The SDSS-II Supernova Survey

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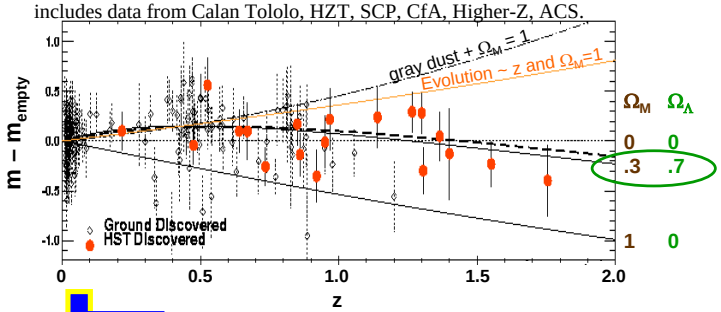
ABSTRACT

The SDSS-II Supernova Survey is part of the recently approved SDSS-II optical survey. The goal is to discover 200 Type Ia supernovae in the redshift range 0.05 < z < 0.35, and to measure their multiband lightcurves. This SN sample will be used to probe dark energy and to investigate corrections to the peak luminosity. Here we present preliminary results of a test campaign in the Fall of 2004, as well as a program for a three-year run (2005-7).

SN Ia Hubble diagram: compilation from Riess et. al., AJ 607 (2004) includes data from Calan Tololo, HZT, SCP, CfA, Higher-Z, ACS.



Motivation

Due to their high luminosities and near uniformity, Type Ia Supernovae (SNe) serve as precise cosmological distance indicators. By combining photometric and spectroscopic observations of SNe Ia, we probe the expansion history of the universe and the nature of Dark Energy. The SDSS SN Survey will contribute mainly to the "redshift desert", a region that is difficult to cover in other surveys.

Low redshift surveys →
Calan Tololo, CfA … SNFactory, KAIT

redshift "desert"

High redshift surveys

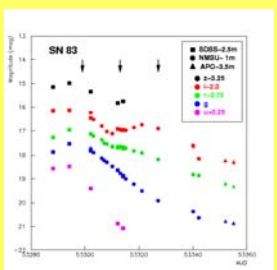
SCP, HZT, Higher-Z, ACS, CfA … ESSENCE, SNLS
(Proposals : DES, LSST, SNAP/JDEM)

SDSS-II Supernova Survey (Approved!)

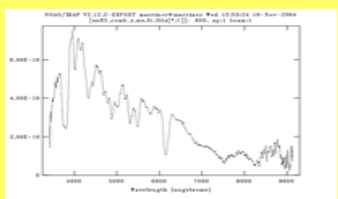
SDSS Fall 2004 Test Campaign

A test run of the SDSS SNe search was undertaken during Sept-Nov 2004. 16 type Ia SNe were discovered with spectroscopic confirmation, plus 5 Type II Sne, and 1 Type Ic.

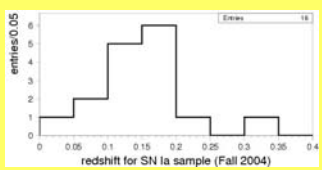
SDSS image of SN 2004ie (z=0.05) with host galaxy, discovered during Fall 2004. Left/right => before/after SN explosion..



SDSS ugriz light curves for SN 2004ie. Arrows indicate dates of spectroscopy



Spectrum of SN 2004ie near peak, taken with ARC 3.5m



Redshift distribution for 16 SNe Ia discovered during Fall 2004.

SDSS 2.5 meter telescope at the Apache Point Observatory in New Mexico. The Sacramento Mountains are in the background.

SDSS-II 2005-7 Campaigns

The SDSS II SN survey will cover ~270 sq. degrees (140 sq. deg per night) from early September – late November 2005-2007. The same area will be revisited every other night. Ten new compute servers at APO (beginning Aug 2005) will be dedicated to searching for SN in g,r,i bands, and the data from each night will be processed within 24 hours.

Compared to Fall 2004, SDSS II anticipates a higher SNe yield by a factor > 4 from:
- longer campaign => more than double the SN lightcurves
- ~x2 larger survey area
- improved detection efficiency (mainly at higher z)

The spectroscopic resources available for SN typing, redshift determination, and multi-epoch spectrophotometry will be substantial:
- Fall 2004: HET 9.2m, ARC 3.5m
- SDSS II: HET 9.2m, ARC 3.5m, MDM 2.4m
- Proposals pending for Subaru 8m, WHT 4.2m, NTT 3.5m, VLT 10m

Goal is to obtain densely sampled, multi-band (ugriz) light curves and spectral typing for ~200 Type Ia SNe in the redshift range 0.05-0.35 in these 3 years. The survey will also find a comparable number of Type II SNe and also the rarer Type Ib/c thought to be associated with gamma-ray bursts.