Testing the consistency of different supernova surveys

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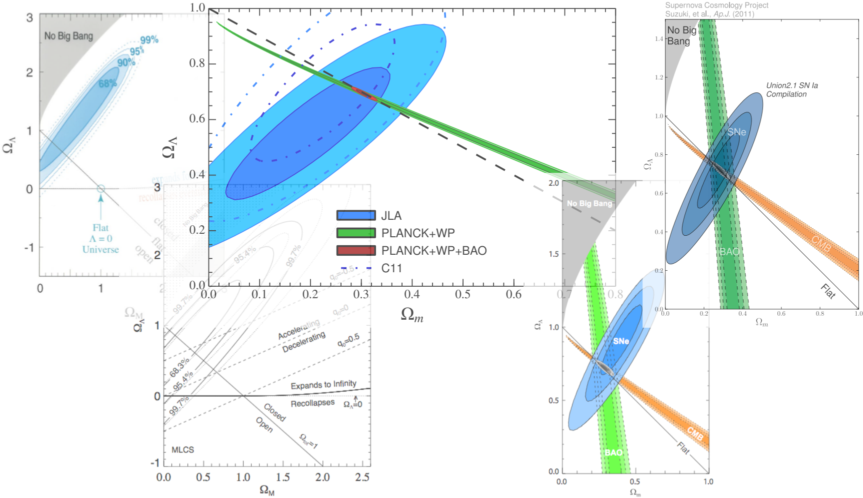
Statistical Challenges in 21st Century Cosmology

There is no example of a single survey delivering interesting supernova constraints on its own



R-test

Assume two hypothesis:

H_0 - data-sets are mutually consistent

H_1 - the data-sets are inconsistent with one another, resulting in each one favouring a different region of the model parameter space.

Hypothesis are equally likely *apriori*.

$$\mathcal{R} = \frac{\Pr(\mathbf{D}|H_0)}{\Pr(\mathbf{D}|H_1)} = \frac{\Pr(\mathbf{D}|H_0)}{\prod_i \Pr(D_\mathrm{i}|H_1)}.$$

Examples of beyond ΛCDM inference

- Model selection between isotropic and anisotropic models
- Looking for weak lensing effects in SNe data

χ^2- method

For SN cosmology χ^2 defined as:

$$\chi^2(\mathcal{C}, \alpha, \beta, M, \sigma_{\text{int}}) = \sum_{i=1}^{N} \frac{[\mu_i^{\text{obs}}(\alpha, \beta, M) - \mu_i(\mathcal{C})]^2}{\sigma_i^2(\alpha, \beta, \sigma_{\text{int}})}$$

$$\mu_i^{\text{obs}}(\alpha, \beta, M) = \hat{m}_{B,i}^* - M + \alpha \hat{x}_{1,i} - \beta \hat{c}_i$$

"Likelihood"

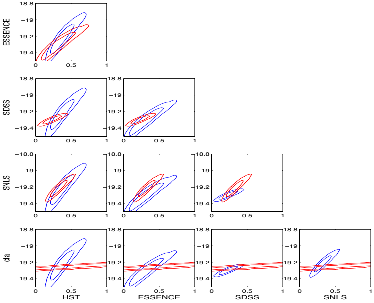
$$\mathcal{L}(\mathcal{C}, \alpha, \beta, M, \sigma_{\text{int}}) = \exp\{-\frac{\chi^2(\mathcal{C}, \alpha, \beta, M, \sigma_{\text{int}})}{2}\}$$

Parameters

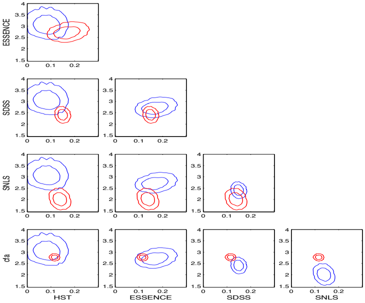
$\mathcal{C}, \alpha, \beta, M, \sigma_{\text{int}}$

UNION2

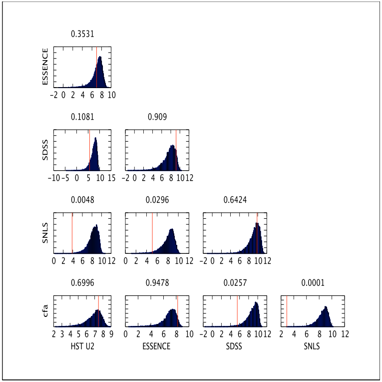
Ω_M *vs* M



α *vs* β



R-values, red line is a real data



α *vs* β