http://kicp-workshops.uchicago.edu/SNphotID_2012/

WORKSHOP ABSTRACTS

The Kavli Institute for Cosmological Physics (KICP) at the University of Chicago host the "Photometric Identification of Supernova" KICP Supernova Hub workshop from Friday March 16th to Saturday March 17th in Chicago, IL.

The workshop will focus on methods for identifying type Ia Supernvae (SNIa) without spectroscopy. The emphasis will be on using these photometric SNIa for Hubble Diagram analyses in PannStarrs, the Dark Energy Survey (DES) and the Large Synoptic Survey Telescope (LSST).

Organizers:

Richard Kessler, University of Chicago
Joshua Frieman, University of Chicago and Fermilab

1. **Heather C Campbell**, ICG, Portsmouth
   Cosmology with SDSS-II Photometrically-Classified Type Ia Supernovae

   March 16, 2012 (2:00 PM - 2:40 PM)

   Co-authors: SDSSII SN collaboration
   Future supernova surveys, such as the Dark Energy Survey (DES), will be unable to spectroscopically classify all the Type Ia Supernovae (SNe Ia) that they are predicted to detect (approximately 4000). The development of an efficient and robust photometric classification system is thus essential. Here I present the cosmological analysis of a photometrically-classified sample of SNe Ia from the full Sloan Digital Sky Survey (SDSS) II Supernova Survey, supplemented with host galaxy redshifts from the Baryon Oscillation Spectroscopic Survey (BOSS). In total, we photometrically-classify approximately 700 SNe Ia out to $z < 0.5$ with cosmologically-useful light curves, which is about 3 times the size of the comparable spectroscopically confirmed sample from SDSS. Tests with simulations show that our method results in less than 5% contamination, which we show does not bias our cosmological results. Using only photometrically-classified SNe Ia, we produce cosmological constraints comparable to the Supernova Legacy Survey (SNLS) 3 year spectroscopically confirmed SNe Ia. This work demonstrates the potential of photometric classification, which will become the primary method of compiling SN Ia samples in high-redshift surveys in the near future.

2. **Brian Connolly**, University of Pennsylvania
   Photometric typing with SDSS

   March 16, 2012 (4:00 PM - 4:40 PM)

3. **John D Cunningham**, Loyola University Chicago
   Simulation inputs for Core Collapse Supernovae

   March 17, 2012 (11:40 AM - 12:30 PM)

4. **Ben Dilday**, LCOGT/ UCSB
   Photometric Search for Weirdos in the SDSS-II SN Survey Data

   March 16, 2012 (11:50 AM - 12:30 PM)

   I discuss a method for photometric classification of transients using model-free light curve interpolations based on Gaussian process regression. The method is applied to a search for weirdos, e.g. ultra-luminous SNe or "point-Ias", in the SDSS-II SN Survey data set.

5. **Jefferson R Duggan**, Loyola University Chicago
   Dark Energy Survey Type Ia Supernovae Selection and Identification

   March 17, 2012 (9:00 AM - 9:20 AM)

   Co-authors: John D. Cunningham, Steve Kuhlman, Eda Gjergo

6. **Eda Gjergo**, Illinois Institute of Technology
   DES Type Ia SNe Selection Part II: Figure of Merit for Cosmology Constraints

   March 17, 2012 (9:20 AM - 9:40 AM)

7. **Renee Hlozek**, Princeton University
   Topics in Photometric Supernova Cosmology

   March 16, 2012 (2:40 PM - 3:20 PM)

   Co-authors: Martin Kunz, Bruce Bassett, Mat Smith, James Newling, Melvin Varughese, Rick Kessler, Joe Bernstein, Heather Campbell, Ben Dilday, Bridget Falck, Joshua Frieman, Steve Kulhmann, Hubert Lampeitl, John Marriner, Robert C. Nichol, Adam G. Riess, Masao Sako, Donald P. Schneider, Bryony Martin, David Parkinson
   I will present a review of approaches to both Photometric SN typing and Bayesian methods for photometric SN cosmology, and I will highlight some outstanding challenges.

8. **Emille E. O. Ishida**, IAG - University of Sao Paulo
   On the application of kernel PCA to the SN photometric classification problem

   March 16, 2012 (9:30 AM - 10:10 AM)

   Co-authors: Rafael da Silva de Souza
   The current and future supernova surveys have the ability to observe much more supernovae than our spectroscopic follow-up capacity. In such a scenario, the development of modern and fast tools for supernova classification based only in their light-curves is of vital importance. We present a method for supernova typification based on a nonlinear variation of textit{Principal Components Analysis} (PCA), namely kernel PCA (KPCA). The method allows us to compute PCA in a higher dimensional space, which is related to input space by a nonlinear map. We combine KPCA with $k=1$ nearest neighbor classification algorithm and applied it to over $sim 20000$ simulated light curves. Using the light curve behavior between ${-3,+24}$ days since maximum brightness, we obtained geq85% efficiency and purity rates for the spectroscopically confirmed sample (through cross-validation). The photometric sample achieved up to 84% efficiency and 91% purity. We also present the first attempt to classify such a large set of photometric SNe light curves using only pre-maximum data. In this scenario, we obtained 80% efficiency and 73% purity using a selection cut of SNR$>$5 and light curve behavior between ${-10,0}$. Using a range of different light curve samplings and data quality cuts, we show the method is comparable to the best template fitting techniques currently used, with the advantage that it is less sensitive to biases between the spectroscopic and photometric samples and does not require information on redshift, as long as we have high quality photometric observations.

9. **Richard Kessler**, University of Chicago
   Why Simulate CC SNe ?

   March 17, 2012 (10:00 AM - 10:20 AM)

10. **Jesse Leaman**, Space Science Institute
Nearby supernova rates by subclass and host galaxy characteristics.

March 17, 2012 (10:20 AM - 11:00 AM)

Co-authors: Weidong Li, Alex Filippenko
We present results from the Lick Observatory supernova search (10 year database) on the luminosity functions (LFs) of various supernova subclasses.These LFs solve two issues that have plagued previous rate calculations for nearby SNe: the luminosity distribution of SNe and the host-galaxy extinction. Using a volume-limited sample of 175 SNe, with photometry for every object, Li W et al. 2011 [SNr II] fit a family of light curves to constrain the peak magnitudes and light-curve shapes. Li W et al. 2011 [SNr III] used an optimal subsample of 726 SNe (274 SNe~Ia, 116 SNe~Ibc, and 324 SNe~II) to determine supernova rates in the local universe ($z < 0.05$). In the 2nd part of the talk we present the rates for supernova types (Ia, Ibc, II) as a function of a few quantities available for the galaxy sample, such as luminosity in the B and K bands, stellar mass, and morphological class. Implications of these new results are discussed in the context of supernova progenitor models and dark energy science.

11. **Joseph W Richards**, UC Berkeley
Semi-Supervised Supernova Classification

March 16, 2012 (10:10 AM - 10:50 AM)

I will introduce a semi-supervised approach to supernova typing using the diffusion map technique for manifold learning. Unlike standard supervised learning methods, semi-supervised learning employs all of the observed supernova data to learn an appropriate low-dimensional embedding of the data. This embedding is subsequently used to train a supervised classifier on the subset of spectroscopically confirmed SNe. I will outline some of the advantages and disadvantages of this method compared to other more commonly used techniques such as template fitting and standard supervised learning. If time permits, I will describe the problem of sample selection bias in SNe training sets and propose some methods to deal with it.

12. **Daniel Scolnic**, JHU
Classification Methods for PS1

March 16, 2012 (11:10 AM - 11:50 AM)

Co-authors: Adam Riess, Steve Rodney

13. **Daniel Scolnic**, JHU
Updated SED templates for CC

March 17, 2012 (11:20 AM - 11:40 AM)