

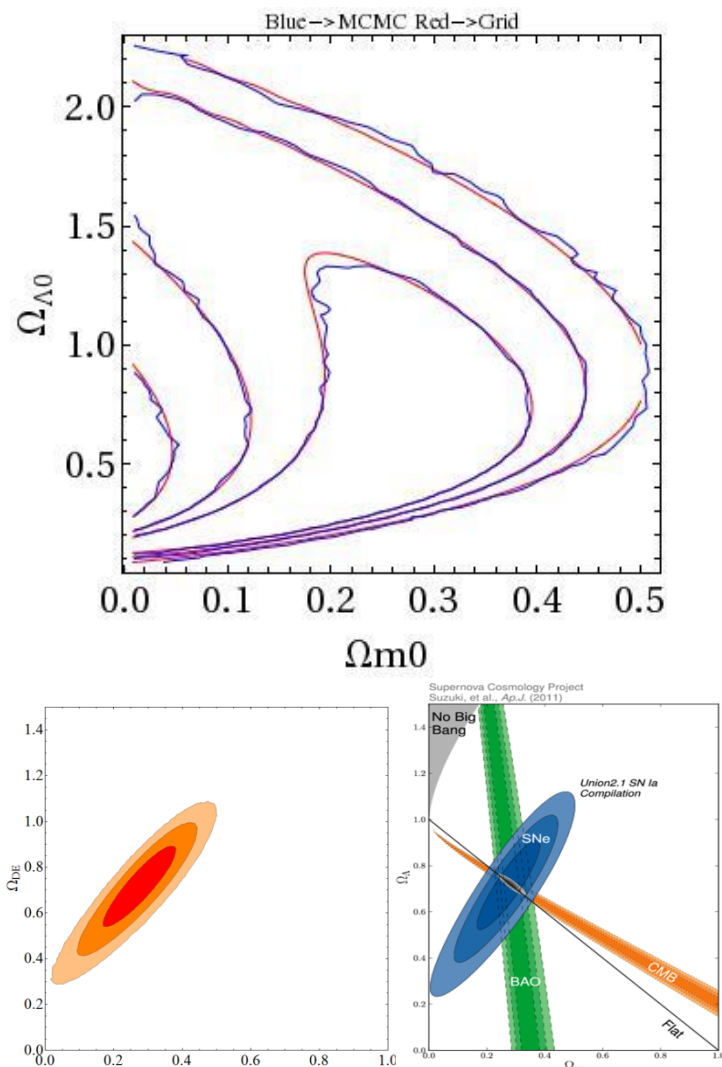


The classic image taken by the HST. In the lower left corner a Type Ia supernova (SN1994D) is shown exploding, its brightness is comparable to the one of the entire galaxy (NGC 4526).

Supernovae constraints and the MCMC method for likelihood analysis

Tiago Castro¹, Miguel Quartin²

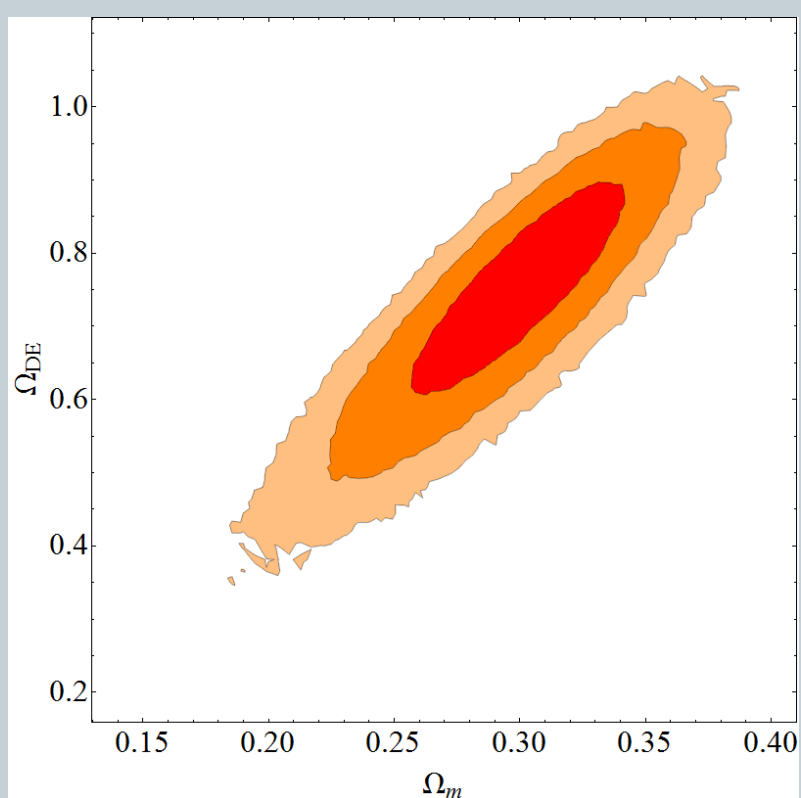
We study the MCMC method and type Ia supernovae distance moduli to obtain the parameter constraints of different cosmological models. Making use of both current data (with the Union 2.1 catalog) and of forecast DES data we evaluate the improvements in the constraints and the ups and downs of the Metropolis MCMC algorithm.



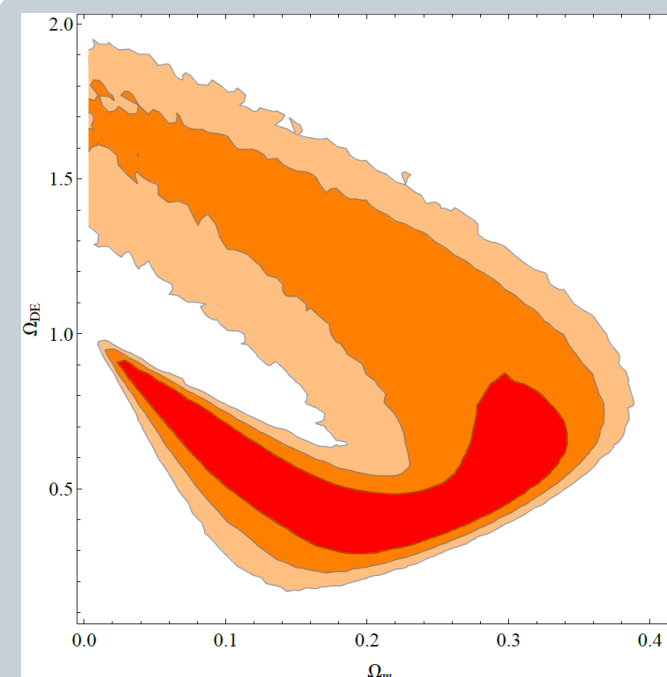
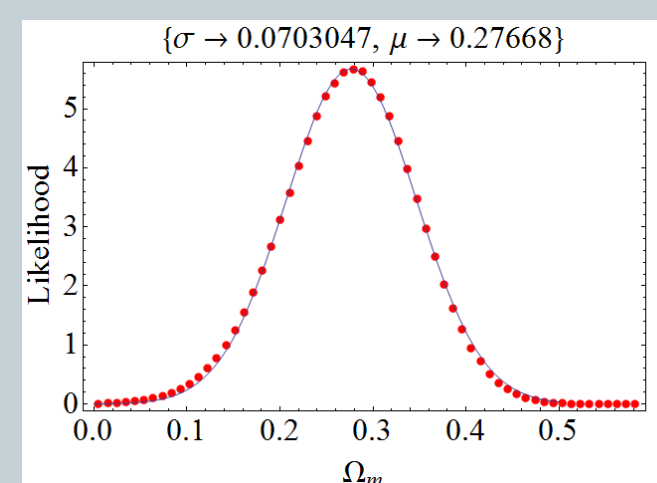
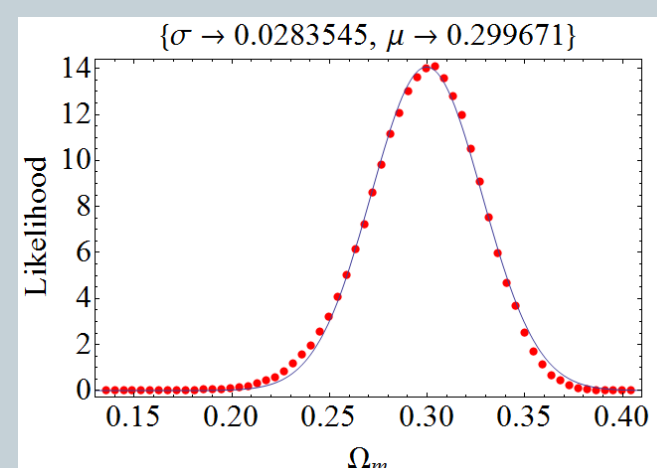
Agreement between MCMC and Grid (using WCDM model) and a comparison between my contours and Union's.

$$\Rightarrow D_c = D_H \int_0^z \frac{dz'}{E(z')}$$
Comoving Distances and its dependence with cosmological models

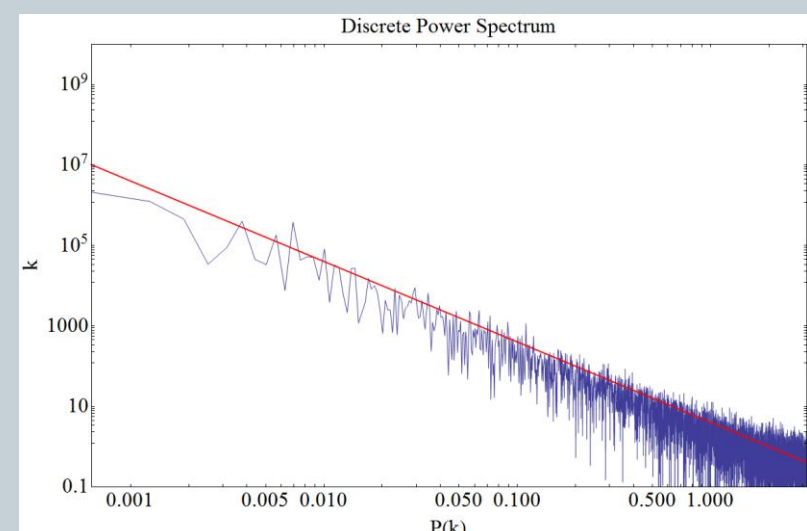
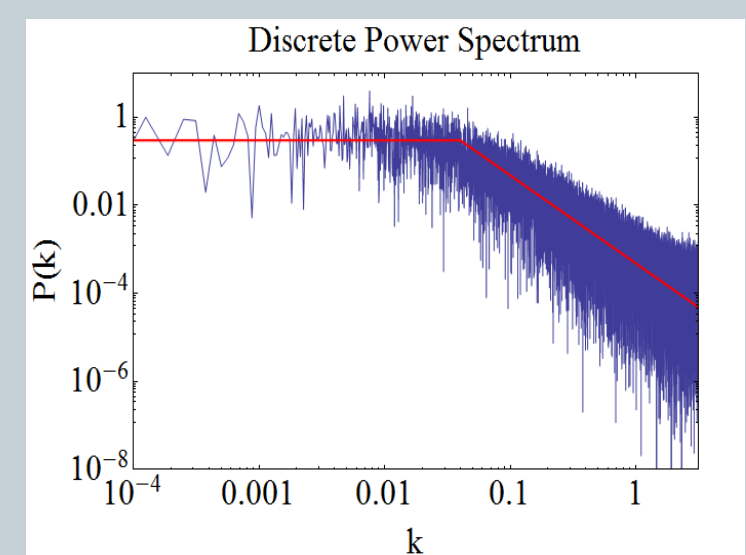
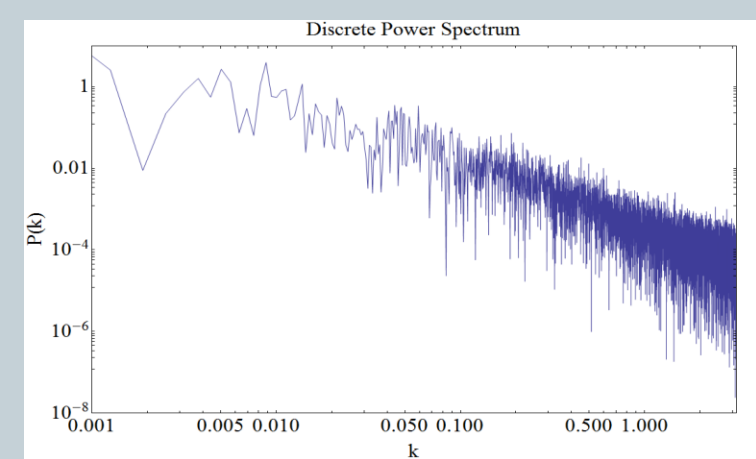
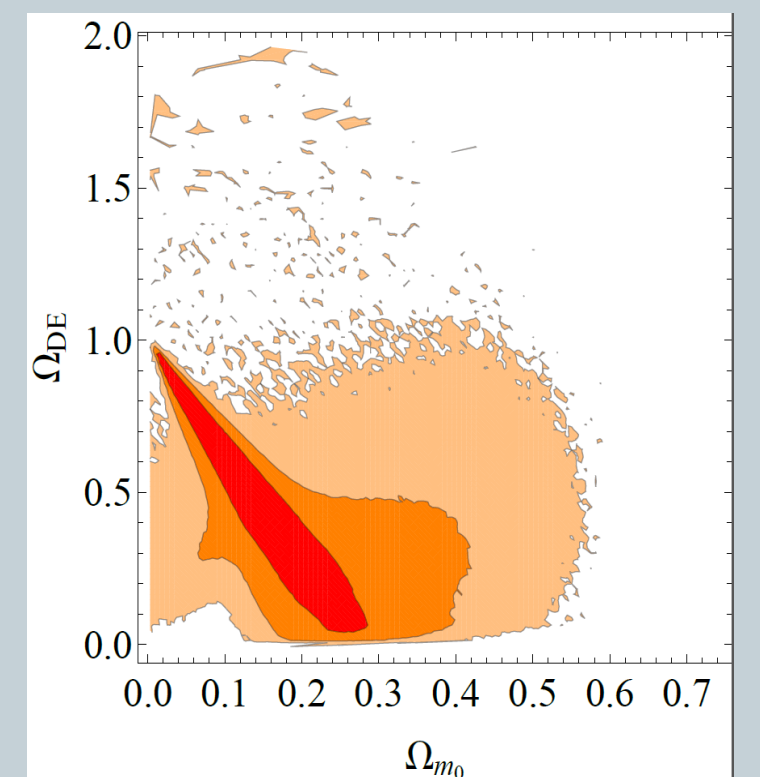
$$\Rightarrow \begin{cases} \text{LCDM} \rightarrow E(z) = \sqrt{\Omega_m(1+z)^3 + \Omega_k(1+z)^2 + \Omega_{DE}} \\ \text{WCDM} \rightarrow E(z) = \sqrt{\Omega_m(1+z)^3 + \Omega_k(1+z)^2 + \Omega_{DE}(1+z)^{3(1+W)}} \\ \text{CPL} \rightarrow E(z) = \sqrt{\Omega_m(1+z)^3 + \Omega_k(1+z)^2 + \Omega_{DE}(1+z)^{3(1+W+W_a)} e^{-\frac{3W_a z}{1+z}}} \end{cases}$$



Above: confidence level of the predicted catalogue of DES. Right: DES might reduce the deviation by a factor 2.5



Comparison of wCDM & CPL. With many degrees of freedom the marginalized Likelihood can sometimes **exclude** the fiducial model.



Spectrum analysis can tell us about **convergence**. Above left: unconverged chain Above: converged chain Left: random walk chain

References

- Dunkley - [arXiv:astro-ph/0405462v1](https://arxiv.org/abs/astro-ph/0405462v1)
- Suzuki et al., Ap.J.(2011)
- Bernstein - [arXiv:1111.1969v4](https://arxiv.org/abs/1111.1969v4)

Models with many parameters need more points to converge. This plot was made with 40x more points than the one above, and the chain still has not converged.

