



Infrared Light Curves of Nearby Supernovae with the Peters Automated Infrared Imaging Telescope (PAIRITEL)



A.S. Friedman, M. Modjaz, W.M. Wood-Vasey, C.H. Blake, R.P. Kirshner, P. Challis, E.E. Falco (*Harvard-Smithsonian Center For Astrophysics*), J.S. Bloom (*UC Berkeley*), M.F. Skrutskie (*U. of Virginia*), CfA Supernova Program, PAIRITEL Collaboration

afriedman@cfa.harvard.edu, http://cfa-www.harvard.edu/~afriedman/ptel_sn.htm

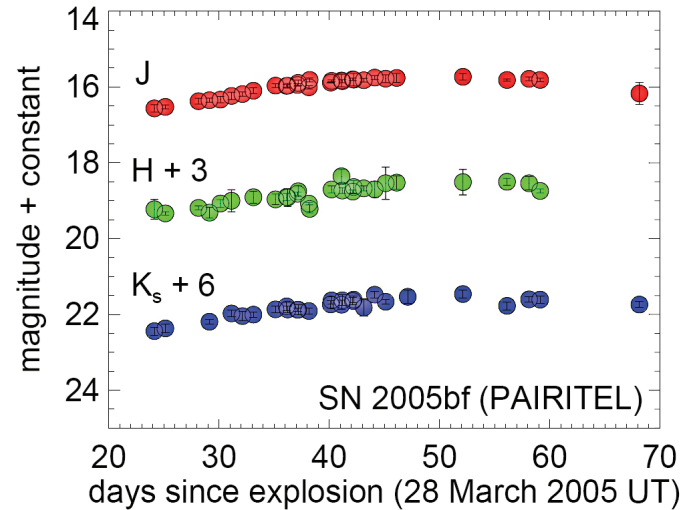
Abstract

We outline the global performance statistics for the first 1.5 observing seasons of the PAIRITEL supernova project using the fully robotic Peters Automated Infrared Imaging Telescope (PAIRITEL) located on Mount Hopkins in Arizona. We present JHK_s light curves for supernova 2005bf, arguably the most interesting supernova followed to date, and we discuss the implications of a densely covered, homogenous sample of nearby Type Ia and Ib/c SNe light curves in the near infrared, which PAIRITEL should provide within the next 2-3 years.

Observations

The PAIRITEL Supernova Project uses the fully robotic 1.3m PAIRITEL telescope at Mount Hopkins, formerly the 2MASS telescope (Bloom 2005). Since its commissioning in October 2004, PAIRITEL has dedicated ~1-2 hours a night to follow up 32 nearby SNe ($z < 0.02$) of all types (20 SNe Ia, 9 SNe Ib/c, 3 SNe II). Simultaneous JHK_s observations and nightly cadence allow for densely sampled light curves reaching K_s < 17 mag, from as many as ~15 days before max. to ~25 days past max., with realistic goals of ~10% photometry overall with ~3% accuracy near both IR peaks.

JHK_s Light Curves: SN 2005bf



JHK_s light curves of the unique SN 2005bf, error bars inside plot circles (Modjaz et al. *in prep.*). The optical LC was double peaked and the late development of He lines suggested an unprecedented transition from Type Ic to Type Ib (Tominaga et al. 2005).

Type Ib/c SNe in the Near Infrared

Roughly 20% of the bolometric flux for SNe Ib/c is emitted in the near-IR, making JHK_s data crucial to understanding the total SN energy budget, constraining explosion models including maverick SNe like 2005bf (above; Tominaga et al. 2005, Modjaz et al. *in prep.*), and elucidating the connection to long duration Gamma-Ray bursts (Staneck 2005, review). With less extinction in the near-IR, and only ~5 SNe Ib/c JHK_s light curves in the literature, the PAIRITEL SN project will considerably expand the current sample and explore exciting new parameter space for Type Ib/c SNe.

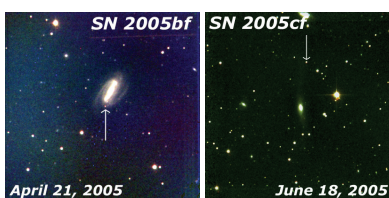
Type Ia Standard Candles in JHK_s

SNe Ia in the near-IR may be superior distance indicators than in the optical bands. As a result, unlike optical Type Ia SNe, which are *standardizable* candles, IR SNe Ia appear to be essentially *standard* candles at the ~ 0.15-0.2 mag level or better (~7-9% in distance), depending on the filter (Krisciunas et al. 2004, 2005). Current PAIRITEL data includes ~15 well sampled SNe Ia in JHK_s. Combining this with the next 2-3 years of data should yield a sample of ~40 well observed SNe Ia from which to construct JHK_s LCs, representing a homogeneous, high quality nearby training set to calibrate the Type Ia Hubble Diagram in the near-IR.

The CfA Supernova Program has been supported by NSF Grant AST0205808 to Harvard University, A.S.F. Acknowledges support from an NSF graduate research fellowship. The PAIRITEL project has been made possible by a grant from the Milton Fund (Harvard University). The camera is on long-term loan from Prof. Mike Skrutskie at the University of Virginia.

2004-05			2005-06 (As of Jan 1st, 2006)		
SN	Type	Epochs	SN	Type	Epochs
2005am	Ia	18	2005el	Ia	50
2004gq	Ib-Ic	3	2005ec	Ia	3
2004gt	Ic	30	2005ek	Ic	24
2004gk	Ic	43	2005M006	Ia	46
2005ao	Ia	26	2005en	II	48
2005ak	Ia	44	2005eo	Ic	48
2005al	Ia	1	2005eq	Ia-pec	50
2005ay	II	17	2005eu	Ia	38
2005bl	Ia	22	2005hf	Ia	32
2005bf	Ic→Ib	26	2005hg	Ib	45
2005bo	Ia	17	2005hk	Ia	25
2005az	Ic	22	2005iq	Ia	16
2005cc	Ia	29	2005ke	Ia	33
2005cf	Ia	30	2005kl	Ic	25
2005ch	Ia	15	2005gj	Ia-pec	10
2005cs	II	6	2005ls	Ia	13

False Color JHK_s Images for SN 2005bf, SN 2005cf



References

- Bloom et al. 2005, (astro-ph/0511842)
- Krisciunas et al. 2004, *ApJ*, 602, 81
- Krisciunas et al. 2005, *ASPC*, 339, 75
- Modjaz et al. 2006, *in preparation*
- Staneck, 2005, *AIPC*, 752, 142S
- Tominaga et al. 2005, *ApJ*, 633L, 97T