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J/A+A/611/A58 SN 2007on and SN 2011iv light curves (Gall+, 2018)

Two transitional type Ia supernovae located in the Fornax cluster member NGC 1404: SN 2007on and SN 2011iv.

Gall C., Stritzinger M.D., Ashall C., Baron E., Burns C.R., Hoeflich P., Hsiao E.Y., Mazzali P.A., Phillips M.M., Filippenko A.V., Anderson J.P., Benetti S., Brown P.J., Campillay A., Challis P., Contreras C., Elias de la Rosa N., Folatelli G., Foley R.J., Fraser M., Holmbo S., Marion G.H., Morrell N., Pan Y.-C., Pignata G., Suntzeff N.B., Taddia F., Torres Robledo S., Valenti S.

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Keywords: supernovae: general - supernovae: individual: SN2007on - supernovae: individual: SN 2011iv - dust, extinction

Abstract:
We present an analysis of ultraviolet (UV) to near-infrared observations of the fast-declining Type Ia supernovae (SNe Ia) 2007on and 2011iv, hosted by the Fornax cluster member NGC 1404. The B-band light curves of SN 2007on and SN 2011iv are characterised by Δm15(B) decline-rate values of 1.96mag and 1.77mag, respectively. Although they have similar decline rates, their peak B- and H-band magnitudes differ by ∼0.60mag and ∼0.35mag, respectively. After correcting for the luminosity vs. decline rate and the luminosity vs. colour relations, the peak B-band and H-band light curves provide distances that differ by ∼14% and ∼9%, respectively. These findings serve as a cautionary tale for the use of transitional SNe Ia located in early-type hosts in the quest to measure cosmological parameters. Interestingly, even though SN 2011iv is brighter and bluer at early times, by three weeks past maximum and extending over several months, its B-V colour is 0.12mag redder than that of SN 2007on. To reconcile this unusual behaviour, we turn to guidance from a suite of spherical one-dimensional Chandrasekhar-mass delayed-detonation explosion models. In this context, ^{56}Ni production depends on both the so-called transition density and the central density of the progenitor white dwarf. To first order, the transition density drives the luminosity-width relation, while the central density is an important second-order parameter. Within this context, the differences in the B-V colour evolution along the Lira regime suggest that the progenitor of SN 2011iv had a higher central density than SN 2007on.

Description:
Detailed optical and NIR light curves of SN 2007on obtained by the first phase of the Carnegie Supernova Project (CSP-I, 2004-2009; Hamuy et al., 2006PASP..118....2H) were published by Stritzinger et al. (2011, Cat. J/AJ/142/156).UV uvw2-, uvm2-, and uvw1-band imaging of both SN 2007on and SN 2011iv were obtained with Swift (+ UVOT). Photome- try of SN 2007on and SN 2011iv was computed following the method described in detail by Brown et al. (2014Ap&SS.354...89B), who use the calibration published by Breeveld et al. (2011, AIPCS, 1358, 373). The Swift UVOT images and photometry are also available as part of the Swift Optical Ultraviolet Supernova Archive (SOUSA; Brown et al. 2014Ap&SS.354...89B). Optical ugriBV-band imaging of SN 2007on and SN 2011iv was obtained with the Henrietta Swope 1.0m telescope (+ SITe3 direct CCD camera) located at the Las Campanas Observatory (LCO). The NIR YJH-band imaging of SN 2007on was obtained with the Swope (+ RetroCam) and the Irenee du Pont 2.5m (+ WIRC: Wide Field Infrared Camera) telescopes (Stritzinger et al., Cat. J/AJ/142/156), while in the case of SN 2011iv all NIR YJH-band imaging was taken with RetroCam attached to the Irenee du Pont telescope. The optical local sequence is calibrated relative to Landolt (1992AJ....104..372L) (BV) and Smith et al. (2002AJ....123.2121S) (ugri) standard-star fields observed over multiple photometric nights. The NIR J-band and H-band local sequences were calibrated relative to the Persson et al. (1998AJ....116.2475P) standard stars, while the Y- band local sequence was calibrated relative to standard Y-band magnitudes computed using a combination of stellar atmosphere models (Castelli & Kurucz, 2003, IAUSymp, 210, A20) with the J-Ks colours of the Persson et al. standard-star catalogue (Hamuy et al., 2006PASP..118....2H).

Objects:

RA (2000)	DE	Designation(s)
03 38 50.90	-35 34 30.0	SN 2007on = SN 2007on
03 38 51.35	-35 35 32.0	SN 2011iv = SN 2011iv

File Summary:

FileName	Lrecl	Records	Explanations
ReadMe	80	.	This file
table1.dat	56	48	UVOT UV photometry of SN 2007on and SN 2011iv

table2.dat	103	30	Optical photometry of the local sequence stars in the field of NGC 1404 in the 'standard' system
table3.dat	70	30	Near-IR photometry of the local sequence stars in the field of NGC 1404 in the 'natural' system
table4.dat	83	99	Optical photometry of SN 2007on and SN 2011iv in the 'natural' system
table5.dat	54	82	NIR photometry of SN 2007on and SN 2011iv in the 'natural' system

Byte-by-byte Description of file: table1.dat

Bytes	Format	Units	Label	Explanations
1- 9	A9	---	SN	SN name (SN 2007on or SN 2011iv)
11- 17	F7.1	d	MJD	Modified Julian date
19- 23	F5.1	d	Phase	Phase, days relative to T(B)max
25- 30	F6.3	mag	UVW2	?=0 UVW2-band magnitude
32- 34	I3	mmag	e_UVW2	?=0 rms uncertainty on UVW2
36- 41	F6.3	mag	UVM2	?=0 UVM2-band magnitude
43- 45	I3	mmag	e_UVM2	?=0 rms uncertainty on UVM2
47- 52	F6.3	mag	UVW1	?=0 UVW1-band magnitude
54- 56	I3	mmag	e_UVW1	?=0 rms uncertainty on UVW1

Byte-by-byte Description of file: table2.dat

Bytes	Format	Units	Label	Explanations
1- 9	A9	---	SN	SN name (SN 2007on or SN 2011iv)
11- 12	I2	---	Star	Star number
15- 16	I2	h	RAh	Right Ascension J2000 (hours)
18- 19	I2	min	RAm	Right Ascension J2000 (minutes)
21- 25	F5.2	s	RAs	Right Ascension J2000 (seconds)
27	A1	---	DE-	Declination J2000 (sign)
28- 29	I2	deg	DEd	Declination J2000 (degrees)
31- 32	I2	arcmin	DEm	Declination J2000 (minutes)
34- 37	F4.1	arcsec	DEs	Declination J2000 (seconds)
39- 44	F6.3	mag	umag	?=0 u-band magnitude
46- 48	I3	mmag	e_umag	?=0 rms uncertainty on umag
50- 55	F6.3	mag	gmag	?=0 g-band magnitude
57- 59	I3	mmag	e_gmag	?=0 rms uncertainty on gmag
61- 66	F6.3	mag	rmag	r-band magnitude
68- 70	I3	mmag	e_rmag	rms uncertainty on rmag
72- 77	F6.3	mag	imag	i-band magnitude
79- 81	I3	mmag	e_imag	rms uncertainty on imag
83- 88	F6.3	mag	Bmag	?=0 B-band magnitude
90- 92	I3	mmag	e_Bmag	?=0 rms uncertainty on Bmag
94- 99	F6.3	mag	Vmag	?=0 V-band magnitude
101-103	I3	mmag	e_Vmag	?=0 rms uncertainty on Vmag

Byte-by-byte Description of file: table3.dat

Bytes	Format	Units	Label	Explanations
1- 9	A9	---	SN	SN name (SN 2007on or SN 2011iv)
11- 13	I3	---	Star	Star number
15- 16	I2	h	RAh	Right Ascension J2000 (hours)
18- 19	I2	min	RAm	Right Ascension J2000 (minutes)
21- 25	F5.2	s	RAs	Right Ascension J2000 (seconds)
27	A1	---	DE-	Declination J2000 (sign)
28- 29	I2	deg	DEd	Declination J2000 (degrees)
31- 32	I2	arcmin	DEm	Declination J2000 (minutes)
34- 37	F4.1	arcsec	DEs	Declination J2000 (seconds)
39- 44	F6.3	mag	Ymag	?=0 Y-band magnitude
46- 48	I3	mmag	e_Ymag	?=0 rms uncertainty on Ymag
50- 55	F6.3	mag	Jmag	?=0 J-band magnitude
57- 59	I3	mmag	e_Jmag	?=0 rms uncertainty on Jmag
61- 66	F6.3	mag	Hmag	?=0 H-band magnitude
68- 70	I3	mmag	e_Hmag	?=0 rms uncertainty on Hmag

Byte-by-byte Description of file: table4.dat

Bytes	Format	Units	Label	Explanations
1- 9	A9	---	SN	SN name (SN 2007on or SN 2011iv)
11- 17	F7.2	d	JD	Julian date (JD-2450000)
19- 24	F6.3	mag	umag	?=0 u-band magnitude
26- 28	I3	mmag	e_umag	?=0 rms uncertainty on umag

30- 35	F6.3	mag	gmag	?=0 g-band magnitude
37- 39	I3	mmag	e_gmag	?=0 rms uncertainty on gmag
41- 46	F6.3	mag	rmag	?=0 r-band magnitude
48- 50	I3	mmag	e_rmag	?=0 rms uncertainty on rmag
52- 57	F6.3	mag	imag	?=0 i-band magnitude
59- 61	I3	mmag	e_imag	?=0 rms uncertainty on imag
63- 68	F6.3	mag	Bmag	?=0 B-band magnitude
70- 72	I3	mmag	e_Bmag	?=0 rms uncertainty on Bmag
74- 79	F6.3	mag	Vmag	?=0 V-band magnitude
81- 83	I3	mmag	e_Vmag	?=0 rms uncertainty on Vmag

Byte-by-byte Description of file: table5.dat

Bytes	Format	Units	Label	Explanations
1- 9	A9	---	SN	SN name (SN 2007on or SN 2011iv)
11- 17	F7.2	d	JD	Julian date (JD-2450000)
19- 24	F6.3	mag	Ymag	?=0 Y-band magnitude
26- 28	I3	mmag	e_Ymag	?=0 rms uncertainty on Ymag
30- 35	F6.3	mag	Jmag	?=0 J-band magnitude
37- 39	I3	mmag	e_Jmag	?=0 rms uncertainty on Jmag
41- 46	F6.3	mag	Hmag	?=0 H-band magnitude
48- 50	I3	mmag	e_Hmag	?=0 rms uncertainty on Hmag
52- 54	A3	---	Tel	Abbreviation of the telescope used (1)

Note (1): Telescope abbreviation as follows:
SWO = Swope telescope
DUP = du Pont telescope

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Christa Gall, christa(at)dark-cosmology.dk

(End) Christa Gall [Aarhus Univ., Denmark], Patricia Vannier [CDS] 29-Nov-2017

*The document above follows the rules of the Standard Description for Astronomical Catalogues; from this documentation it is possible to generate **f77** program to load files into arrays or line by line*

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