

The Nearby Supernova Factory

Benjamin Weaver for the Nearby Supernova Factory

<http://snfactory.lbl.gov/>

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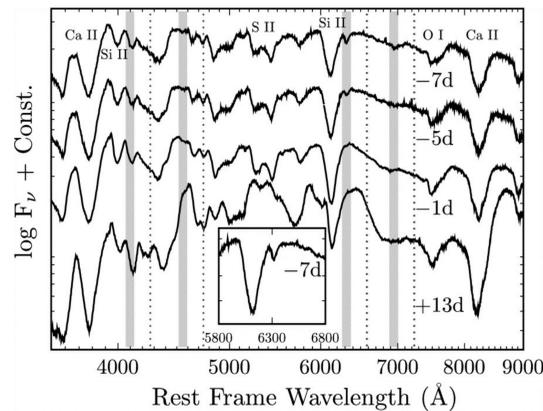
(artist's concept)

Abstract

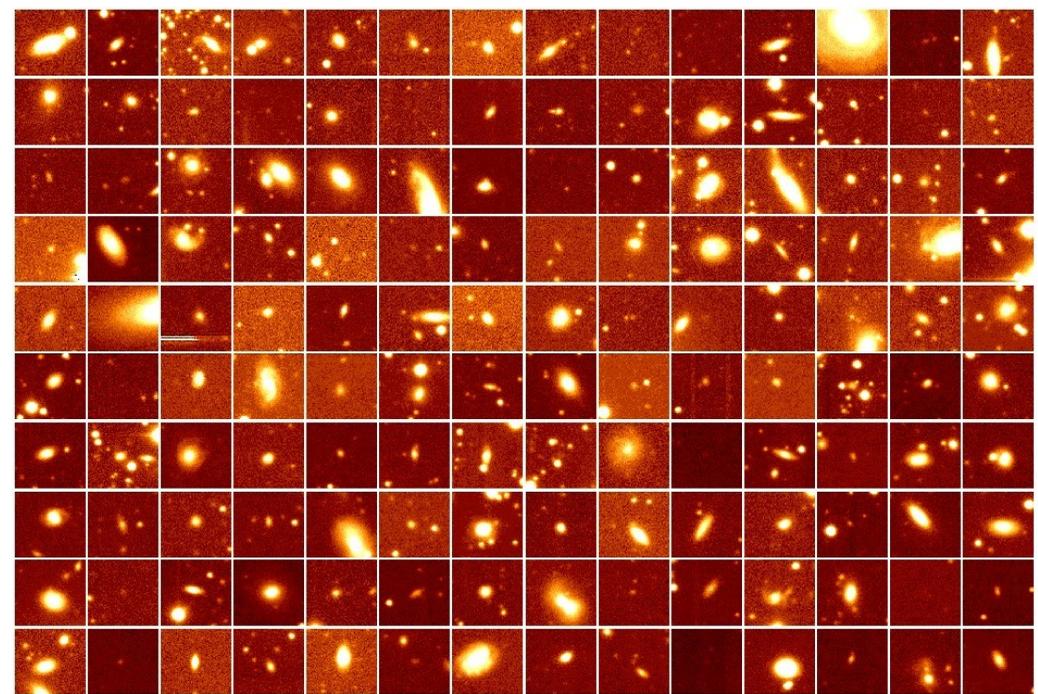
The Nearby Supernova Factory is an international project to discover and study nearby thermonuclear (type Ia) supernovae. The search of targets in the redshift range $0.03 < z < 0.08$ is based on data from the Near Earth Asteroid Tracking (NEAT) program and the Palomar Consortium QUEST camera program at Mt. Palomar. This produces a sample of SNe that is not biased against low-luminosity, low-metallicity hosts. Follow-up observations are performed with the dedicated Supernova Integral Field Spectrograph (SNIFS) at the University of Hawaii 2.2 meter telescope at Mauna Kea. The goal is to acquire a large and homogeneous spectro-photometric dataset covering the extended optical range (320-1000 nm), and spanning the full life-time of the explosions. This will allow detailed studies of the local Hubble diagram, the SNe Ia physics, the SNe-host galaxy correlations, and will serve as an unprecedented nearby benchmark for the high- z cosmological studies to come.

SN 2006D

- R. C. Thomas *et al.*, *Astrophys. J. Lett.* **654** (2007) L53.
- Strongest signature of unburned (carbon) material at photospheric velocities ever observed in a Type Ia
- Most consistent with multidimensional deflagration models of white dwarf explosion
- Figure:** SNIFS spectroscopy of SN 2006D. Phases are expressed relative to a B -band peak brightness date of 2006 January 21.8 UTC. Dotted vertical lines mark rest frame wavelengths of C II lines 4267, 4745, 6580, and 7234. Dark bands indicate blueshifts between 10,000 and 14,000 km s^{-1} with respect to these lines, typical of the velocity at the photosphere at these phases. The inset is a zoom of the region around the 6320 Å notch in the -7 day spectrum.



Please see R. C. Thomas, "Nearby Supernova Factory Spectroscopy of the Type Ia Supernova 2006D", Presentation 229.07, 10 January, 10:00 AM for further details.



Host Mosaic

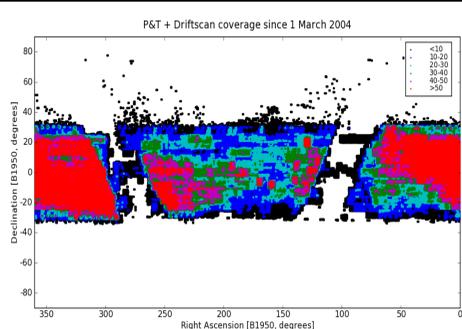
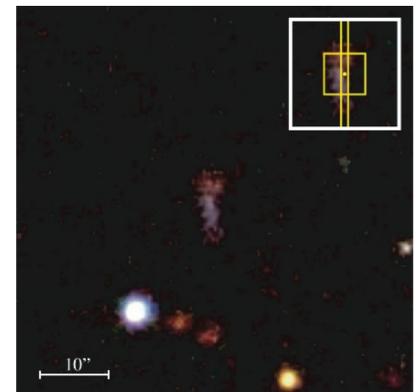
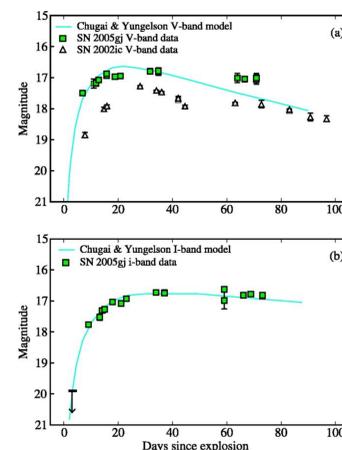
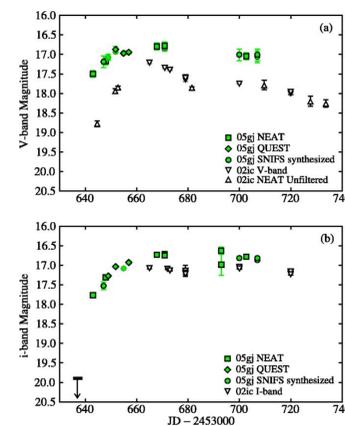
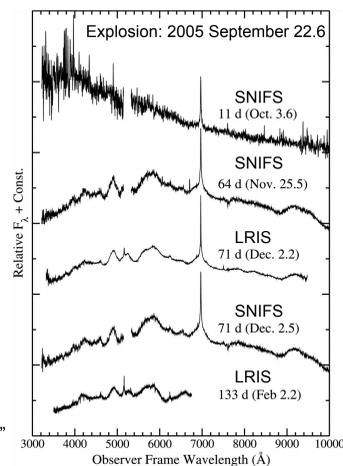
A selection of hosts of supernovae observed by the Nearby Supernova Factory. The images were produced from coaddition of on average 50 individual reference images.

SN 2005gj

- G. Aldering *et al.*, *Astrophys. J.* **650** (2006) 510.
- A "hybrid" SN similar to SN 2002ic: a Type Ia with prominent Type II-like H features.
- Discovered in anonymous, low-luminosity, low-metallicity host
- Consistent with explosion of a Type Ia in a circumstellar medium.
- Unusual lightcurve has implications for cosmology using Type Ia SNe

FIGURES

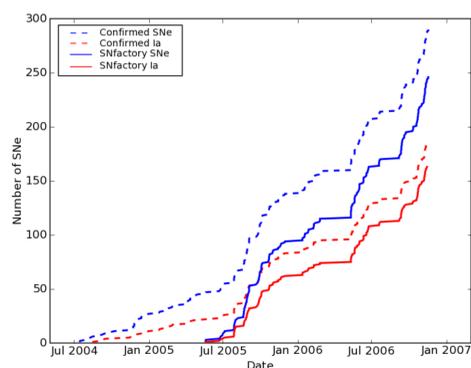
- Combined spectroscopy of SN 2005gj.
- Light curve of SN 2005gj in (a) V band and (b) i band. All data points have been extinction corrected, and the SN 2002ic data points have been adjusted for the cosmological effects, but not the bandpass shift, due to the small difference in redshift.
- Comparison if SN 2005gj data with the V- and i-band light-curve model of Chugai & Yungelson (2004) as calculated for SN 2002ic using a flat CSM radial density profile.
- SDSS gri color composite of the host galaxy of SN 2005gj with north up. In the inset to the upper right, the SNIFS IFU 6"x6" field of view is shown as a square, the LRIS 1" wide slit runs north and south, and the location of SN 2005gj is indicated by the dot. The bar at the lower left is 10".



Search Coverage

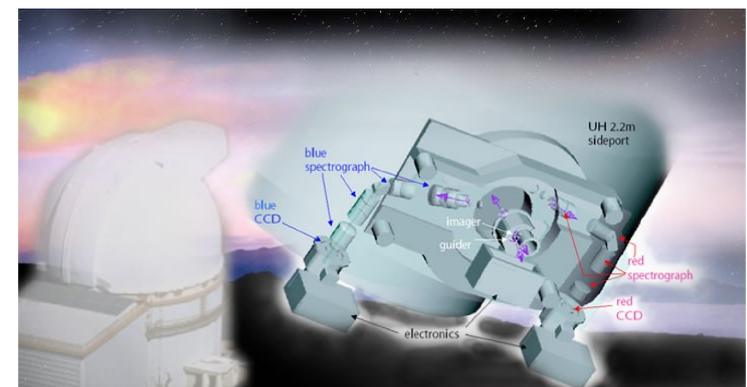
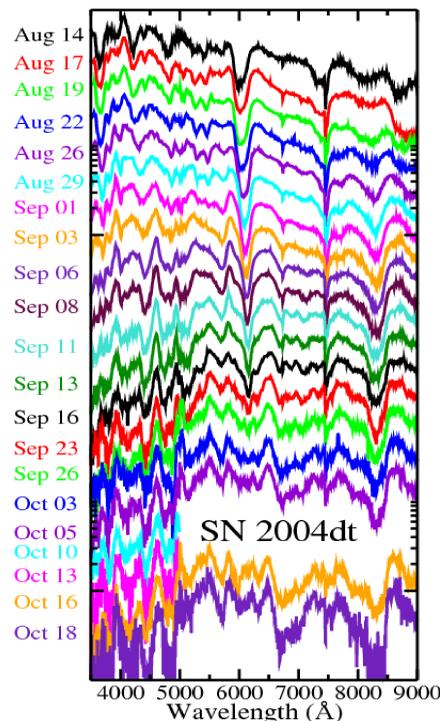
Since 2004 we have observed ~20000 square degrees with an average depth of ~30 epochs. The NEAT asteroid search operates in point & track mode while the QUEST program operates in driftscan mode. This constitutes one of the largest contemporary sky surveys.

Galaxies in the redshift range $0.03 < z < 0.08$ are distant enough to be in the smooth Hubble flow, yet close enough for detailed spectral imaging.



Number of SNe

As of December 2006, we have observed 290 SNe, including 184 SNe Ia, 75 with at least 6 spectral epochs.



SuperNova Integral Field Spectrograph

The Supernova Integral Field Spectrograph (SNIFS) was installed on the UH 2.2 m telescope on Mauna Kea in April 2004. At present 20-30% of observing time is allocated to observing supernovae with SNIFS. The instrument features a dual-channel optical spectrograph and an imaging/guiding camera. Each spectrometer channel has a 15x15 microlens array that splits the 6"x6" field of view into 225 spectra. Supernovae spectra are then extracted from the resulting datacubes. Simultaneous multi-filter imaging of adjacent stars allows correction of supernovae spectra for atmospheric extinction on non-photometric nights.