

Background

Type Ia supernovae are at the forefront of cosmological inference. They play a leading role in the local distance ladder estimate of the Hubble Constant and in measurements of the dark energy equation of state. From a stellar evolution standpoint, we know that they are thermonuclear explosions of a carbon-oxygen white dwarf in a binary system, however, all cosmological inference is performed purely empirically. There are different empirical templates, either at the spectral energy distribution or lightcurve level, that are designed to measure distances. These distances, in combination with redshift from the host galaxy allow us to infer cosmology.

Project Goal

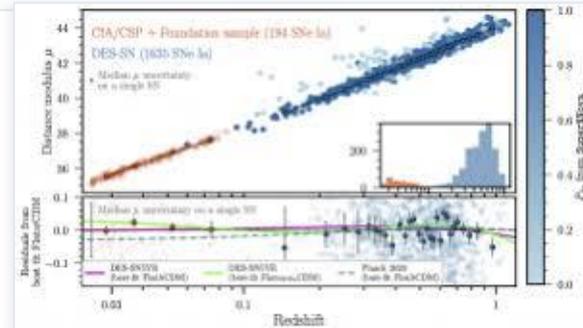
Infer supernova parameters and distances from multi-band photometry. Quantify uncertainties in the distances and use the distance-redshift relation for cosmology. Test the dependence of the cosmological inference on the assumptions in the distance measurement.

Necessary Concepts

- A basic (equivalent to Year 2 or Year 3) background in cosmology would be beneficial
- Python proficiency (matplotlib, numpy, scipy)

Computing Need

Analysis can be run on laptops, but setting up packages on a common system is recommended to avoid software troubles.



Type Ia supernova magnitude-redshift relation from the dark energy survey (DES Collaboration et al. 2024). The top panel shows the data from the DES (blue) and the low- z anchor (red). The bottom panel shows the residuals relative to the Λ CDM and the w_0wa CDM cosmology.

★ Background Resources

Dark Energy Constraints from Type Ia supernovae

<https://arxiv.org/abs/2401.02929>

Hubble Constant Constraints from Type Ia supernovae

<https://arxiv.org/abs/2408.06153>

Supernova Likelihood from Cobaya

https://cobaya.readthedocs.io/en/latest/likelihood_sn.html

Python

Easily available resources (matplotlib, numpy, scipy)



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