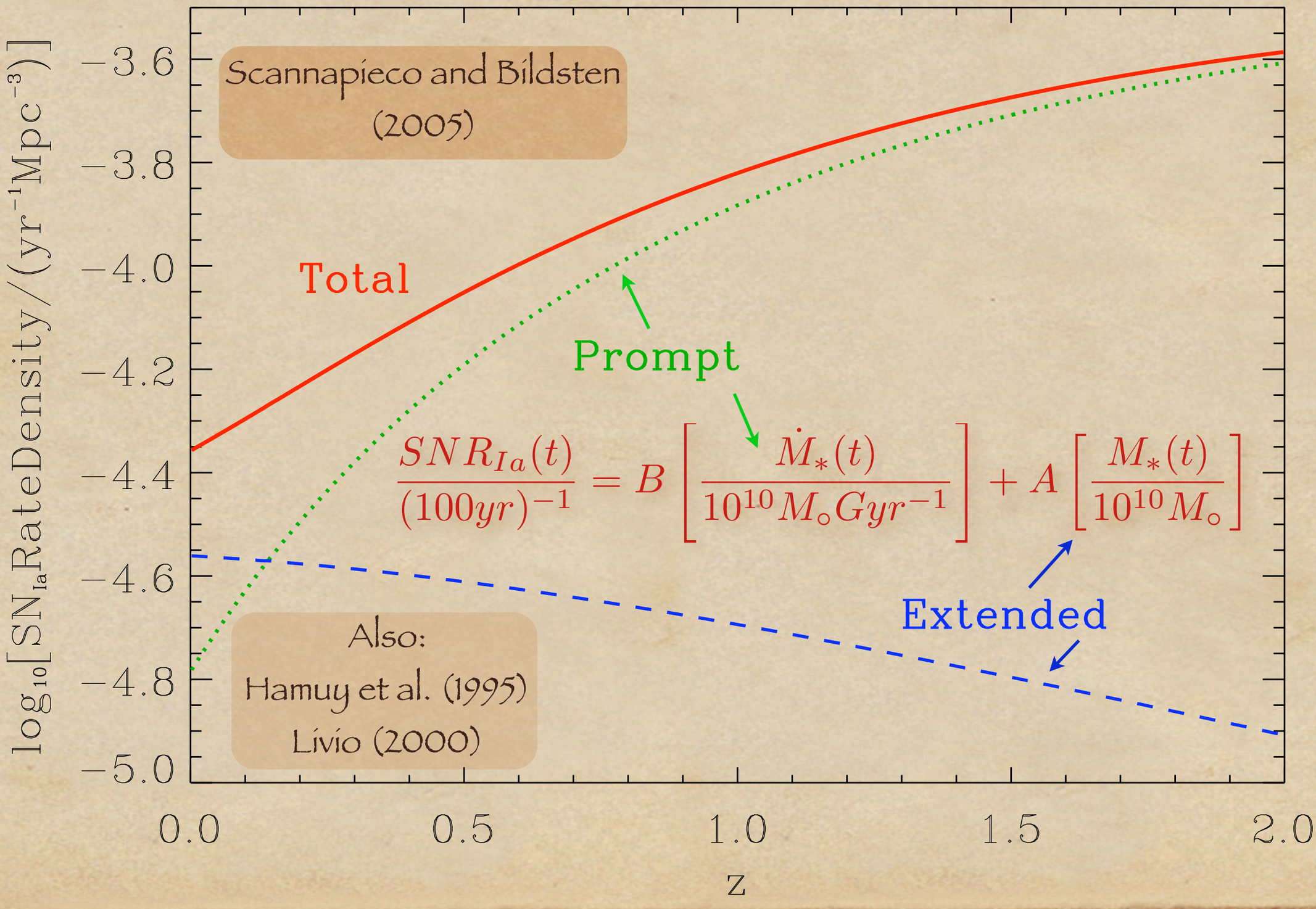
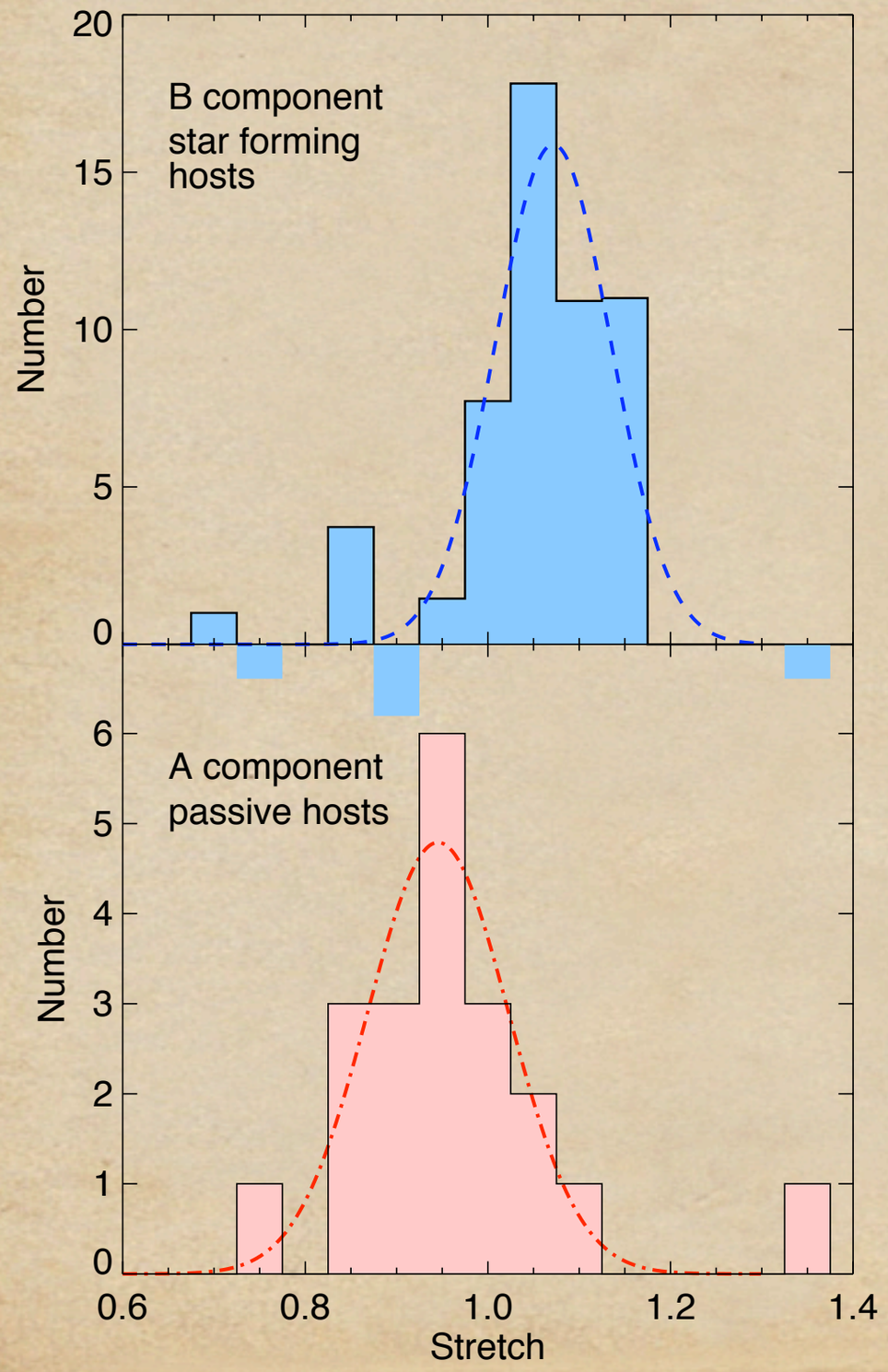
Two Supernova Populations



Two Supernova Populations



$$\mu_B = m_B^* - M + \alpha(s-1) - \beta c$$

Tripp (1998), Guy et al. (2005)

PROMPT

12% Difference

in

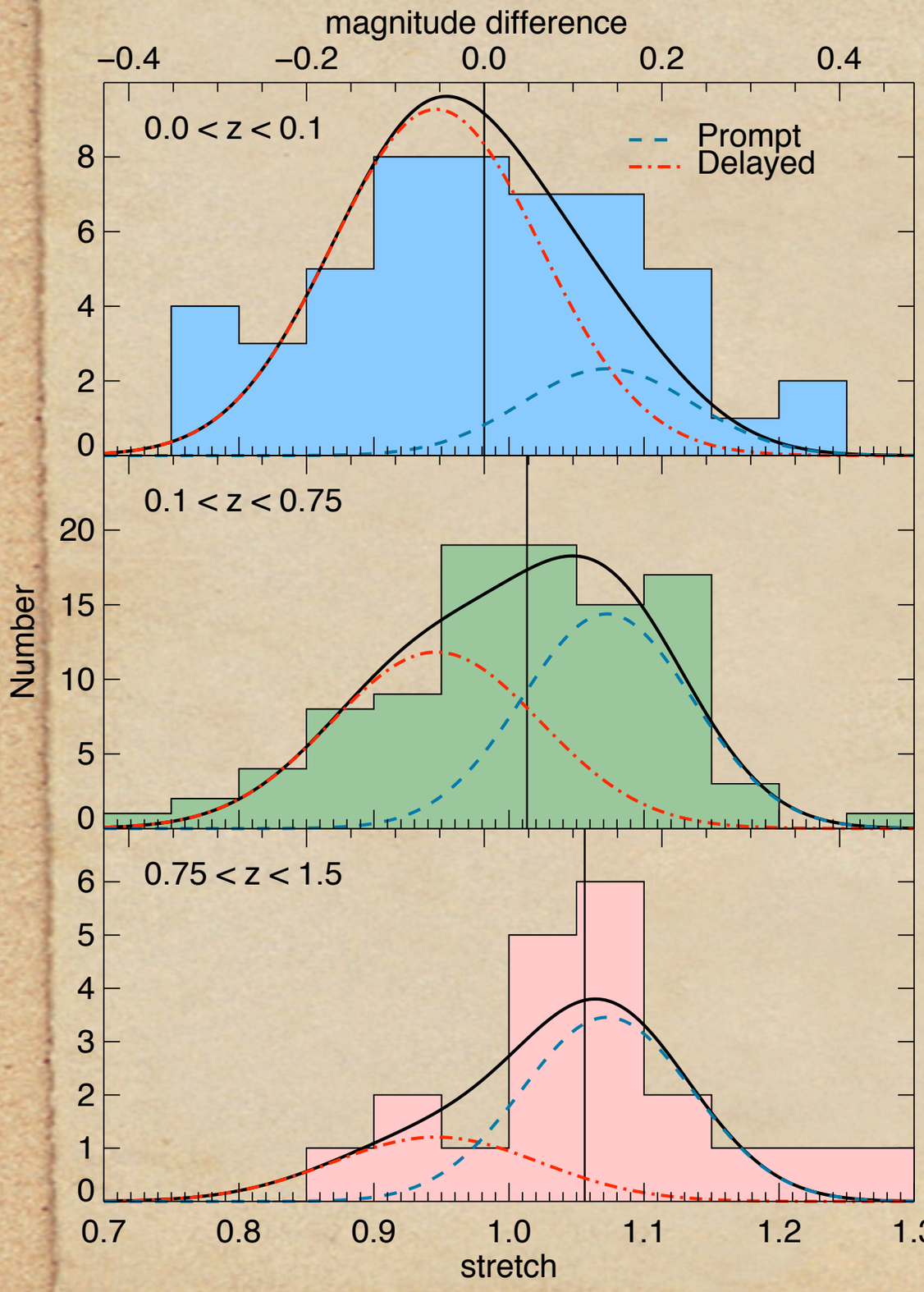
Intrinsic Luminosity

$$\mathcal{L}_P = \mathcal{L}_E + \Delta\mathcal{L}$$

DELAYED

Howell et al. 2007

Data Source: Sullivan et al. 2006 (SNLS)



Median Redshift: 0.026

N=50

Median Redshift: 0.55

N=99

Median Redshift: 1.12

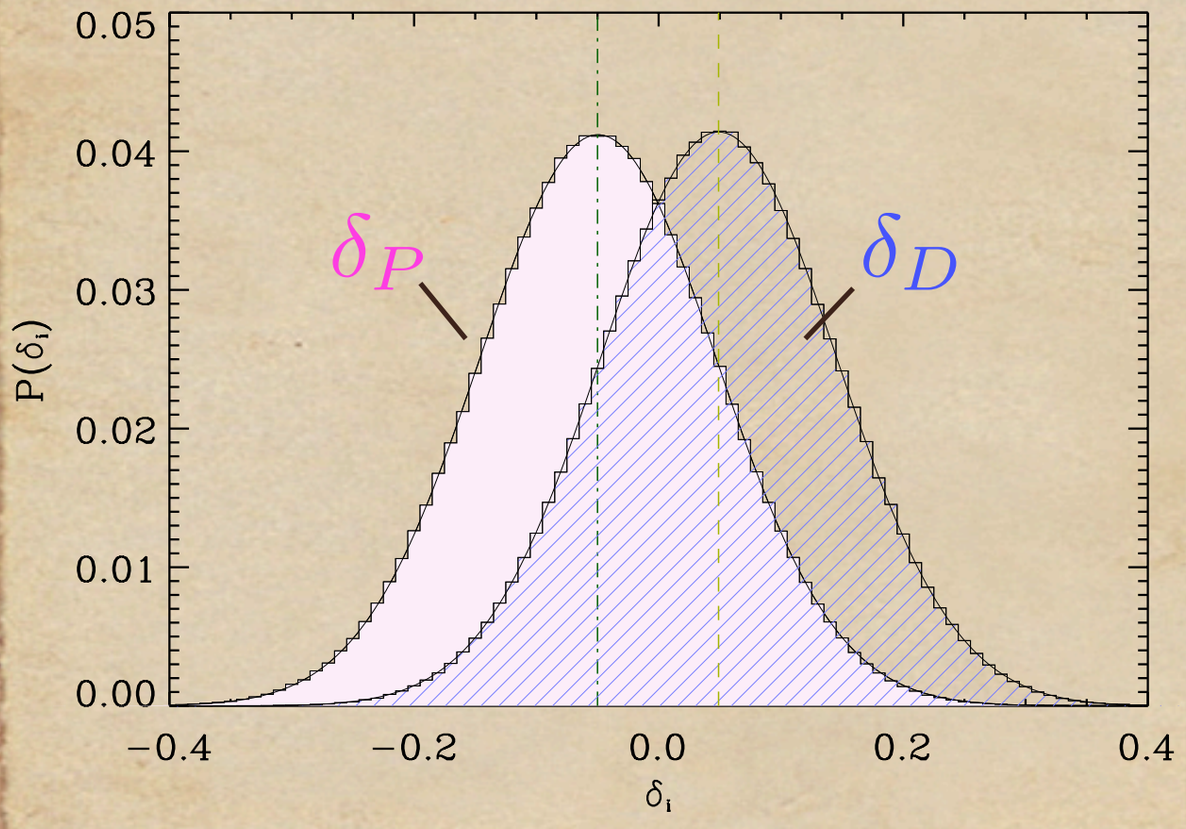
N=20

Howell et al. 2007

Average effect on the Hubble diagram

$$m - M = 5 \log \left(\frac{d_L}{\mathrm{Mpc}} \right) + 25 + \mathcal{M} + \delta_D * f_D(z)$$

with $\delta_D = 2.5 \log(L_P/L_D) = m_D - m_P$



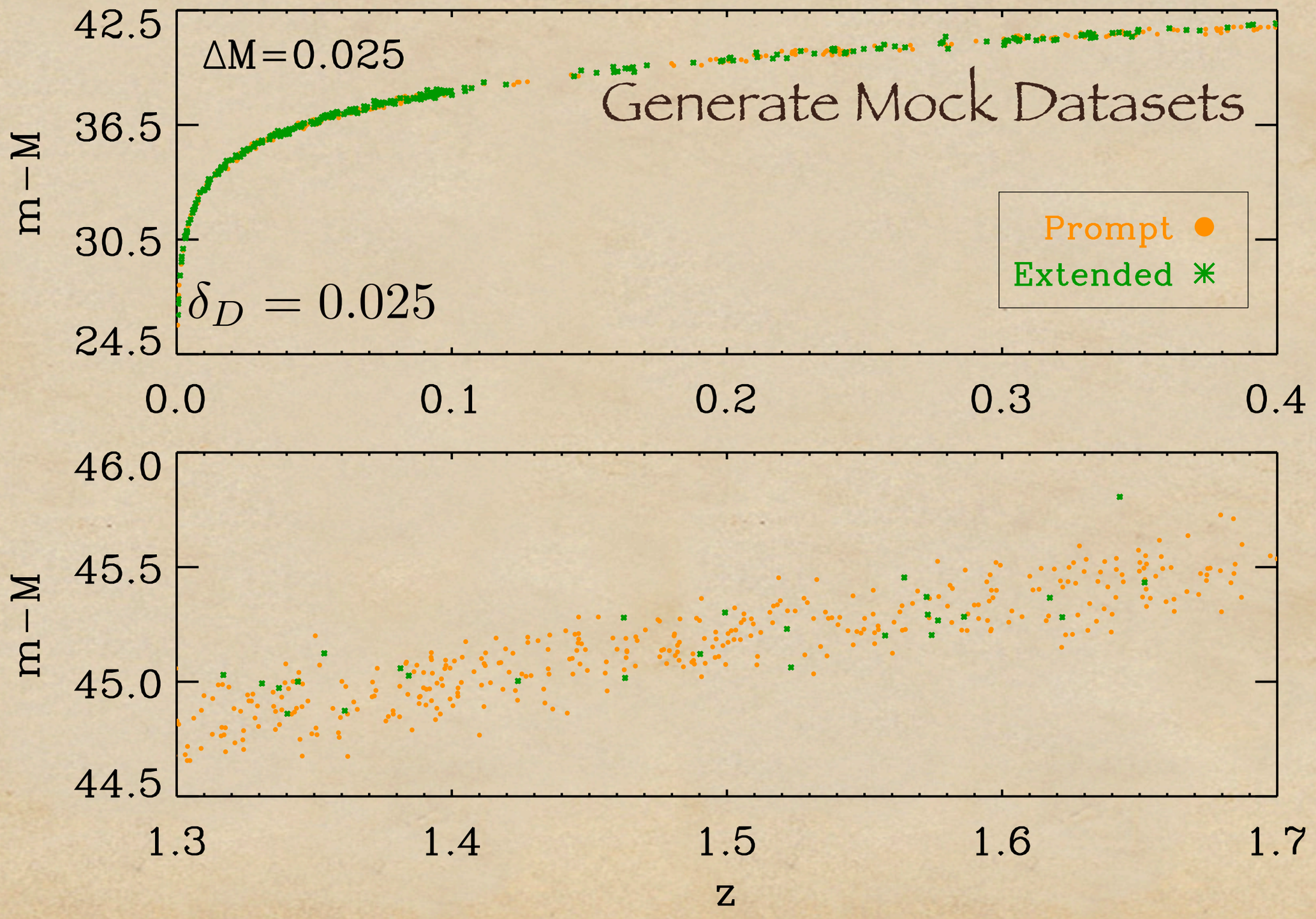
With dataset from Davis et al., Wood-Vasey et al., Riess et al. 2007(192 SNe), the residual is consistent with zero:

$$\delta_D \sim (5 \pm 9)\%$$

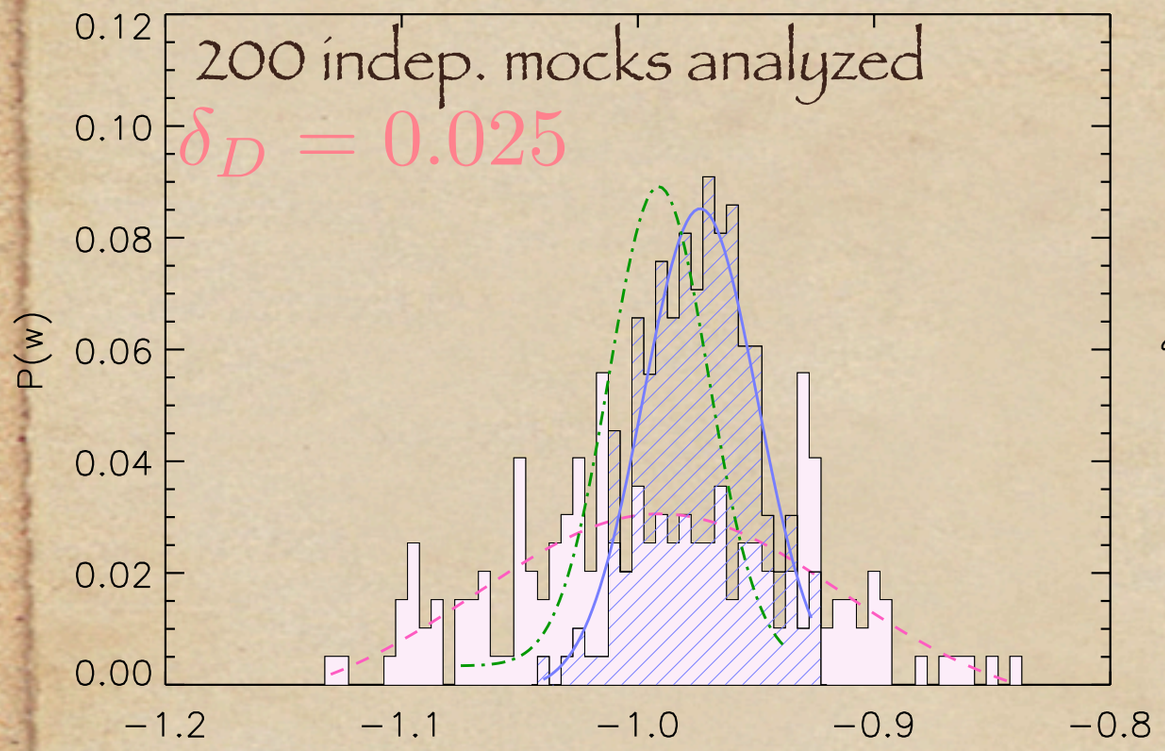
With future data, one will be able to constrain the residual much better.

D.Sarkar, A. Amblard, A. Cooray, and D. Holz; ApJL, 684, L13 (2008)

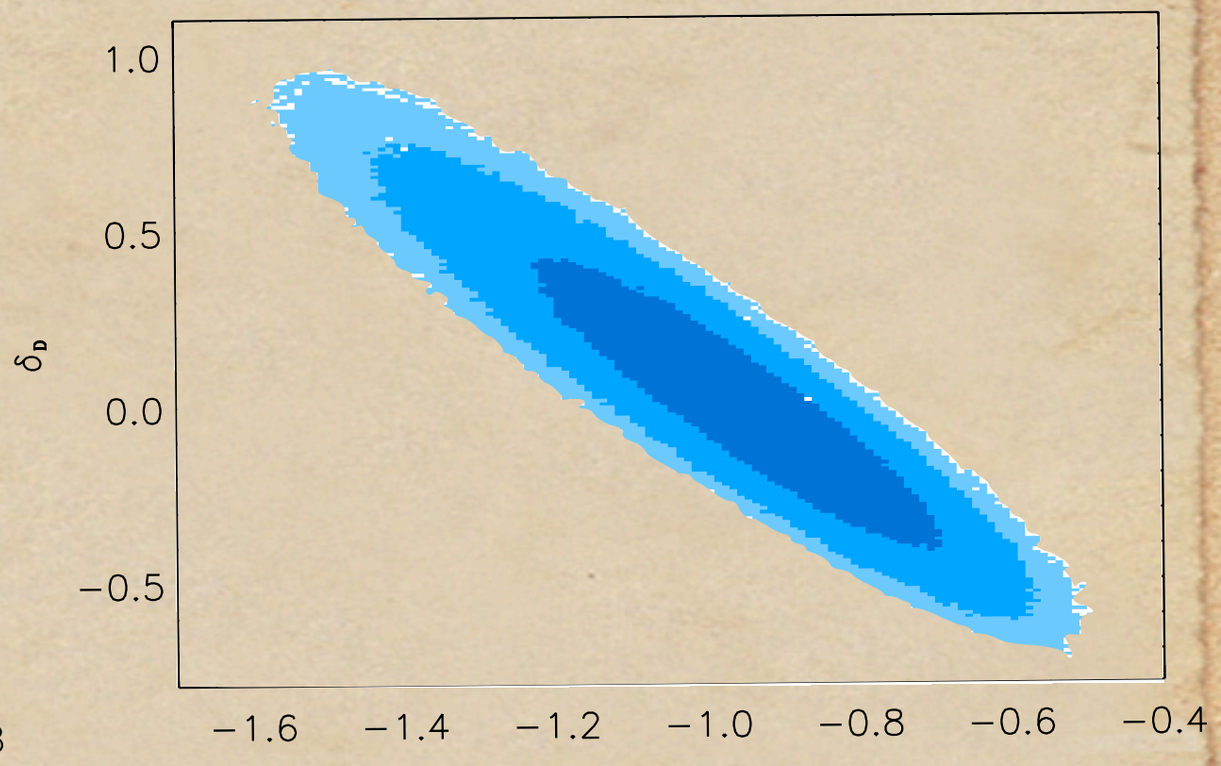
Looking at future surveys (JDEM-like) with 2000 SNIa



with 200 mock datasets analysed :



~1-sigma bias in "w"



Correlation

While model-fitting the data

$\delta_D \approx 0 \Rightarrow \sim 1\sigma$ bias in ω

δ_D= FREE $\Rightarrow$ NO bias in ω, BUT Error bar increased by 2.5 times

Best situation: Constrain δ_D <= 2% with confidence

Conclusions

- No evidence of two SNIa populations after stretch correction : $\delta_D = 5 \pm 9$ %

- a residual 0.025 magnitude difference could have an effect on DE EoS measurement.

- the effect can be accounted for in the Hubble diagram