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YONSEI NEARBY SUPERNOVA EVOLUTION INVESTIGATION (YONSEI) SUPERNOVA CATALOGUE

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ABSTRACT

We use light-curve fitting models (MLCS2k2, SALT2, and SNooPy) as implemented in SNANA to make the YOnsei Nearby Supernova Evolution Investigation (YONSEI) Supernova Catalogue. The catalogue consists of several hundred Type Ia supernovae (SNe Ia) in the redshift range from 0.01 to 1.35, and provides distance moduli, light-curve shape parameters, and color or extinction values for each supernova. This data set will be used to study the dependence of SNe Ia luminosities on the host galaxy morphologies. In this paper, we present the YONSEI Supernova Catalogue and preliminary systematic tests for the catalogue.

Key words: cosmology: obervations - distance scale - supernovae: general

1. YONSEI SUPERNOVA CATALOGUE

The luminosity evolution of Type Ia supernovae (SNe Ia) and dust extinction play major roles in the systematic uncertainties of SN cosmology. In order to overcome these obstacles, we have initiated the YOnsei Nearby Supernova Evolution Investigation (YONSEI) project. As the first step of YONSEI, we needed to produce our own SN catalogue.

We have use the `SNANA` package (SuperNova ANAlysis; Kessler et al., 2009) to produce the YONSEI SN Catalogue. We choose MLCS2k2, SALT2, and SNooPy light-curve fitting models (Jha et al., 2007; Guy et al., 2007; Burns et al., 2011) to analyze SNe Ia data. As shown in Table 1, our sample consists of several hundreds of SNe Ia in the redshift range from 0.01 to 1.35. All samples are in the `SNANA` data set, except for PS1 data. PS1 data are taken from Rest et al. (2014). If the the same light-curve appears in different surveys, we use the light-curve with the most observations.

Figure 1 shows the Hubble diagram from the YONSEI SN Catalogue. The distance modulus from SNe Ia is simultaneously estimated in the case of MLCS2k2 and SNooPy. SALT2, however, needs one more step to obtain the distance modulus. The SALT2mu program (Marriner et al., 2011) in `SNANA` is used to transform SALT2 light-curve fit parameters into the distance modulus. The YONSEI SN Catalogue also provides light-curve shape parameters and color or extinction values for each SN.

2. SYSTEMATIC TESTS

We are now performing systematic tests for the YONSEI SN Catalogue. An example is shown in Figure 2, which shows the correlations between light-curve shape parameters. MLCS2k2 Δ and SALT2 x1 in the top panel show a good correlation (see also Hicken et al., 2009). In the middle panel, there is a negative trend between SNooPy Δm_{15} and SALT2 x1 as suggested by Guy et al. (2007). The correlation between MLCS2k2 Δ and SNooPy Δm_{15} in the bottom panel, which has not been not presented before, is very similar to that between MLCS2k2 Δ and SALT2 x1.

3. FUTURE WORK

We will estimate the best cosmological parameters from the Hubble diagram using SNe Ia, and will study the dependence of SNe Ia luminosities on the host galaxy morphologies (Kim et al. 2015, *in prep.*).

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REFERENCES

Burns, C. R., Stritzinger, M., & Phillips, M. M., et al., 2011, The Carnegie Supernova Project: Light-Curve Fitting with SNooPy, AJ, 141, 19
Guy, J., Astier, P., & Baumont, S., et al., 2007, SALT2: Using Distant Supernovae to Improve the Use of Type Ia Supernovae as Distance Indicators, A&A, 466, 11

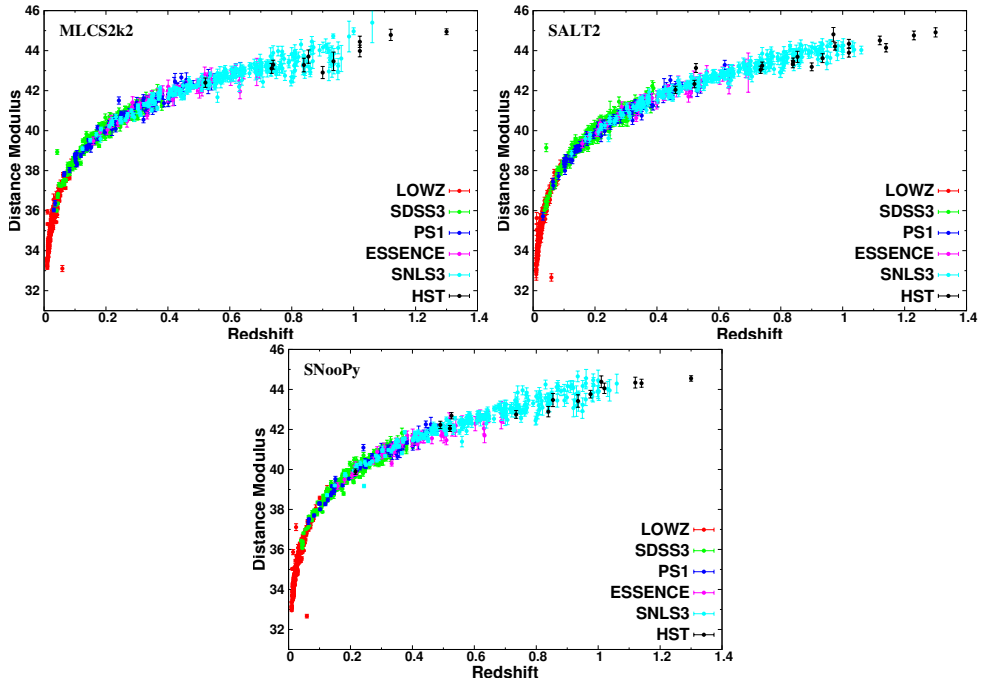

Figure 1. Hubble diagrams from YONSEI SN Catalogue. The distance modulus is estimated from MLCS2k2, SALT2, and SNooPy light-curve fitters with SNe Ia data.

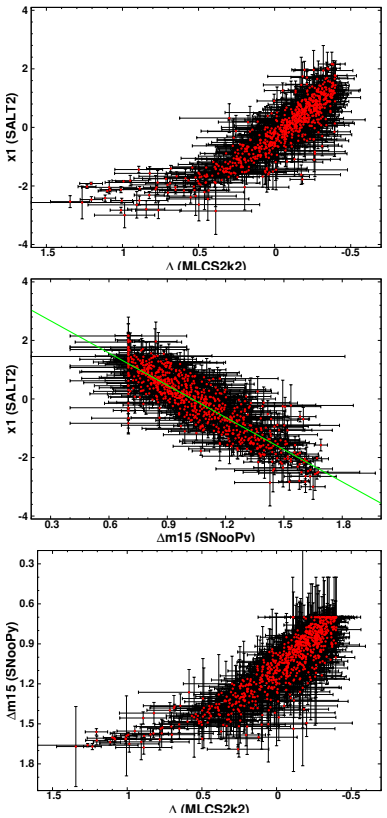

Figure 2. Correlations between the light-curve shape parameters of MLCS2k2, SALT2, and SNooPy. MLCS2k2 Δ vs. SALT2 x1 (top) and MLCS2k2 Δ vs. SNooPy Δm_{15} (bottom) show a similar trend. SNooPy Δm_{15} vs. SALT2 x1 (middle) shows a negative trend between them.

Table 1
YONSEI Supernova Catalogue Summary

Sample	Redhisft Range	N_{SN}		
		MLCS2k2	SALT2	SNooPy
JRK07[a]	0.01 - 0.13	59	59	59
CFA3	0.01 - 0.07	81	73	75
CFA4	0.01 - 0.08	56	49	51
CSPDR2	0.01 - 0.09	54	40	47
SDSS3	0.03 - 0.43	379	393	325
PS1	0.03 - 0.64	118	108	66
ESSENCE	0.15 - 0.70	52	51	54
SNLS3	0.12 - 1.06	240	262	237
HST	0.35 - 1.35	11	18	14
		1050	1053	928

Notes. All samples are in SNANA data set except PS1 data. PS1 data are taken from Rest et al. (2014).
[a] JRK07 sample is collected by Jha et al. (2007) including the Calan/Tololo survey, CfA1, and CfA2 SN surveys.

Hicken, M., Wood-Vasey, W. M., & Blondin, S., et al., 2009, Improved Dark Energy Constraints from ∼ 100 New CfA Supernova Type Ia Light Curves, ApJ, 700, 1097
Jha, S., Riess, A. G., & Kirshner, R. P., 2007, Improved Distances to Type Ia Supernovae with Multicolor Light-Curve Shapes: MLCS2k2, ApJ, 659, 122
Kessler, R., Bernstein, J. P., & Cinabro, D., et al., 2009, SNANA: A Public Software Package for Supernova Analysis, PASP, 121, 1028
Marriner, J., Bernstein, J. P., & Kessler, R., et al., 2011, A More General Model for the Intrinsic Scatter in Type Ia Supernova Distance Moduli, ApJ, 740, 72
Rest, A., Scolnic, D., & Foley, R. J., et al., 2014, Cosmological Constraints from Measurements of Type Ia Supernovae Discovered during the First 1.5 yr of the Pan-STARRS1 Survey, ApJ, 795, 44