

# Astr 513: Final Project

Cheng, Lidens

`lidenscheng@email.arizona.edu`

McClintock, Tom

`tmccclintock@email.arizona.edu`

Wagoner, Erika

`wagoner47@email.arizona.edu`

April 28, 2016

## 1 Type Ia Supernovae

## 2 Data

Our data is compiled from Betoule et al. (2014) and Rest et al. (2014) blah blah blah...

### 2.1 The JLA sample

Betoule et al. (2014) define their “joint light-curve analysis” (JLA) sample, a total of 740 type Ia supernovae (SNe Ia) compiled from a combination of data from the Sloan Digital Sky Survey (SDSS), the Supernova Legacy Survey (SNLS), the Hubble Space Telescope (HST), and several other experiments. The 613 SDSS SNe Ia come from the SDSS supernova survey (SDSS-SNS) of SDSS-II (Sako et al., 2014) with redshifts of  $0.05 < z < 0.4$ , and 374 of them are selected from those that were confirmed in the spectroscopic follow-up. The rest of the SNe come from the compilation by Conley et al. (2011), which includes 242 spectroscopically confirmed SNe Ia from SNLS at redshifts  $0.2 < z < 1$ , 14 SNe Ia from HST at very high redshifts of  $0.7 < z < 1.4$ , and 123 low redshift ( $z < 0.08$ ) from a variety of sources. We made use of the publicly available distance moduli, redshifts, and covariance matrix provided by Betoule et al. (2014)<sup>1</sup>. We note that the distance moduli are binned, so that they are only computed and given on a grid of redshifts. The distance modulus can then be well approximated by a piecewise linear function of  $\log(z)$  that is given in a single redshift bin  $z_b \leq z < z_{b+1}$  as (see Betoule et al., 2014, Appendix E.1)

$$\bar{\mu}(z) = (1 - \alpha)\mu_b + \alpha\mu_{b+1}, \quad (1)$$

where they have defined  $\alpha = \log\left(\frac{z}{z_b}\right) / \log\left(\frac{z_{b+1}}{z_b}\right)$  and  $\mu_i$  is the distance modulus at control point  $z_i$ . Therefore, the data and covariance matrix are merely given at the 31 control points log-spaced in the redshift range  $0.01 < z < 1.3$ .

---

<sup>1</sup>Data is available for download via <http://cdsweb.u-strasbrg.fr/cgi-bin/qcat?J/A+A/568/A22>

## References

- Betoule, M., Kessler, R., Guy, J., et al. 2014, *Astron. Astrophys.*, 568, A22+.
- Conley, A., Guy, J., Sullivan, M., et al. 2011, , 192, 1.
- Rest, A., Scolnic, D., Foley, R. J., et al. 2014, *Astrophys. J.*, 795, 44+.
- Sako, M., Bassett, B., Becker, A. C., et al. 2014, *ArXiv e-prints*, arXiv:1401.3317.