

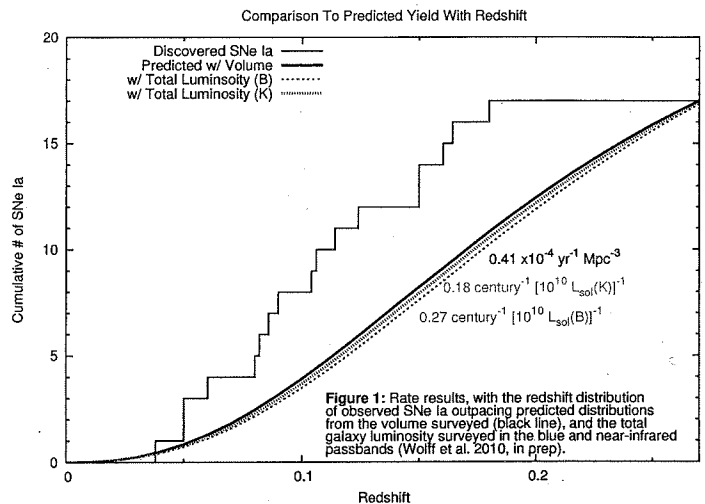
I am a co-investigator (under the direction of Dr. Louis-Gregory Strolger) in an investigation into the rates of type Ia supernovae (SNe Ia) in low- $z$  galaxies. The project seeks to address if galaxies of certain star-formation rates, metallicities, or ages are predisposed to producing SNe Ia. Our method is to compare metallicities, star-formation rates, and stellar ages in the  $\sim 30$  anonymous galaxies which have hosted SNe Ia in the duration of the Nearby Galaxies Supernova Search project (NGSS) to literature measures for known galaxies in the same redshift regime ( $z < 0.1$ ), and to results from similar investigations at various redshifts (e.g., The Sloan Digital Sky Survey, SNfactory, the Supernova Legacy Survey, and the GOODS program with the Hubble Space Telescope). Current investigations on SN Ia rate and luminosity trends with environmental parameters have thus far been ambiguous, partly due to indirect proxies used for galaxy metallicities (i.e., luminosity and morphology), and the large variances in these relations. Direct measures from a relatively small sample of SN Ia hosts may provide more leverage than the current convention of indirect measures on large host samples. These data will resolve the most influential factors for SN Ia production, further constraining the nature (stars involved, accretion rates, and explosion mechanism) of these systems, and provide critical insights on the robustness of SNe Ia as cosmological tools.

Since the Spring of 2007, I have led the re-analysis of rates in the NGSS data. I have been chiefly responsible for a more thorough review of the survey data, which covers approx. 490 square degrees of sky over four non-congruent search epochs for an effective search area of over 1200 square degrees. We have employed new, more optimal baseline combinations between template and search epoch images to maximize potential yield, and through improved image subtraction techniques, we have been able to uncover 20 previously unknown candidate SNe Ia, in addition to the 18 (+24 core-collapse supernovae) that were discovered in the initial cadence of the survey (for a total of 62 SNe and strong SN candidates).

With these new discoveries, I have spent the last year re-calculating the volumetric and luminosity-weighted rate of SNe Ia in the  $z < 0.15$  universe, including detailed calculations of survey depth efficiency, effective time on the sky, and total comoving volume surveyed. I have had the exclusive responsibility in creating the series of IDL programs to calculate the rate based on the variety of experimental factors described.

A preliminary result I've found, shown in Figure 1, is that the observed redshift distribution of confirmed SNe Ia (18 events) appears very different from the expected distribution, predicted from the known volume density of galaxies at low- $z$  and the sensitivity constraints of the survey. Culprits for the discrepancies are that the

observation list is incomplete (likely, as more S. candidates have been identified), or that the luminosity density (presumably the number of progenitors) is not the only principle factor for SN Ia production. The full results of these new rates will be published in a manuscript I am currently preparing (as the lead author) for publication in the *Astrophysical Journal* in 2010.



The next phase in this investigation is to examine the spectroscopic properties of these SN host galaxies. We have recently obtained spectra of these hosts with the Mayall 4-meter at Kitt Peak National Observatory, and the Hale 200" at CalTech Palomar Observatory. I am a co-investigator on proposals for additional time in the 2010B semester, and will travel to assist in the observations. From these spectra, we will use galaxy modeling synthesis techniques to constrain the stellar population ages and the total stellar mass. We will use  $H\alpha$ /  $H\beta$  to measure the rate of star formation in these galaxies. Gas-phase metallicity will be measured via the R23 method from [OII] and [OIII]. Comparisons will be made to both direct and indirect metallicity/age results from the literature, and other pending results from various supernova surveys in several redshift regimes, including the GOODS/HST-SN surveys.

Once the host sample measurements are complete (expected in Fall 2010), my next task will be to break the survey yield into subsamples based on similar galaxy properties, and to recalculate the SN Ia rates, with careful consideration of new effective survey efficiencies, sky coverage, and volumes. The results of this analysis will make up my undergraduate Honors thesis. I will also assist in comparison study of rates as a function of host galaxy morphology, led by my other student collaborators (directed by Dr. Strolger). From these projects, it is hoped that reliable trends can be established that elucidate the largely unknown progenitors of Type Ia supernovae.