Supernova Cosmology

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Summary

- Supernovae
- Type Ia supernovae
- Constraining cosmological parameters

Supernovae

- Type I
  - Binary system with a white dwarf and a donor star
  - An absence of the Balmer series of Hydrogen in it’s spectrum
- Type II
  - A massive star which features a core-collapse
  - Balmer series of Hydrogen present

- More sub-classifications within Type I and Type II

S. E. Woosley and T. A. Weaver. The Physics of Supernova Explosions. Annual Review of Astronomy and Astrophysics, 24:205–253, 1986.

Type Ia Supernovae

- Standardised explosion mechanism
- Usage in finding cosmological parameters
- The Friedman equation[1]

$$\left(\frac{\dot{a}(t)}{a(t)}\right)^2 = \frac{8\pi G}{3}\rho(t) - \frac{kc^2}{a^2(t)}$$

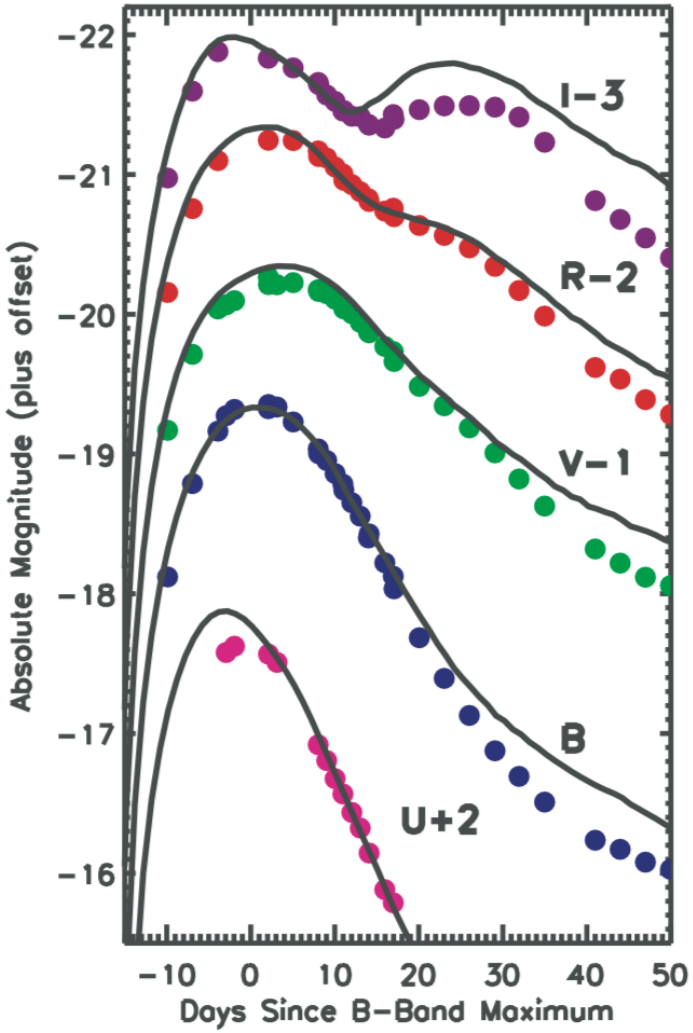

Figure 1. Type Ia SN light curves in five different bands. Data and model offset to produce a clearer image.

[1] C. R. Genovese et al. Inference for the dark energy equation of state using Type Ia supernova data. The Annals of Statistics, 3:144-178, 2009.

S. E. Woosley and T. A. Weaver. The Physics of Supernova Explosions. Annual Review of Astronomy and Astrophysics, 24:205–253, 1986. Figure 1. Adapted from S. E. Woosley et al. Type Ia Supernova Light Curves. The Astrophysical Journal, 662:487-503, 2007.

Constraining cosmological parameters

- Uncertainties in data sets
- Larger data sets of SNe – investigating the uncertainties on Ω_Λ
- Obtaining another measure for the quality of fit for the models to the data, χ^2 to MCMC.

T. A. Ottosen. A Bayesian Approach to Statistical Mechanics. arXiv, 2012.

Conclusions

- Type Ia Supernova Explosions as Standard Candles
- Constraining cosmological parameters
  - Using larger data sets
  - Obtaining another measure for the quality of fit for the data to the model