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CORE-COLLAPSE SUPERNOVAE AND HOST GALAXY STELLAR POPULATIONS

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ABSTRACT

We have used images and spectra of the Sloan Digital Sky Survey to examine the host galaxies of 519 nearby supernovae. The colors at the sites of the explosions, as well as chemical abundances, and specific star formation rates of the host galaxies provide circumstantial evidence on the origin of each supernova type. We examine separately SN II, SN IIn, SN IIb, SN Ib, SN Ic, and SN Ic with broad lines (SN Ic-BL). For host galaxies that have multiple spectroscopic fibers, we select the fiber with host radial offset most similar to that of the SN. Type Ic SN explode at small host offsets, and their hosts have exceptionally strongly star-forming, metal-rich, and dusty stellar populations near their centers. The SN Ic-BL and SN IIb explode in exceptionally blue locations, and, in our sample, we find that the host spectra for SN Ic-BL show lower average oxygen abundances than those for SN Ic. SN IIb host fiber spectra are also more metal-poor than those for SN Ib, although a significant difference exists for only one of two strong-line diagnostics. SN Ic-BL host galaxy emission lines show strong central specific star formation rates. In contrast, we find no strong evidence for different environments for SN IIn compared to the sites of SN II. Because our supernova sample is constructed from a variety of sources, there is always a risk that sampling methods can produce misleading results. We have separated the supernovae discovered by targeted surveys from those discovered by galaxy-impartial searches to examine these questions and show that our results do not depend sensitively on the discovery technique.

Subject headings: supernovae: general — stars: abundances — galaxies: star formation — gamma-ray burst: general

1. INTRODUCTION

The only supernovae (SN) found in passive, elliptical galaxies are Type Ia (van den Bergh & Tammann 1991; van den Bergh et al. 2005). Finding these events in galaxies without ongoing star formation is strong evidence that long-lived (or relatively long-lived) progenitors contribute to the observed SN Ia population. SN of other spectroscopic types have been discovered only in star-forming galaxies: that is why we think these SN types are explosions of massive, short-lived stars.

Our aim here is to use more detailed information on the hosts to help sort out the origin of the varieties of core-collapse events. Host galaxy measurements have started to identify patterns among the environments of the many spectroscopic types of core-collapse supernovae (e.g., van Dyk et al. 1996; Modjaz et al. 2008; Kelly et al. 2008). Here, we construct a nearby sample of supernova hosts where ground-based images provide useful spatial resolution: for the median redshift in our sample ($z \approx 0.02$), one arcsecond corresponds to 400 parsecs assuming H_o=73 km s^{-1} Mpc^{-1}. We use images from SDSS Data Release 8 (DR 8) to measure the color at the supernova sites and to estimate the hosts' stellar masses, and Sloan spectra to determine the hosts' oxygen abundances, specific star formation rate (SFR), and the interstellar reddening. Although these are blunt tools for determining how star formation, stellar evolution, mass loss, and progenitor chemistry produce the diversity of core-collapse phenomena, circumstantial evidence can provide useful clues to these complex processes.

The primary SN spectroscopic classes are organized around evidence of hydrogen and helium features (see Filippenko 1997 for a review). Young, massive stars with an intact hydrogen envelope at the time of their explosion yield hydrogen-rich spectra, the Type II class. When massive SN progenitors lose their hydrogen-rich shells, the explosion can produce a variety of spectroscopic outcomes. SN Ib have a hydrogen-deficient spectrum that shows helium features, while SN Ic do not show either hydrogen or helium lines. The chameleon SN IIb class shows the hydrogen lines of a SN II at first, but then shows helium lines, suggesting there is only a low-mass layer of hydrogen on the surface. Line widths are also important. The spectra of SN Ic sometimes show very broad lines, suggesting expansion of the surface at $0.1c$: these are the broad-lined SN Ic (SN Ic-BL). Conversely, SN II are sometimes seen with exceptionally narrow lines. These are the SN IIn, which result from interaction between the ejecta and circumstellar matter. SN Ia are a distinct class whose spectra are characterized by the absence of hydrogen and the presence of a broad absorption feature at 6150Å that is attributed to Si. Unlike all the others, they are attributed to thermonuclear explosions in white dwarfs.

Spectra of the SN are reported by their discoverers or, in many cases, by independent teams. The CfA Supernova program aims to obtain spectra of all the SN north of -20° and brighter than 18th mag (e.g., Matheson et al.

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TABLE 1
Galaxy-Impartial Sample Construction

Criterion	II	IIn	IIb	Ib	Ic	Ic-BL
CC/Asiago+PTF/$z < 0.08$	116	10	10	11	23	9
Discovered 1990-Present	116	10	10	11	23	9
Confident Spec. Type	113	10	9	11	21	9
Not Ca-rich	113	10	9	11	21	9
SN Position	113	10	9	11	21	9
DR8 Imaging Footprint	97	9	9	10	17	9
Sufficient Coverage	94	9	8	10	17	9
No Host Detected	91	7	6	9	17	9
Host Photometry Sample						
No Bright Star	90	7	6	9	16	9
No SN Contamination	79	6	5	9	15	9
Host Spectroscopy Sample						
Host Fiber	41	1	1	5	8	3
No AGN Contam.	34	1	1	4	8	3
Nuclear Fiber	25	1	1	3	7	2
Offset within 3 kpc	20	1	1	3	6	3

Note. — See Table 2 description.

TABLE 2
Targeted Sample Construction

Criterion	II	IIn	IIb	Ib	Ic	Ic-BL
CC/Asiago/$z < 0.023$	577	71	46	70	118	11
Discovered 1990-Present	486	65	45	61	113	11
Confident Spec. Type	467	59	40	58	105	11
Not Ca-rich	467	59	40	57	105	11
SN Position	455	58	40	57	102	11
DR8 Imaging Footprint	247	36	22	34	57	9
Sufficient Coverage	234	34	19	31	55	8
No Host Detected	234	34	19	31	55	8
Host Photometry Sample						
No Bright Star	230	34	19	30	55	8
No SN Contamination	204	29	17	27	43	7
Amateur	90	14	9	10	16	5
Host Spectroscopy Sample						
Host Fiber	115	18	15	15	27	5
No AGN Contam.	91	13	12	12	26	5
Nuclear Fiber	42	8	7	6	13	3
Offset within 3 kpc	59	6	4	7	17	3
Amateur	46	3	8	8	11	4

Note. — SN remaining of each spectroscopic type after applying inclusion criteria. Indented rows are subsets of the last unindented row. (1) SN collected in the Asiago Catalog updated through 2010 November 7 with $z < 0.023$ for targeted discoveries (and, for Table 1, $z < 0.08$ Asiago galaxy-impartial discoveries combined with the 72 Palomar Transient Factory (PTF) core-collapse SN discoveries from March 2009 through March 2010 (Arcavi et al. 2010)) and not classified as Type Ia; (2) SN discovered during period 1990-present to eliminate most discoveries made using photographic plates; (3) Asiago catalog or PTF SN classification not accompanied by ('?'; ambiguous identification) or (':'; type inferred from light curve not spectrum); (4) calcium-rich SN 2000ds, SN 2003dg, SN 2003dr, and SN 2005E are grouped apart from other SN (Ib+Ic) because of their potentially distinct progenitor population; (5) SN position coordinates in the host galaxy; (6) inside SDSS DR 8 imaging footprint; (7) retrieved SDSS images collectively cover host galaxy without header issue; (8) host galaxy not detected (SN 2006jl (IIn); SN 2006lh (II); SN 2007fl (II); SN 2008bb (II); SN 2008it (IIn); SN 2009dv (IIP); SN 2009lz (IIP); SN 2009ny (Ib); PTF09gyp (IIb)); (9) no contamination from nearby bright stars; (10) no contamination from residual SN light, the sample used for photometry measurements; (10a) amateur discoveries in the targeted photometry sample; (11) an SDSS host fiber available with SPECTROTYPE='GALAXY' and sufficient S/N to classify using BPT diagram; (12) no contamination from an active galactic nucleus (AGN) in SDSS spectrum; (12a) fibers that are positioned on the host galaxy nucleus; (12b) where the difference between the fiber's host offset and the SN host offset is less than 3 kpc; (12c) amateur discoveries in the spectroscopy sample; Two SN-LGRB had $z < 0.08$ (SN 1998bw and SN 2006aj), and only the host of SN 2006aj was inside the SDSS DR8. The middle and bottom sections of the Table correspond to the 'Photometry' and the 'Spectroscopic' samples, respectively, subsets of the SN remaining after the 'No Host Detected' criterion is applied.

2008; Blondin et al. 2012), following up discoveries made by amateurs and by programs like the Lick Observatory Supernova Search (LOSS; Filippenko et al. 2001; Filippenko 2003). Programs with the MMT, Magellan, and Gemini pursue fainter SN discoveries from the wide-field PAN-STARRS survey (Kaiser et al. 2010). The Palomar Transient Factory (PTF) (Law et al. 2009), a galaxy-impartial search with the 1.2m Oschin Telescope begun in 2009, has discovered and spectroscopically classified more than a thousand SN. Supernova classifications have become more refined over time and the brief reports in IAU Circulars or in catalogs may need to be revisited as new varieties are defined. For this reason, it will be valuable to archive spectra for future analysis, not just present the classification in an IAU Circular. The CfA spectra, and collections of other spectra organized by the University of Oklahoma and the Weizmann Institute, are currently available online[4,5,6].

With the uniform spectroscopy and $u'g'r'i'z$ imaging of the SDSS, we study the environments of the most populous SN types, identifying a series of strong patterns for stripped-envelope SN types. Section 2 describes the data. Section 3 details the construction of the SN sample, classification of the SN, and explains how we categorize SN surveys. We distinguish between the methods of SN discovery and test hypotheses using only targeted or only galaxy-impartial SN. In Section 4, we use the redshift distributions of galaxy-impartial SN discoveries to test for detection-related systematic effects. The measurement of host galaxy photometry and spectroscopic oxygen abundances is described in Section 5, our statistical method is described in Section 6, and Section 7 presents the results of our analysis. We compare the relative rates of stripped-envelope SN to Type II with increasing host metallicity to model predictions in Section 8. Section 9 presents a discussion of potential systematic effects. Finally, we discuss our results in Section 10 and present conclusions in Section 11.

2. DATA

The imaging component of the SDSS DR8 spans 14555 square degrees and consists of 53.9 s $u'g'r'i'z'$ exposures taken with the 2.5m telescope at Apache Point, New Mexico. Each frame consists of a 2048 × 1498 pixel array that samples a 13.5′ × 9.9′ field. The complementary fiber SDSS DR8 spectroscopic survey covers a 9274 square degree subset of the DR8 imaging footprint. Objects detected at greater than 5σ, selected as extended, and with r'-band magnitudes brighter than 17.77 comprise the main galaxy sample for spectroscopic targeting. When the r'-band 3" fiber magnitude is fainter than 19 magnitudes, fiber targets must meet additional criteria, and physical constraints limit adjacent fibers to be no closer than 55″ (Strauss et al. 2002) in a single fiber mask. Because of their large angular sizes,

[4] http://www.cfa.harvard.edu/supernova/SNarchive.html
[5] http://suspect.nhn.ou.edu/∼suspect/
[6] http://www.weizmann.ac.il/astrophysics/wiserep/

nearby galaxies were often 'shredded' into multiple objects by the SDSS object detection algorithm [see Fig. 9 of Blanton et al. (2005)], and many of these galaxies were targeted in multiple locations with fibers. Wavelength coverage of the SDSS spectrograph extends from 3800 to 9200 Å. Exposures typically are a total of 45 minutes taken in three separate 15 minute exposures.

We admit only the spectra that the SDSS pipeline classifies as a galaxy (SPECTROTYPE='GALAXY'), a step that includes normal galaxies and Type 2 AGN but removes QSOs and Type 1 AGN.

3. SAMPLE

We assemble our SN samples from discoveries collected in the Asiago catalog (Barbon et al. 1999) through 2010 November 6 and 72 Palomar Transient Factory (PTF) core-collapse SN discoveries from March 2009 through March 2010 (Arcavi et al. 2010). Eight of the SN in the Asiago catalog (all Type II SN) are also among the Arcavi et al. (2010) PTF SN (IAU/PTF: 09ct/09cu; 09bk/09t; 09bj/09r; 09bl/09g; 09ir/09due; 09nu/09gtt; 10K/09icx; 10Z/10bau). Table 2 shows the criteria we describe in this Section on the galaxy-impartial and targeted SN samples.

3.1. *Excluding SN Contamination*

We consider images taken during the period from 3 months before to 12 months after discovery to be potentially contaminated by SN light. Arcavi et al. (2010) do not report the exact discovery dates of PTF SN, so, for these SN, the contamination window begins three months before the start and ends 12 months after the completion of the search period.

To assemble SDSS frames of each SN host, we first queried the SDSS SkyServer for any frames within 9.75' of the host galaxy center. If none was available without possible contamination from SN light (even with partial coverage not including from the field center), we instead assembled and constructed mosaics from potentially contaminated images. Such mosaics were used only to measure the deprojected offsets of SDSS spectroscopic fibers and the SN site in each host galaxy. The header of each SDSS image provides keywords that define a tangent plane projection (TAN) which maps coordinates on the sky to pixel coordinates. We discarded the small number of images retrieved from the SDSS server that lacked the keywords.

3.2. *Spectroscopic Classes*

Our previous work has shown that SN Ic are more strongly associated with bright regions in their host galaxies' g'-band light than are SN Ib (Kelly et al. 2008), indicating that they have a distinct progenitor population, so we group them separately in this analysis. SN IIb and SN IIn subtypes are excluded from the "SN II" sample. A single SN with an associated long duration gamma-ray burst (LGRB), SN 2006aj, meets the sample criteria, but we consider it separately from SN Ic-BL discovered through their optical emission (which have no associated LGRB), as did Modjaz et al. (2008). Today's gamma-ray searches are not sensitive to normal SN explosions.

From a comprehensive set of spectra, we update the classification of SN 2005az. This SN was discovered approximately seventeen days before maximum and spectroscopically classified three days after discovery as a SN Ic by Quimby et al. (2005a). The Nearby Supernova Factory (SNF), from a spectrum taken five days after discovery, suggested it was a Type Ib (Aldering et al. 2005). Spectral cross correlation using the Supernova Identification code (SNID; Blondin & Tonry 2007), applied to 24 spectra taken by the CfA Supernova Group from approximately ten days before to twenty-five days after maximum, shows that it was a Type Ic explosion.

We update the spectroscopic types of ten SN found in the Asiago catalog with reclassifications from CfA spectra (Modjaz et al. 2012, in preparation) using SNID. We also use new spectroscopic classifications for two SN from Sanders et al. (2012a), based on revisions by the authors of the original IAU circulars. The SN in our sample that have new classifications from these papers have footnotes in Tables 7 and 8.

We exclude SN 2006jc, a peculiar SN Ib with narrow helium emission lines and an underlying broad-lined SN Ic spectrum (e.g., Foley et al. 2007; Pastorello et al. 2007), from our SN Ib statistical sample. The helium emission may reflect the collision of ejecta with a helium-rich circumstellar medium.

We group calcium-rich SN 2000ds, SN 2003dg, SN 2003dr, and SN 2005E separately from other SN (Ib+Ic) because of their potentially distinct progenitor population (Perets et al. 2010).

We exclude SN IIn imposters (e.g., Van Dyk et al. 2000; Maund et al. 2006), a group which includes SN 1997bs, SN 1999bw, SN 2000ch, and SN 2001ac.

3.3. *Classification of SN as Type IIb*

While spectra taken over several epochs are necessary to observe the spectroscopic transition that defines SN IIb, such follow up is not always available. Fortunately, the spectra of Type IIb SN similar to SN 1993J are sufficiently distinctive that cross correlation with spectroscopic templates (e.g., SNID), has been able to identify substantial numbers of explosions as Type IIb from a single spectrum. Although classifications based on a single spectrum may overlook examples of SN IIb, the Type IIb explosions they do identify should be reliable.

3.4. *Classification of SN as Type Ib/c SN*

The Asiago catalog entries sometimes have less information than the IAU Circulars and published papers. For example, SN 1997dq and SN 1997ef were listed in the Asiago catalog (as of November 2010) as "Type Ib/c" while Matheson et al. (2001) and Mazzali et al. (2004) identified them as SN Ic-BL. Motivated by these examples, we searched the circulars to see whether additional information was available. Despite making note of the presence or absence of helium more than ten days after the explosion, some authors report a Type Ib/c classification. Authors may feel that a SN Ib/c classification was sufficiently precise while, in other cases, they may have wanted to emphasize conflicting spectroscopic characteristics. An example of the latter is SN 2003A which was classified as a Type Ib/c by Filippenko & Chornock (2003) who noted that "[w]eak He I absorption lines are visible, but the overall spectrum resembles that of type-Ic supernovae."

TABLE 3
SN Luminosity Functions

Survey	Ia	II	IIn	IIb	Ib	Ic	Ic-BL	Ib+Ic
LOSS	-18.49 (0.76)	-16.05 (0.17)	-16.86 (0.59)	-16.65 (0.40)	-17.01 (0.17)	-16.04 (0.31)	...	-16.09 (0.23)
P60	...	...	...	...	-17.0 (0.7)	-17.4 (0.4)	-18.3 (0.6)	...

Note. — Estimates of the mean luminosities of the SN types. The standard deviation of the luminosity function is shown in parentheses. The LOSS (Li et al. 2011b) and the P60 (Drout et al. 2011) samples, respectively, are constructed differently, but differences between the mean luminosities of the SN species should be approximately consistent for these surveys. Li et al. (2011b) favor a much larger difference between SN Ib and SN Ic luminosities than that found by Drout et al. (2011). SN Ic-BL may be more intrinsically luminous than SN Ic. Luminosities above are before correction for extinction, for studying SN detection efficiency.

Classifications by the Nearby Supernova Factory (Aldering et al. 2002; Wood-Vasey et al. 2004) reported in circulars include an unusually high percentage of Type Ib/c. The high fraction of SN Ib/c reported by the Nearby Supernova Factory survey is hard for us to assess without being able to see the spectra or use impartial classification techniques. We have therefore excluded SN discovered by the Nearby Supernova Factory from our statistical sample.

3.5. *Galaxy-Impartial and Targeted SN Surveys*

We measure the host galaxy properties of SN discovered by both *targeted* surveys, which aristocratically discover almost all their SN in luminous galaxies, as well as *galaxy-impartial* surveys, which democratically scan swaths of sky without special attention to specific galaxies. Galaxy-impartial surveys generally employ larger telescopes (e.g., the SDSS 2.5m; the PTF 1.2m) than targeted surveys (e.g., the KAIT 0.76m), have fainter limiting magnitudes, and image much greater numbers of low-mass galaxies. The SN harvested by galaxy-impartial surveys are found in host galaxies that are not apparently bright or nearby (and are not in bright galaxy catalogs). For example, in our sample, 34% (45/133) of galaxy-impartial SN but only 3.4% (13/387) of targeted SN have host galaxy masses smaller than $10^9 M_\odot$.

3.6. *Identifying Galaxy-Impartial Discoveries*

We used the Discoverer column from the IAU classification[7] to determine the provenance of each SN. There are relatively few galaxy-impartial discovery teams, because discovering substantial numbers of SN by impartially scanning the sky requires significant dedicated observing time and investment in data processing. Any SN whose discovery team we did not identify as part of a galaxy-impartial search effort, including amateur discoveries, was considered a targeted discovery.

Surveys that we considered galaxy-impartial are as follows: Catalina Real-Time Sky Survey and Siding Spring Survey (Djorgovski et al. 2011), La Sagra Sky Survey, PAN-STARRS (Kaiser et al. 2010), Palomar Transient Factory (Law et al. 2009), ROTSE (Yost et al. 2006), ESSENCE (Miknaitis et al. 2007), Palomar-Quest (Djorgovski et al. 2008), SDSS-II (Sako et al. 2005), Supernova Legacy Survey (Astier et al. 2006), Supernova Cosmology Project (Perlmutter et al. 1999), Near Earth Asteroid Tracking Program (Pravdo et al. 1999), High-z Supernova Search (Riess et al. 1998), Experience de Recherche dObjets Sombres (EROS) (Hardin et al. 2000), Great Observatories Origins Deep Survey (GOODS) (Dickinson et al. 2003), Deep Lens Survey (Wittman et al. 2002), and, except for discoveries in targets IC342, M33, M74, M81, NGC 6984, and NGC 7331, the Texas Supernova Search (Quimby et al. 2005b).

3.7. *SN Detection*

The control time t is the total time period during which a SN with a specific light curve, luminosity, and extinction by dust along the line-of-sight would have been detected by a survey's observations of a given galaxy (e.g., Cappellaro et al. 1999; Leaman et al. 2011). Extinction along the line-of-sight to potential explosion sites in each monitored galaxy as well as to the actual sites of SN explosions, however, is challenging to estimate. Therefore, control times are generally estimated for apparent luminosity functions and magnitudes uncorrected for extinction, instead of for dust-free luminosity functions and magnitudes with a galaxy-by-galaxy correction for obscuring dust. The expectation value of the number of discoveries of type T SN during a survey in the ith monitored galaxy is,

$$\langle N_i^T \rangle = r_i^T \times t_i^T, \tag{1}$$

where r_i^T is the rate of and t_i^T is the control time for type T SN in the galaxy. The probability of detecting N_i^T type T SN in the ith galaxy imaged by a survey follows a Poisson distribution,

$$P(N_i^T) = \text{Pois}(r_i^T \times t_i^T). \tag{2}$$

The ith galaxy observed by the survey has properties that include, for example, the stellar mass M_i. We are interested in making inferences about how the rates of the SN types may depend upon galaxy properties. The statistical approach we take in this paper is to look for differences among the distributions of host properties of the reported SN of each type $S^T(M_i)$ (see Section 6),

$$S^T(M_i) \approx \text{Pois}(r_i^T \times t_i^T). \tag{3}$$

Here we cannot estimate control times because we lack information about the contributing surveys. We do not explicitly model the effect of different possible control times as well as other potential effects in our statistical analysis.

In the following sections, however, we find evidence that control times may be sufficiently similar that any differences do not dominate the results we find. We consider the published luminosity functions, place appropriate redshift upper limits on samples, and examine the

[7] http://www.cfa.harvard.edu/iau/lists/Supernovae.html

TABLE 4
Mean Redshifts for Each SN Type

Survey Type	II	IIn	IIb	Ib	Ic	Ic-BL
Galaxy-Impartial	0.042	0.044	0.033	0.041	0.035	0.045
Targeted	0.013	0.014	0.012	0.014	0.011	0.013

Note. — Mean redshifts of each SN type in the galaxy-impartial and targeted samples.

redshift distributions of galaxy-impartial SN discoveries. Only differences among control times for SN species that correlate with galaxy properties will introduce bias into our statistical analysis.

The number of galaxies monitored by galaxy-impartial surveys grows with the volume within the limiting redshift (i.e., $\propto z^3$). The number of galaxies monitored by targeted surveys, by contrast, likely does not increase as quickly with redshift, because the generally high-mass targets are selected from galaxy catalogs that have, for example, Malmquist bias.

3.8. *Luminosity Functions, Light Curves, and Detection*

Recent measurements have compared the mean luminosities of the core-collapse spectroscopic species, but any differences are not yet well constrained. Li et al. (2011b) (LOSS) and Drout et al. (2011) (Palomar 60") measured the mean peak absolute magnitudes (before correction for host galaxy extinction) of core-collapse species, and these values are shown in Table 3. Drout et al. (2011) found that SN Ic-BL are intrinsically brighter explosions, on average, than normal Type Ic explosions, but the LOSS sample included too few examples to corroborate a difference. Although Li et al. (2011b) found some evidence that SN Ib and SN Ic have different mean intrinsic luminosities, Drout et al. (2011) did not find a similar indication.

Luminosity functions are broad, so the control time will not necessarily vary strongly with the mean SN luminosity. Li et al. (2011b) found, for example, that the SN (Ib+Ic) luminosity function has a standard deviation of 1.24 mag and that the SN II luminosity function has a standard deviation of 1.37 mag.

3.9. *Redshift Upper Limits for Targeted and Galaxy-Impartial Samples*

We exclude SN discovered at redshifts where only SN Ib, SN Ic, and SN II with brighter-than-average luminosities are detected. Targeted surveys generally employ smaller telescopes and have shallower limiting magnitudes, because their galaxy targets are nearby. We select LOSS and SDSS as the representative targeted and galaxy-impartial surveys respectively, because they are responsible for the greatest numbers of discoveries in each category.

From luminosity functions and search limiting magnitudes, we estimate these upper redshift limits where detection efficiency falls below 50% as $z = 0.023$ and $z = 0.08$ for LOSS and SDSS-II, respectively. We use -16 as the mean absolute SN magnitude, because Li et al. (2011b) measured mean absolute magnitudes for SN (Ib+Ic), -16.09 ± 0.23 mag, and SN II, -16.05 ± 0.15 mag. For LOSS, which contributes 42% of our targeted sample, Leaman et al. (2011) report a median limiting magnitude of 18.8 ± 0.5, corresponding to a detection limit of $z = 0.023$ for SN (Ib+Ic) and SN II. LOSS survey observations are taken without a filter, and the total response function peaks in the R band (Li et al. 2011b).

Dilday et al. (2010) report a ∼21.5 mag r'-band detection limit for the SDSS-II survey, which accounts for 33% of the galaxy-impartial sample. For our sample of galaxy-impartial discoveries, the redshift upper limit is $z = 0.08$, corresponding to the SDSS-II detection limit. The PTF, accounting for 32% of galaxy-impartial SN, has a limiting R-band magnitude of ∼20.8 mag which corresponds to an upper detection limit of $z = 0.056$.

Varying the upper redshift limit for galaxy-impartial and targeted SN discoveries (e.g., from $z = 0.023$ to $z = 0.02$ or $z = 0.06$) does not alter the type-dependent trends we find. Table 4 presents the mean redshifts for each SN type.

3.10. *Amateur Discoveries*

From the information available in IAU circulars, we separated discoveries into those made by amateur astronomers, who generally use comparatively small telescopes, and by professional astronomers. Table 2 lists the numbers of SN in each sample that were amateur discoveries. We present significance values for several sample comparisons with and without amateur discoveries in Section 7.

3.11. *Spectroscopic Fiber Locations On Host Galaxy*

We identified SDSS spectroscopic fibers that targeted the galaxy nucleus by visually inspecting images and fiber positions. Oxygen abundance varies primarily with offset from the galaxy center, and we also determined which fibers have host offsets within 3 kpc of the SN host offset. The numbers of fibers in each category are listed in Table 2.

4. TESTING FOR DETECTION-RELATED SYSTEMATICS

4.1. *Comparing Detection Control Times Indirectly with Galaxy-Impartial SN Discoveries*

Galaxy-impartial searches do not target specific galaxies, so their discovery rate may be expressed in terms of the rate of SN per unit volume,

$$\langle N_{z_i}^T \rangle = r_{z_i}^T \times V_{z_i} \times t_{z_i}^T, \qquad (4)$$

where $r_{z_i}^T$ is the type T SN rate per unit volume, V_{z_i} is the volume within the survey field-of-view, and $t_{z_i}^T$ is the control time for type T SN that explode in the z_i redshift bin (e.g., $0.01 < z < 0.015$).

The power-law form of the Schechter luminosity function (Schechter 1976) cuts off exponentially at the characteristic absolute magnitude, M_*. The AGN and Galaxy Evolution Survey (AGES) found that M_* becomes ∼0.2 mag brighter between $z = 0$ and $z = 0.2$

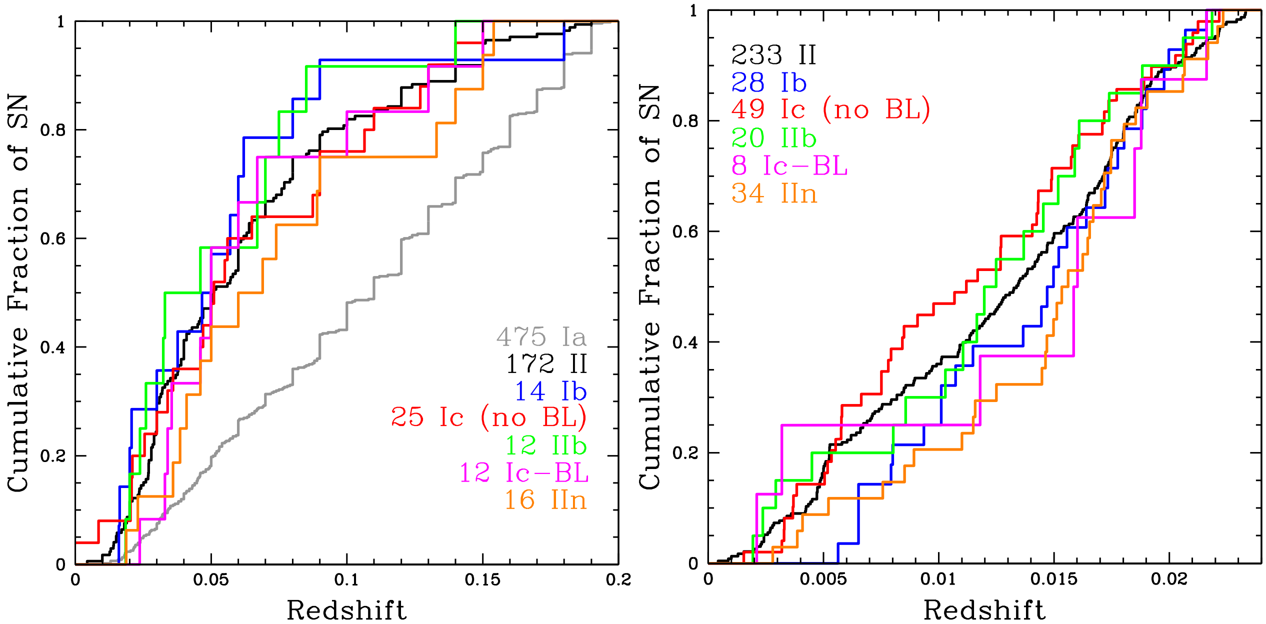

FIG. 1.— Redshifts of SN discovered by galaxy-impartial surveys to $z = 0.2$ (left) and of SN discovered by targeted surveys in our sample (right). To increase the size of the sample, the left plot includes discoveries to $z = 0.2$, a higher upper limit than the $z = 0.08$ galaxy-impartial sample limit. Except for cosmic evolution, low-redshift galaxy-impartial surveys image the same galaxy populations at increasing redshift. This plot provides no suggestion that the detection efficiency functions, $\eta(z, T, m_{\rm lim}, C)$, for SN II, SN IIb, SN IIn, SN Ib, SN Ic, and SN Ic-BL vary differently with redshift, although the numbers of some species are small. The plot on the right shows the redshift distributions of the SN in our sample discovered by targeted surveys. Among the 15 possible two-sample comparisons, the most extreme difference is between the SN Ic and SN IIn distributions and has $p = 1.1\%$.

(Cool et al. 2012). Moustakas et al. (2011) reported, also from AGES spectroscopy, that the mean gas-phase metallicity of galaxies decreases by only ∼0.02-0.03 dex from $z = 0.1$ to $z = 0.2$. Given this evidence for relatively modest changes in the galaxy population, we may reasonably expect the fractional representation of each SN type among SN that explode to change only modestly to $z \approx 0.2$,

$$\frac{r^A_{z_i}}{r^B_{z_i}} \approx \frac{r^A_{z_j}}{r^B_{z_j}}, \tag{5}$$

where z_i and z_j are redshifts less than 0.2 and A and B are distinct spectroscopic classes of SN. The relationships in Equations 4 and 5 suggest that changes in the ratio between the numbers of detected SN of two species with increasing redshift depends primarily upon changes in the control times for the species,

$$\frac{d}{dz}\frac{\langle N^A\rangle}{\langle N^B\rangle} \approx \frac{r^A}{r^B}\frac{d}{dz}\left(\frac{t^A}{t^B}\right) \tag{6}$$

The left panel of Figure 1 plots the cumulative redshift distributions of core-collapse SN as well as Type Ia SN with $z < 0.2$ reported to the IAU by galaxy-impartial surveys We extend the redshift upper limit beyond the $z = 0.08$ galaxy-impartial limit to compile a larger sample of SN discoveries. This plot suggests that surveys may have similar control times for SN II, SN IIb, SN IIn, SN Ib, SN Ic, and SN Ic-BL with increasing redshifts, although the numbers of some species are small. The Type Ia SN are, however, discovered at greater redshifts than the core-collapse species because of greater intrinsic brightness. This test may only be sensitive to strong differences among control times, however, and we expect that a more complete analysis based on detailed knowledge of each survey and improved constraints on SN luminosity functions will find differences among the control times for the core-collapse spectroscopic types.

The control times for targeted surveys are likely to have similar behavior from $z = 0$ to $z = 0.023$ (where $\eta = 0.5$) as those for galaxy-impartial surveys from $z = 0$ to $z = 0.08$ (where $\eta = 0.5$). Targeted surveys generally have shallower limiting magnitudes, but their galaxy targets are also at smaller distance.

4.2. *Redshift Distributions of Targeted SN Discoveries*

The redshift distributions of targeted SN, shown in the right panel of Figure 1, additionally depend on the set of galaxy search targets as well as type-dependent host galaxy preferences. A Malmquist effect in galaxy catalogs (e.g., the NGC) used to select targets (Leaman et al. 2011) means that more distant monitored galaxies are, on average, more luminous, and likely more metal-rich. The redshift distributions of the targeted SN samples in Figure 1 show greater differences than those for galaxy-impartial SN samples.

4.3. *Detection Related Systematics*

Here we have only discussed possible systematic errors associated with differences between the luminosity functions of the core-collapse species and the redshift dependence of the galaxies monitored by SN searches. In Section 9, we list additional potential sources of systematic error including fiber targeting and spectroscopic classification.

5. METHODS

5.1. *SDSS Imaging Processing*

The WCS provided in SDSS DR8 **frame*.fits** headers is a TAN approximation to the **asTrans*.fits** full astrometric solution and has subpixel accuracy (private communication; M. Blanton), an improvement over the astrometric solution provided in DR7 **fpC*.fit** headers. We used SWarp (Bertin et al. 2002) to register and resample SDSS images of each host galaxy to a common pixel grid and coadded SDSS images in the $u'g'r'i'z'$ bands. The SDSS DR8 **frame*.fits** images also feature an improved background subtraction (in comparison to DR7 **fpC*.fit** images). The DR8 background level is estimated from a spline fit across consecutive, adjacent frames from each drift scan, after masking objects in each image.

5.2. *Galaxy Photometry and Stellar Mass*

Host galaxy images were used to measure the color of the stellar population near the site of each SN, estimate each host's stellar mass, a proxy for chemical enrichment (e.g., Tremonti et al. 2004), and compute the deprojected host offsets of SN and SDSS spectroscopic fibers.

The SExtractor measurement MAG_AUTO, corresponding to the flux within 2.5 Kron (1980) radii, was used to estimate host galaxy stellar mass-to-light ratio (M/L) through fits with spectral energy distributions (SEDs) from PEGASE2 (Fioc & Rocca-Volmerange 1997, 1999) stellar population synthesis models using the appropriate SDSS instrumental response function. An estimate of the stellar mass was then computed: $M = M/L \times L$ where L is the galaxy's absolute luminosity. See Kelly et al. (2010) for a detailed description of the star formation histories used.

5.3. *Color Near Explosion Site*

We then estimated the host galaxy's color near the SN location using two techniques. The first and more simple method was to extract the $u'g'r'i'z'$ flux inside of a circular aperture with 300 pc radius centered on the SN location, after subtracting the median of the peripheral background regions. While this technique is straightforward, a small number of apertures centered at the sites of SN at large host offsets or found in low-luminosity hosts had low S/N, especially in the u' and z' bands. The primary intent of the second method was to obtain higher S/N u'-band flux measurements near the sites of SN, in particular near the sites of the SN with faint hosts. To identify g'-band pixels with S/N > 1 associated with each host galaxy, we used SExtractor to generate a segmentation map of each image, which identifies the pixels associated with each object. We adjusted the SExtractor settings so that the segmentation map included only pixels with S/N > 1 (i.e., DETECT_THRESH=1). The 20 pixels closest to the SN location contained in the g'-band segmentation maps define the aperture for measurements of u'-z' color and u'-band surface brightness.

The aperture generally consists of the 20 pixels on the CCD array closest to the SN position (i.e., within a circle of radius $\sim1''$). Only for twenty of the 519 SN is the average distance between aperture pixels and the explosion site greater than 0.8". Excluding measurements where the average pixel is more than 0.8" from the explosion coordinates does not affect the distributions we plot in this paper. The median uncertainties of the measured $u'g'r'i'z'$ magnitudes are 0.11, 0.06, 0.06, 0.06, and 0.13 magnitudes, respectively. We correct for Galactic reddening using the Schlegel et al. (1998) dust maps.

The reported SN positions come from a variety of sources that may rely on catalogs (e.g., USNO B1, 2MASS, or GSC) with more modest astrometric accuracy than available for SDSS images. Repeated photometric follow-up, available for some SN, can also be useful for improving the accuracy of explosion coordinates (e.g., Hicken et al. 2012).

We use KCORRECT (Blanton & Roweis 2007) to estimate rest-frame $u'g'r'i'z'$ magnitudes from the fluxes we measure. KCORRECT fits the input measured fluxes with a model for the rest-frame SED, and it uses this SED to estimate the rest-frame $u'g'r'i'z'$ magnitudes for each galaxy. The estimated rest-frame $u' - z'$ color, for example, therefore depends upon the full set of measured observer-frame $u'g'r'i'z'$ magnitudes that inform the SED model. Consequently, even if u' and z' measurements are noisy, the estimated rest-frame $u' - z'$ color may be informative, given constraints from less noisy measured $g'r'i'$ fluxes.

5.4. *Selecting SDSS Spectroscopic Fibers*

To identify SDSS fibers that coincide with a host galaxy, we searched inside a catalog available online from an MPA-JHU collaboration[8] for fibers that fell within an aperture with radius $(1.65/z)$" placed on the host center and with redshifts that agree with that of the SN. For an object in the Hubble flow, this angle corresponds to a physical distance of approximately 34 kpc. At $z = 0.03$, for example, this radius subtends a 55" angle. If the g'-band SExtractor segmentation map ID at the fiber location was the same as the ID of the SN host galaxy, the fiber was considered a match to the galaxy after a visual check. The deprojected normalized offset of the fiber was then calculated by computing the offset at each pixel in the 3" fiber aperture and averaging these offsets weighted by each pixel's g'-band counts.

5.5. *AGN Activity*

Only the spectra classified by the SDSS pipeline as a galaxy spectrum (SPECTROTYPE='GALAXY') enter our analysis, a restriction that excludes quasi-stellar objects (QSO) and Type 1 active galactic nuclei (AGN) whose continua have significant non-stellar contributions. The SDSS 'galaxy' class, however, includes spectra with emission line strength ratios characteristic of Type 2 AGN and low ionization nuclear emission regions (LINERs). The emission line patterns associated with AGN activity are significantly degenerate with variation in oxygen abundance, so AGN line ratios preclude metallicity measurements.

We use the classifications of fiber spectra as star forming, low S/N star forming, composite, AGN, or low S/N AGN made available by the MPA-JHU group following Brinchmann et al. (2004). That analysis uses each spectrum's position on the Baldwin et al. (1981) (hereafter BPT) diagram of [O III] $\lambda5007$/Hβ and [N II] $\lambda6584$/Hα line ratios.

5.6. *Extinction Estimated from Balmer Ratios*

[8] http://www.mpa-garching.mpg.de/SDSS/DR8/

From the fiber spectra (closest in deprojected offset to the SN sites), we estimate host galaxy reddening A_V using the Balmer decrement (Hα/Hβ), assuming the R_V=3.1 Cardelli et al. (1989) extinction law. Following Osterbrock (1989), we assume a Case B recombination ratio of 2.85 when spectra are classified as star forming or low S/N star forming and a ratio of 3.1 when spectra are classified as composite, AGN, or low S/N AGN.

5.7. *Metallicity and Specific SFR Measurements*

Our analysis uses both (a) abundances and specific star formation rate estimates available from the MPA-JHU collaboration for SDSS fiber spectra and (b) abundances we compute using the Pettini & Pagel (2004) metallicity calibration. We only use galaxies with S/N>3 Hβ, Hα, [N II] λ6584, and [O III] λ5007, as designated by the MPA-JHU analysis. For abundance measurements, we only analyze spectra classified as star forming. For specific SFR estimates, we use star forming, composite, and AGN spectra.

5.7.1. *MPA-JHU Metallicity and Specific SFR*

To extract an oxygen abundance and specific SFR from a spectrum, the MPA-JHU collaboration first uses Charlot & Longhetti (2001) stellar population synthesis and photoionization models to calculate an extensive library of line strengths spanning potential effective gas parameters including gas density, temperature, and ionization as well as the dust-to-metal ratio. Then galaxy [O II], Hβ, [O III], Hα, [N II], and [S II] optical nebular emission lines are fit simultaneously with the library and used to compute metallicity and specific SFR likelihood distributions. Here we use the median of these distributions as the oxygen abundance and specific SFR estimates. We refer to the metallicity estimates as T04 oxygen abundances, in reference to Tremonti et al. 2004 who employed the MPA-JHU values.

When emission lines show AGN patterns, metallicity estimates are not possible from emission lines. For these spectra, the MPA-JHU group uses the strength of the 4000 Å break [see Figure 11 of Brinchmann et al. (2004)] and the ratio Hα/Hβ to estimate the specific SFR[9]. To calibrate the 4000 Å break as a specific SFR proxy, star-forming spectra are placed into bins according to the strength of the 4000 Å break as well as the Hα/Hβ ratio, a proxy for interstellar extinction. The galaxies in each bin are then used to compute the expected specific SFR for each set of parameters.

Kauffmann et al. (2003) found that a sample of SDSS spectra of Type 2 AGN with median $z \approx 0.1$ and selected according to the criteria we apply here show no evidence of a significant superposed AGN continuum. Schmitt et al. (1999) showed that AGN emission rarely accounts for more than 5% of the continuum of nuclear spectra of nearby galaxies with Type 2-patterned emission lines.

5.7.2. *Pettini and Pagel Metallicity*

Since we have no prejudice about which emission-line method is most correct, we have also computed abundances using the Pettini & Pagel (2004) (hereafter PP04) prescription. This is based on the relative line strengths of Hβ, Hα, [N II] λ6584, and [O III] λ5007, after correcting for dust emission. The PP04 indicator relies on lines relatively close in wavelength, reducing its sensitivity to uncertainty in the extinction correction and does not require the [O II] λ3727 line, which falls beyond the blue sensitivity of the SDSS spectrograph for objects at $z < 0.02$.

Our measurements trace the Kewley & Ellison (2008) PP04 mass-metallicity relation of SDSS galaxies when stellar mass is plotted against nuclear metallicity for galaxies in the Hubble flow ($z > 0.005$).

5.8. *Comparison of Host Abundance Proxies*

Oxygen abundances measured from fibers centered on the host galaxy nucleus are, on average, only 0.01 dex (T04) greater than the abundance inferred from the stellar mass with the Tremonti et al. (2004) *M-Z* relation, with a scatter of 0.14 dex. If we instead select fibers closest in host offset to SN explosion sites, spectroscopic abundances are 0.053 dex (T04) less than abundances estimated from stellar masses with a scatter of 0.16 dex.

6. STATISTICAL METHOD

6.1. *Kolmogorov-Smirnov Statistic*

In the following sections, we test the null hypothesis that two samples are drawn from a single underlying distribution using the Kolmogorov-Smirnov (KS) test. The KS test statistic is defined as $D = \sup_x |F_1(x) - F_2(x)|$, the maximum difference between the samples' cumulative distribution functions, where $F_n(x) = \frac{1}{n}\sum_{i=1}^{n} I_{X_i \le x}$. The KS distribution is the distribution of the test statistic D, given the null hypothesis that two distributions are identical. The p-value is the probability of observing a value of the test statistic, D, more extreme than the observed value of D given the null hypothesis that the two samples are drawn from a single underlying distribution. Low p-values ($< 5\%$) are significant evidence that the underlying distributions are distinct.

When two independent samples are drawn from the same distribution, there is, by definition, a 5% random chance of obtaining a p-value less than 5%. If we were to make, for example, twenty comparisons among samples drawn from identical distributions, one misleading $p < 5\%$ difference would occur by chance on average. The number of independent comparisons we make in this paper should therefore be taken into account when comparisons yield p-values of modest significance ($p \approx 5\%$). We note that the host properties we measure are correlated (e.g., host color and metallicity), so independent comparisons are fewer than the total number of comparisons.

7. RESULTS

Instead of placing the numerical values of all statistical Kolmogorov-Smirnov (KS) tests in the following descriptions of results, we list many of them in Table 5, which includes comparisons for all types, and Table 6, which includes comparisons for SN IIb and SN Ic-BL, restricted to only targeted and only galaxy-impartial samples. Tables 7 and 8 list the measurements of the SN host galaxies.

[9] http://www.mpa-garching.mpg.de/SDSS/DR7/sfrs.html

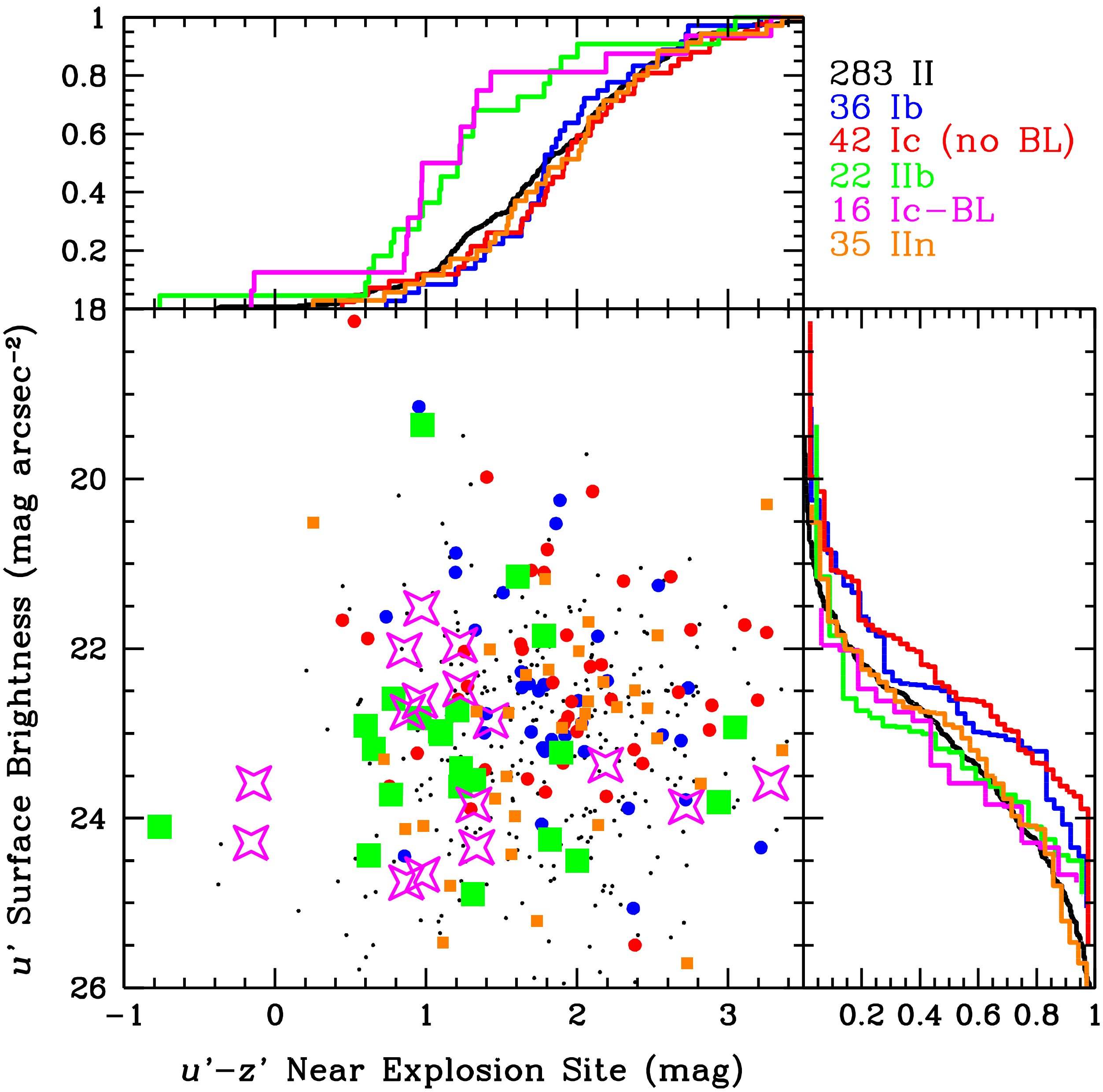

FIG. 2.— Host galaxy $u' - z'$ color versus u' surface brightness near SN location. The top panel plots the fraction of SN of each type with environments bluer than the horizontal axis coordinate, and the right panel plots the fraction of SN of each type whose environments have higher u'-band surface brightness than the vertical axis coordinate. SN IIb environments are bluer than SN Ib, SN Ic, and SN II environments ($p = 0.03\%$, 0.2%, and 0.1%, respectively), and SN Ic-BL environments are bluer than those of SN Ib, SN Ic, and SN II ($p = 0.04\%$, 0.09%, and 0.04%, respectively). SN Ib and SN Ic explode in regions with higher u'-band surface brightness than do SN II ($p = 0.6\%$ and 0.6%, respectively), and SN Ic sites have higher u'-band surface brightnesses than SN Ic-BL locations (3.8%). The aperture is the 20 host pixels with S/N > 1 in g' band nearest the SN location.

7.1. *Host Color and u′ Surface Brightness Near Explosion Site*

As can be seen in Figure 2, SN IIb and SN Ic-BL erupt in exceptionally blue environments, while high u'-band surface brightness is typical of SN Ib and SN Ic sites. SN II sites show substantial overlap in color or surface brightness with the other classes. This plot shows u'-z' color versus u'-band surface brightness, measured inside an aperture consisting of the 20 pixels closest to the SN site with g'-band S/N > 1.

The u'-z' color near the site of SN 2006aj, the SN-LGRB in our sample, was 0.88 mag.

7.2. *Host Stellar Mass and SN Host Offsets*

Figure 3 helps to explain the exceptionally blue u'-z' color of SN IIb and SN Ic-BL sites and the high u'-band surface brightnesses near SN Ib and Ic sites. At one set of extremes, SN Ic-BL have generally low mass hosts, while SN IIb explode at larger offsets when they occur in galaxies of large masses. At another extreme, SN Ib and especially SN Ic more often occur inside the g'-band half-light radius of massive galaxies, sites expected to have redder color and high surface brightness.

Host galaxy mass is a moderately precise (∼0.1 dex) proxy for chemical abundance (e.g., Tremonti et al.

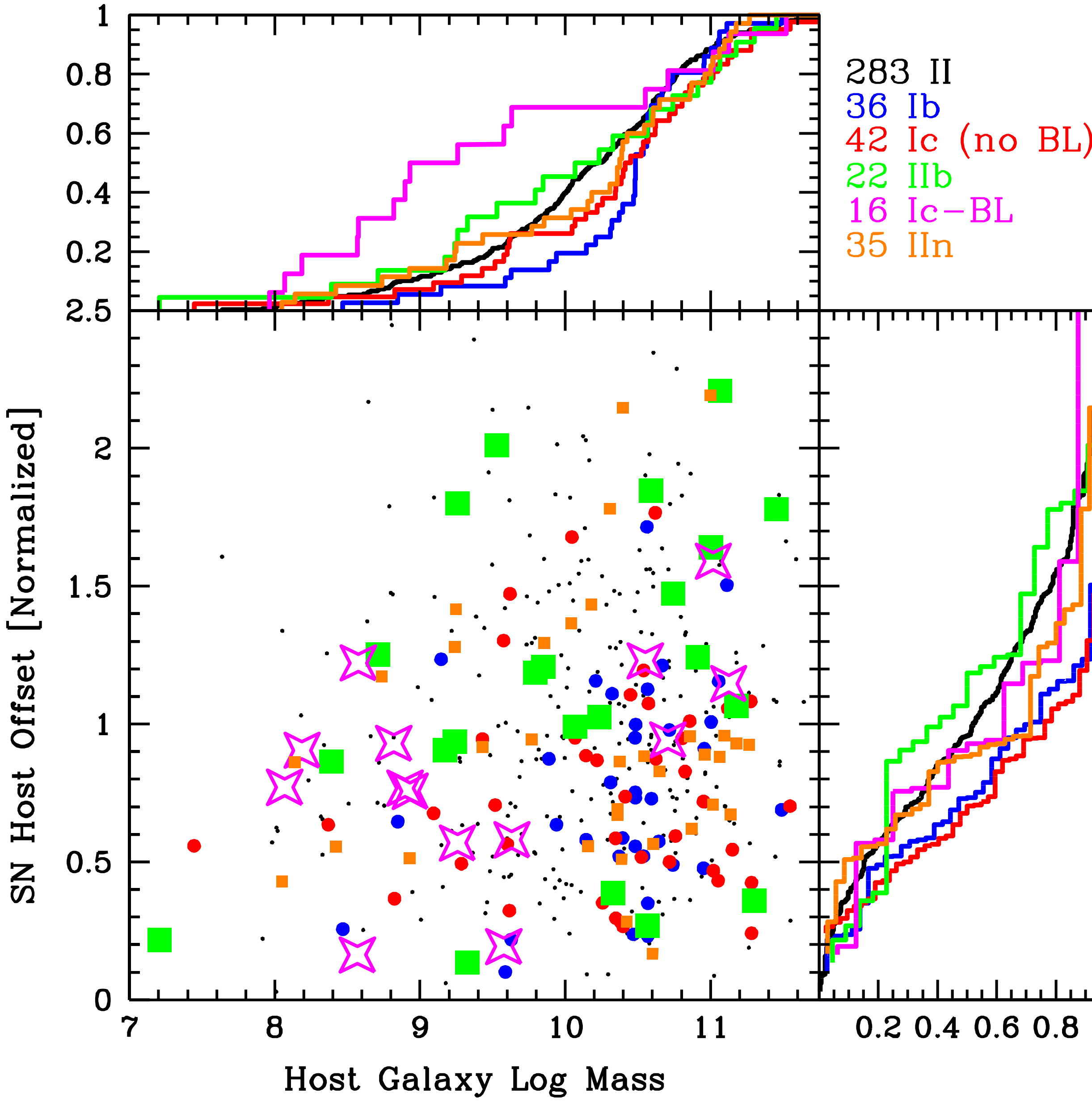

FIG. 3.— Stellar masses of host galaxies versus SN host offset, deprojected and normalized by host g'-band half-light radius. The top panel plots the fraction of each SN type with hosts less massive than the horizontal axis coordinate, and the right panel plots the fraction of SN of each type whose host offsets are greater than the vertical axis coordinate. SN Ic-BL are found in significantly less massive galaxies than are the SN Ib, SN Ic, or SN II ($p = 0.1\%$, 0.8%, and 0.4%, respectively). Host galaxy stellar masses are estimated from PEGASE2 fits to $u'g'r'i'z'$ host magnitudes. A two-sample KS test finds evidence ($p = 0.7\%$) that SN IIb explode at larger host offsets than SN Ib, among the SN discovered in galaxies with log M > 9.5. SN Ic explode closer to their host centers than SN II ($p = 0.5\%$).

2004) which does not suffer from the AGN selection effects. The hosts of SN (Ib+Ic), excluding SN Ic-BL, are more massive than SN II hosts.

The host stellar mass of SN 2006aj, the only SN-LGRB in our sample, was $8.0 \times 10^{10} M_{\odot}$. We find with $p = 12\%$ that the SN IIn offset distribution is consistent with the SN II host offset distribution.

7.3. *Oxygen Abundance Measurements Closest to SN Positions*

To probe the metallicities of the core-collapse hosts, we measure oxygen abundance from the fiber spectrum with deprojected offset most similar to the SN offset. Among the 311 host galaxies with spectroscopic fibers measurements, 139 have multiple SDSS fiber spectra. SDSS fiber spectra generally target the central regions of host galaxies (see Tables 1 and 2), with an average host offset in our sample of $0.45 \times r_{half-light}$. The low metallicities shown in Figure 4 for SN Ic-BL and SN IIb hosts and high metallicities for SN Ic hosts are consistent with the patterns we see among the species' colors near explosion sites, host offsets, and host masses.

7.3.1. *Every Abundance Measurement*

For galaxy-impartial discoveries, SN Ic-BL hosts ($n = 3$) follow a significantly more metal-poor distribution than the hosts of normal SN Ic ($n = 4$; $p = 2.1\%/2.1\%$ for T04/PP04 calibrations). Among the

TABLE 5
KS p-values for Combined Samples

Measurement	Figure	Samples	P-value
u'-z'	2	Ic-BL vs. Ib, Ic, II	0.04%, 0.09%, 0.04%
...	...	IIb vs. Ib, Ic, II	0.03%, 0.2%, 0.1%
u' SB	2	Ib vs. Ic, II	0.6%, 55%
...	...	Ic vs. II	0.6%
log M	3	Ic-BL vs. II, IIb, Ib, Ic	0.4%, 13%, 0.1%, 0.8%
...	...	IIb vs. II, Ib, Ic	66%, 10%, 47%
...	...	II vs. Ib, Ic, (Ib+Ic)	0.7%, 19%, 0.5%
Offset	3	Ic-BL vs. II, Ib, Ic	95%, 93%, 26%, 16%
...	...	IIb vs. II, Ib, Ic	12%, 0.7%, 0.4%
...	...	II vs. Ib, Ic	2.5%, 2.0%
T04/PP04	4	II vs. Ib, Ic	15%/5.2%, 1.4%/5.2%
< 3 kpc	...	Ic-BL vs. Ib, Ic	1.6%/0.1%, 2.3%/0.02%
...	...	II vs. Ib, Ic	60%/26%, 9.4%/3.0%
SSFR	5	II vs. Ib, Ic, Ic-BL	17%, 3.4%, 3.5%
...	...	Ib vs. Ic	26%
A_V	6	(Ib+Ic) vs. IIb, II	5.1%, 2.1%

Note. — P-values from Kolmogorov-Smirnov two-sample comparisons that include both targeted SN and galaxy-impartial SN discoveries. The two rows below "T04/PP04" show oxygen abundance statistics computed from spectra whose host offsets are within 3 kpc of the SN host offset. The statistics comparing offsets includes only SN found in massive galaxies (log $M > 9.5$).

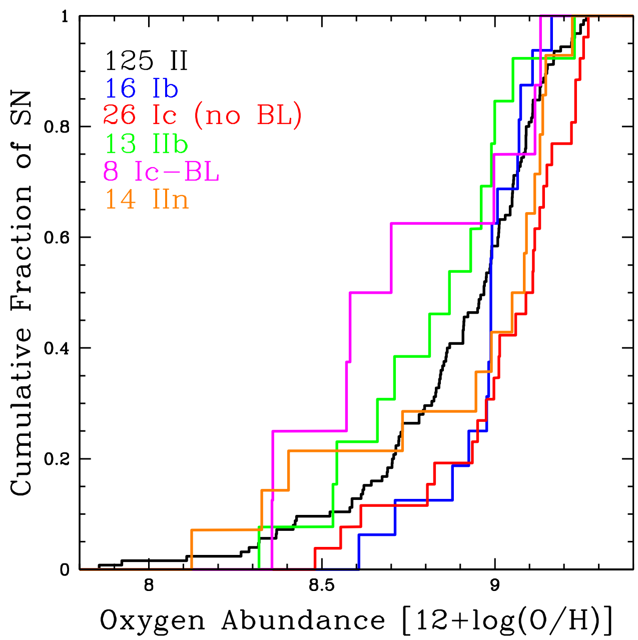

Fig. 4.— Host oxygen abundance measured from SDSS 3" fiber spectrum with host radial offset most similar to that of SN explosion site. While Tremonti et al. (2004) spectroscopic abundances are plotted, we also measure abundances using the Pettini & Pagel (2004) calibration. Even when we consider only SN discovered by galaxy-impartial surveys, we find a statistically significant difference between the SN Ic-BL and the SN Ic host abundance distributions ($p = 2.1\%/2.1\%$, respectively for the T04/PP04 calibrations). When we consider only SN discovered by targeted surveys, we find a statistically significant difference between the SN IIb and the SN Ib host abundance distributions for one of two abundance diagnostics ($p = 13\%/1.8\%$, respectively for the T04/PP04 calibrations). Evidence for a difference between the SN IIb and SN Ib host distributions strengthens when all SN discoveries are considered (8.5%/0.9%).

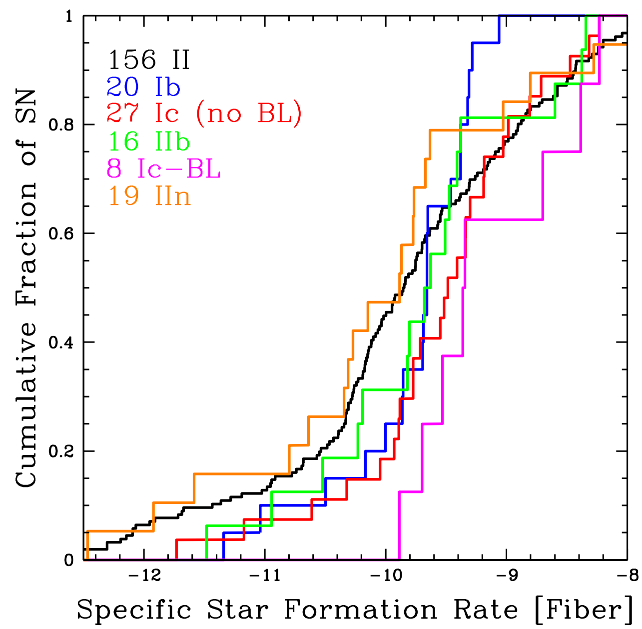

Fig. 5.— Host specific SFR estimated from SDSS 3" fiber spectrum with host radial offset most similar to that of SN explosion site. The sequence of the spectroscopic classes, arranged in order of the loss of the progenitor's outer hydrogen and helium envelopes (i.e., SN II, SN IIb, SN Ib, SN Ic), exhibit increasing average host galaxy specific SFR (SFR $M_{\odot}^{-1}$ yr^{-1}), measured from SDSS fiber spectra. SN (Ib+Ic) hosts have greater specific SFR than SN II hosts ($p = 0.3\%$). SN Ic-BL hosts have greater specific SFR than SN II hosts (3.5%). SDSS fibers largely sample light within the the host galaxy half-light radius and are often centered on the host galaxy nucleus.

hosts of targeted discoveries, host galaxies of SN IIb ($n = 13$) follow a significantly more metal-poor distribution than hosts of SN Ib ($n = 11$; $p = 13\%/1.8\%$). Among the hosts of targeted and galaxy-impartial discoveries, host galaxies of SN IIb ($n = 13$) are more metal-poor than hosts of SN Ib ($n = 11$; $p = 13\%/1.8\%$).

The SN II host abundance distribution is more metal-poor than that of the SN Ic hosts, but a selection effect may inflate any difference. A higher fraction of SN II (20±3% (36/156)) than SN (Ib+Ic) host galaxy fiber spectra (9±4% (5/55)) have the emission line ratios of AGN (see Tables 1 and 2), which makes spectra unusable for abundance analysis. AGN occur pri-

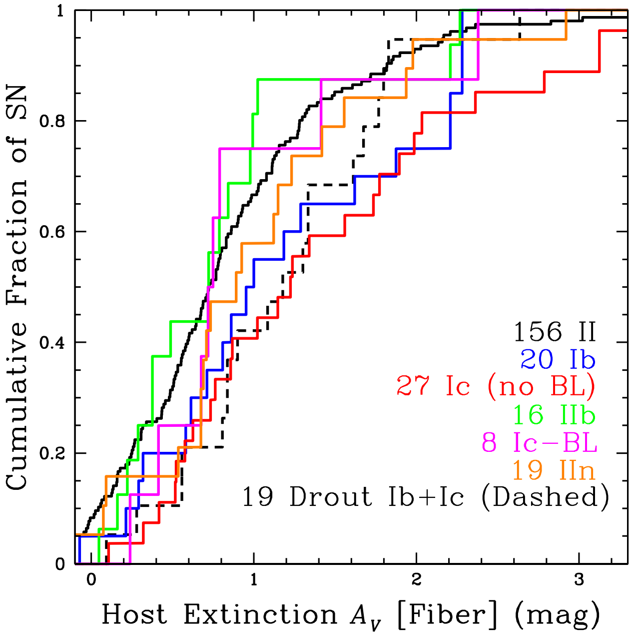

FIG. 6.— Host extinction estimated from 3" SDSS fiber spectrum with host radial offset most similar to that of SN explosion site. There is significant evidence that SN IIb and SN II hosts have less internal extinction than SN (Ib+Ic) host galaxies ($p = 5.1\%$ and 2.1%, respectively). The Drout et al. (2011) SN (Ib+Ic) A_V extinction values estimated along the line of sight to the SN from light curve color and shape are consistent with the values we measure, although the spectroscopic fibers are largely not positioned at the SN site.

TABLE 6
KS p-VALUES FOR DIFFERENT SAMPLES

	Sample	IIb vs. Ib	Ic-BL vs. Ic
u'-z'	**All SN**	**0.03% (22, 36)**	**0.09% (16, 42)**
	Targeted	0.8% (19, 26)	10% (7, 37)
	Impartial	0.9% (4, 9)	4.9% (9, 5)
	No Amateur	1.9% (14, 25)	0.02% (11, 30)
log M	**All SN**	**10% (22, 36)**	**0.8% (16, 42)**
	Targeted	14% (19, 26)	64% (7, 37)
	Impartial	9.5% (4, 9)	63% (9, 5)
	No Amateur	7.9% (14, 25)	0.005% (11, 30)
PP04	**All SN**	**0.9% (13, 16)**	**0.4% (8, 26)**
	Targeted	1.8% (13, 11)	15% (5, 23)
	Impartial	15% (1, 4)	2.1% (3, 4)
	No Amateur	19% (6, 7)	0.07% (4, 19)
T04	**All SN**	**8.5% (13, 16)**	**5.4% (8, 26)**
	Targeted	13% (13, 11)	47% (5, 23)
	Impartial	15% (1, 4)	2.1% (3, 4)
	No Amateur	46% (6, 7)	0.2% (4, 19)
Host	**All SN**	**0.7% (15, 33)**	**16% (7, 36)**
Offset	Targeted	1.7% (16, 26)	1.6% (5, 35)
	Impartial	... (0, 6)	9.7% (2, 2)
	No Amateur	16% (9, 22)	20% (2, 25)

NOTE. — P-values and sample sizes from Kolmogorov-Smirnov two-sample comparisons that include all SN discoveries, targeted SN discoveries, galaxy-impartial SN discoveries, or only professional SN discoveries. The difference between the metallicity distributions of the hosts of Type Ic-BL and Type Ic SN is statistically even when including only SN discovered by galaxy-impartial hosts. The differences between the SN Ib and SN IIb host galaxy u'-z' color distributions as well as host galaxy metallicities are statistically significant when including only SN discovered by targeted surveys. The statistics from comparing host offsets includes only SN found in massive galaxies (log $M > 9.5$).

marily in massive, metal-rich galaxies ($M > 10^{10} M_\odot$; Kauffmann et al. 2003), so rejecting AGN spectra removes a higher fraction of metal-rich SN II hosts than of SN Ib/c hosts. We note that the presence of nuclear activity in a host galaxy does not necessarily mean that every SDSS host spectrum will show contamination, because SDSS fibers are sometimes offset from the nucleus (see Tables 1 and 2). A host galaxy with mass $10^{10.5} M_\odot$, typical of an AGN host, will have an oxygen abundance of ∼9 dex (T04) and ∼8.75 dex (PP04) (e.g., Tremonti et al. 2004).

SN IIn hosts follow a similar distribution to that of the entire SN II sample ($p = 35\%/53\%$).

7.3.2. *When Fiber and SN Host Offsets Are Similar*

Most galaxies have metallicity gradients, with abundance declining away from the galaxy center. Van Zee et al. 1998 found, for example, a mean radial abundance gradient of -0.052 dex kpc^{-1} for a sample of 11 NGC host galaxies. To assemble improved proxies for metallicity at the SN location, we selected fibers whose deprojected host offset (away from the galaxy center) was within 3 kpc of that of a SN.

Among these fibers, the SN Ic-BL host spectra are significantly more metal-poor than both the SN Ib and SN Ic spectra. Without making a correction for the difference between fractions of SN II and SN Ib/c host SDSS spectra with no abundance estimate due to AGN contamination, the SN II host fibers (with similar host offset) are significantly less metal-rich than that of SN Ic host fibers.

Median offset differences between the SDSS fiber and SN location (in kpc): SN Ib (1.02), SN Ic (1.32), SN Ic-BL (1.56), SN II (1.11), SN IIb (1.66).

7.4. *Host Specific Star Formation Rate from Fiber Spectra*

SDSS spectra provide an estimate of the specific SFR (SFR $M_\odot^{-1}$ yr^{-1}) within the aperture of the fiber, which generally targets the host galaxy within the g'-band half-light radius. As can be seen in Figure 5, there is a progression of increasing specific SFR from SN II to SN Ib to SN Ic host spectra. SN Ic-BL host spectra also have significantly greater specific SFR than SN II host spectra.

Using visual inspection, we identified fibers that target the host galaxy nucleus to $z = 0.04$ where the 3" fiber aperture primarily samples nuclear light. These spectra yield significant evidence that the nuclei of SN (Ib+Ic) host galaxies have greater specific star formation rates than those of SN II host galaxies ($p = 10\%$). Strong central star formation among SN (Ib+Ic) hosts may overwhelm AGN-patterned emission and explain the relatively low AGN fraction among SN (Ib+Ic) host galaxies.

7.5. *Extinction Inferred from Spectra*

Although SN Ic hosts have stronger specific SFR within the half-light radius, the region where most SN Ic explode, the sites of SN Ic are not bluer than those of SN II (see Figure 2). Figure 6 shows that the high extinction of SN (Ib+Ic) host galaxies, measured from host spectra, may redden ongoing star formation in SN Ic host galaxies.

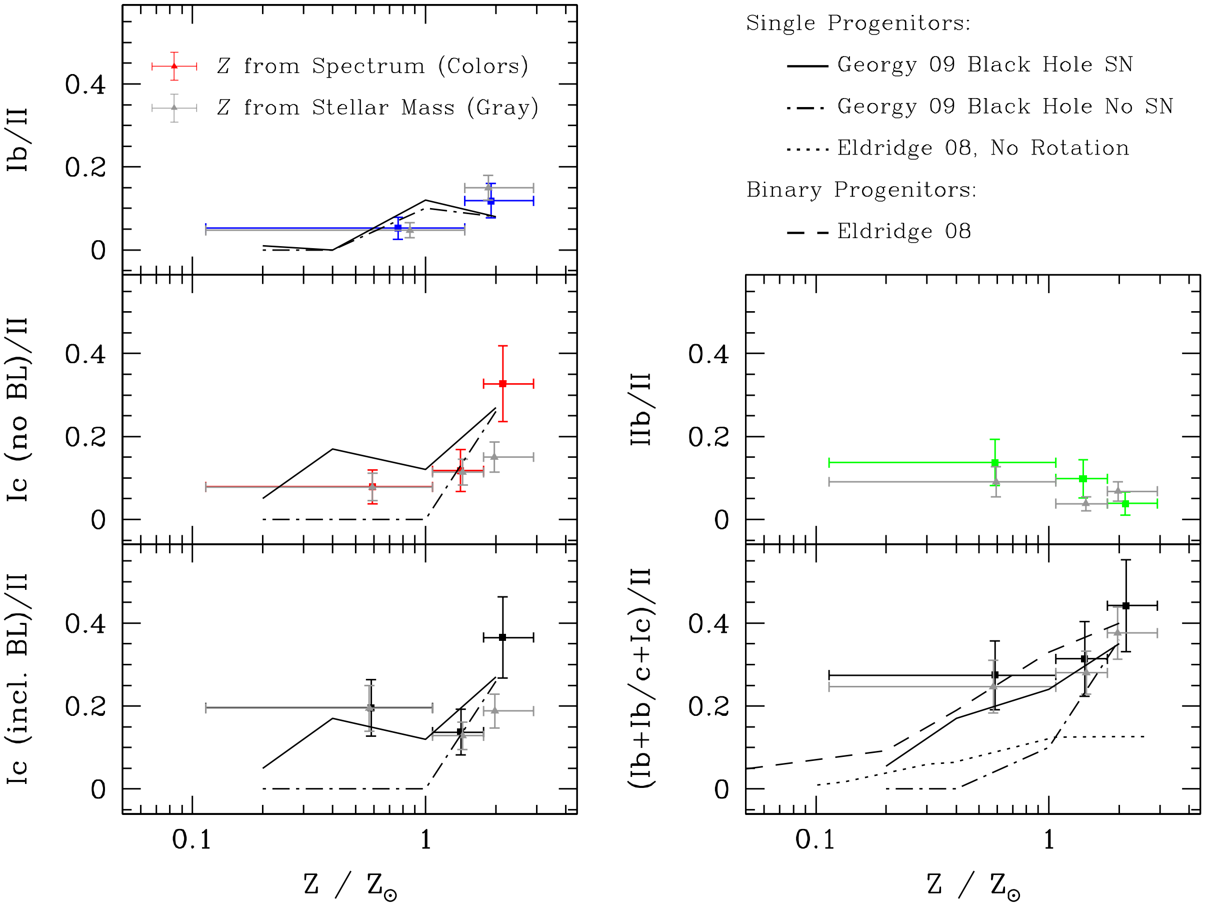

FIG. 7.— Ratio of stripped-envelope SN to SN II versus oxygen abundance (T04 calibration). The comparatively high fraction of SN (Ib+Ib/c+Ic) to SN II at subsolar metallicity in the right lower panel favors contributions from a binary progenitor population or explosions even after collapse to a black hole. Color points correspond to spectroscopic metallicity measurements, and gray points correspond to metallicities estimated from stellar masses using the Tremonti et al. (2004) mass-metallicity relation. The comparatively high fraction of SN II host fiber spectra with contamination from AGN activity (present only in massive, metal-rich galaxies) excludes a considerable fraction of metal-rich SN II host galaxies, inflating the apparent fraction of stripped-envelope SN in metal-rich galaxies (color points). Indeed, the stripped-envelope fraction is smaller using metallicities estimated from host galaxy stellar masses (gray) which do not suffer from an AGN selection effect. Dashed line is Eldridge et al. (2008) prediction for binary progenitors; dotted line is Eldridge et al. (2008) prediction for non-rotating single progenitors; and solid and dash-dot lines are Georgy et al. (2009) predictions for single, rotating progenitors (where a minimum helium envelope of 0.6 $M_\odot$ separates SN Ib from SN Ic progenitors). Whether core collapse to a black hole can yield a SN explosion is not clear (e.g., Fryer et al. 1999), especially if high angular momentum does not support an accretion disk (Woosley et al. (1993)). The Georgy et al. (2009) solid line prediction is where core collapse to a black hole produces SN while the dashed-line prediction is where core collapse to a black hole yields no SN. Vertical error bars reflect Poisson statistics while horizontal bars reflect the range of metallicities in each bin with the position of the vertical bar corresponding to the mean Z in the bin. Here $Z_\odot = 8.86$ from Delahaye et al. (2010).

The host galaxies of SN IIb have less extinction than SN (Ib+Ic) host galaxies. The average extinction difference between SN (Ib+Ic) and SN IIb hosts is $A_V \approx 0.5$ mag, a u'-z' reddening of ∼0.6 mag. The approximately similar internal extinctions of SN II and SN IIb hosts, however, suggest that the stellar populations near SN IIb likely are intrinsically bluer than those near SN II sites.

SN (Ib+Ic) host reddening is consistent ($p = 45\%$) with that estimated along the line-of-sight to 19 SN (Ib+Ic) from their light curve colors by Drout et al. (2011) using an empirical model of SN Ib/c photometric color evolution. Comparison between the Drout et al. (2011) sample and the SN II host A_V distribution yields $p = 2.4\%$. Here we plot only the Drout et al. (2011) Gold and Silver SN. There is a median $A_V \approx 1.2$ mag extinction through SN (Ib+Ic) host fiber apertures ($E(B-V) \approx 0.4$ mag).

8. RELATIVE FREQUENCIES OF CORE-COLLAPSE SN AS A FUNCTION OF METALLICITY

We plot the ratio of stripped-envelope SN (including SN IIb) to SN II in our sample with increasing host galaxy oxygen abundance in Figure 7. Vertical error bars show the Poisson uncertainties, while horizontal bars indicate the range of metallicities in each bin. The color points are calculated from successful *spectroscopic* metallicity measurements, while the gray points are estimated using *stellar mass* as a metallicity proxy, applying the Tremonti et al. (2004) mass-metallicity relation.

AGN emission, present disproportionately in SN II host spectra, is found primarily in high-mass, high-metallicity galaxies. This selection effect misleadingly *inflates* the apparent ratio SN (Ib+Ic) / SN II (color points) in the highest metallicity bin. Indeed, the ratio at high metallicity calculated instead using stellar masses as a proxy (which has no similar selection effect) is sig-

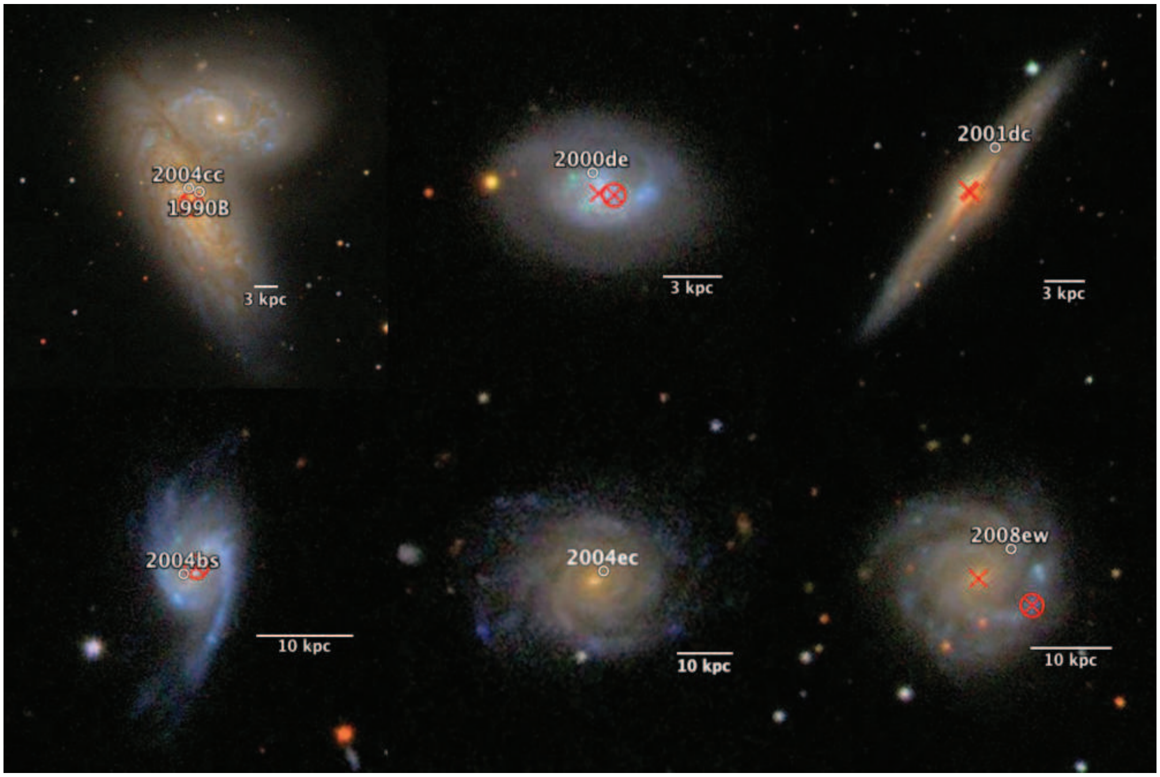

FIG. 8.— SDSS color composite images of 6 SN Ib, SN Ic, and SN II host galaxies in our sample. These include: SN 1990B (Ic), SN 2004cc (Ic), SN 2000de (Ib), SN 2001dc (IIP), SN 2004bs (Ib), SN 2004ec (IIn), and SN 2008ew (Ic). Red cross hatches show SDSS fiber positions yielding oxygen abundance measurements. An additional red circle marks fibers whose host offsets are within 3 kpc of the SN offset.

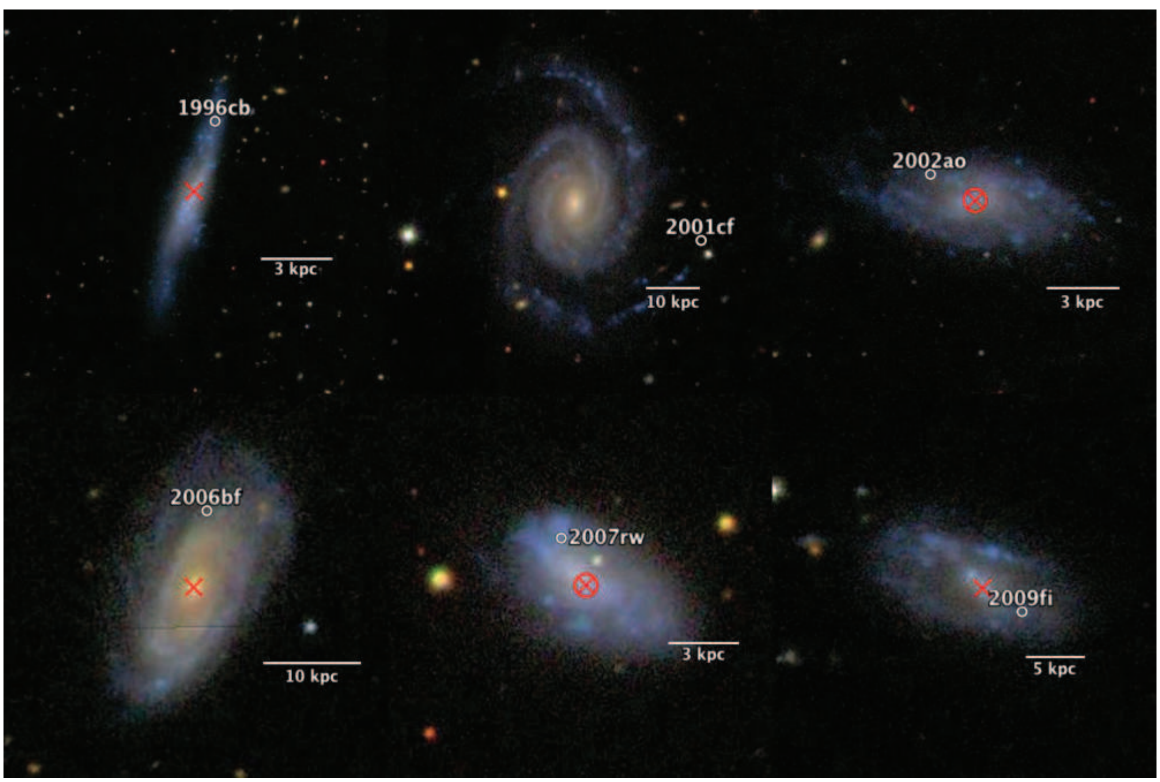

FIG. 9.— SDSS color composite images of 6 SN IIb in our sample. Their local environments are substantially bluer than those of SN Ib, SN Ic, and SN II. Red cross hatches show SDSS fiber positions yielding oxygen abundance measurements. An additional red circle marks fibers whose host offsets are within 3 kpc of the SN offset.

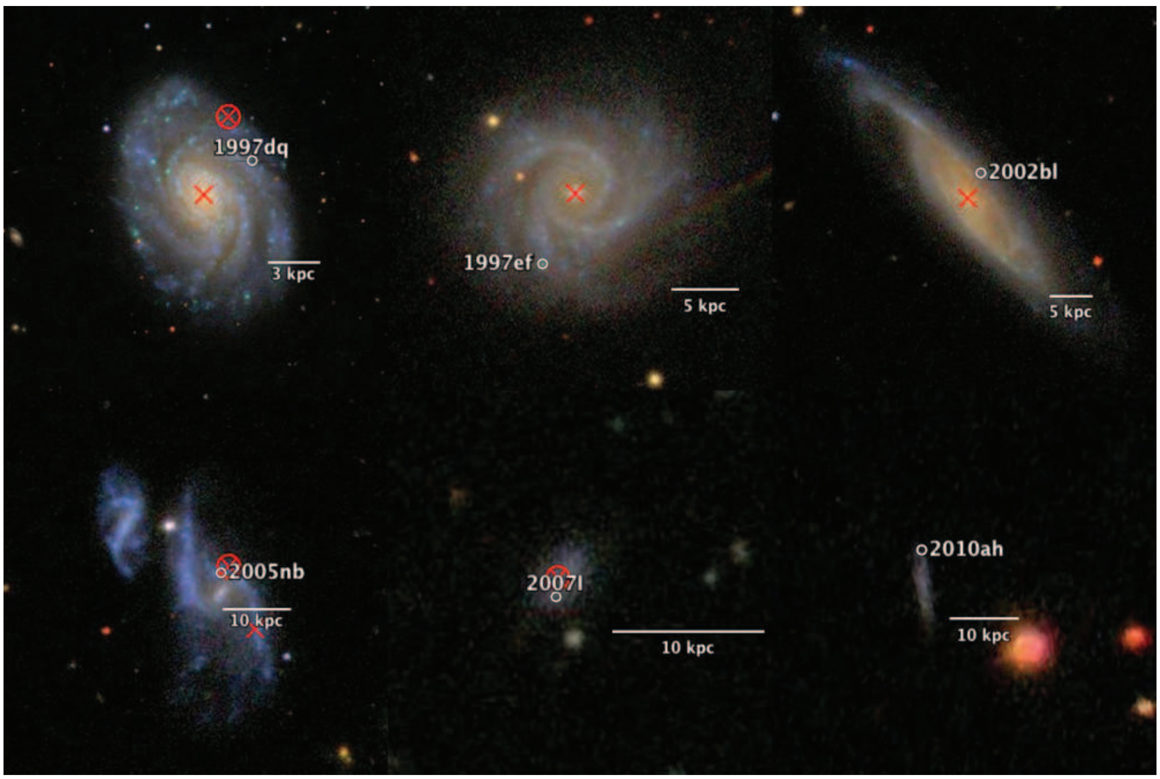

FIG. 10.— SDSS color composite images of 6 SN Ic-BL in our sample. SN Ic-BL in our sample occurred preferentially in lower-mass, low-metallicity host galaxies. Red cross hatches show SDSS fiber positions yielding oxygen abundance measurements. An additional red circle marks fibers whose host offsets are within 3 kpc of the SN offset.

nificantly lower (gray points). Earlier efforts using SDSS fiber spectra (i.e., Prieto et al. 2008), which also exclude AGN-contaminated spectra, have not noted this strong selection effect at high metallicity.

While we have attempted to identify and limit systematic effects, we cannot fully know the selection biases (e.g., from classification, detection) that may affect the measured ratios. We compare the relative rates of SN types in our sample to the model predictions for single, rotating progenitors (Georgy et al. 2009), single, non-rotating progenitors (Eldridge et al. 2008), and binary progenitors (Eldridge et al. 2008). Plotted Georgy et al. (2009) predictions were made with the assumption that a minimum helium envelope of 0.6 $M_{\odot}$ separates the progenitors of SN Ib and SN Ic. Because core collapse to a black hole may not yield a SN explosion (e.g., Fryer et al. 1999), especially if high angular momentum does not support an accretion disk (Woosley et al. 1993), Georgy et al. (2009) calculated predictions where viable SN occur after core collapse to (a) only neutron stars and (b) neutron stars and black holes. These predictions adopted 2.7 $M_{\odot}$ as the maximum mass of neutron star (Shapiro & Teukolsky 1983) and use the Hirschi et al. (2005) relation between neutron star mass and the mass of the carbon-oxygen core.

Model predictions are parameterized by $Z/Z_{\odot}$, requiring us to subtract the solar value from 12+log(O/H) estimates for each host galaxy to compute $\log(Z/Z_{\odot})$. The value of the solar metallicity is, however, not well constrained. Atmospheric modeling favors lower solar values (e.g., 12+log(O/H)=8.69; Asplund et al. 2009) than helioseismic analyses (e.g., 12+log(O/H)=8.86; Delahaye et al. 2010). Here we use the helioseismic value of Delahaye et al. (2010).

Returning to our data, we note that the spectroscopic oxygen abundance measurements should, on average, be *overestimates* of the oxygen abundance at the SN site because the SDSS fibers are concentrated toward the inner regions of the galaxies. Likewise, abundances calculated from host masses and the Tremonti et al. (2004) $M - Z$ relation should also be overestimates, because the Tremonti et al. (2004) relation is a fit to SDSS stellar masses and fiber metallicities.

Wind-driven mass losses by single stars at low metallicity are thought to be comparatively modest (e.g., Eldridge et al. 2008; Smartt 2009; Yoon et al. 2010). To explain the presence of stripped-envelope SN in low-metallicity environments in Figure 7, model comparison requires that collapse to a black hole or binary stripping be a viable route to stripped-envelope explosions. Single star models predict that the only stars that lose their outer envelopes at low metallicity are sufficiently massive that they collapse to black holes (e.g., Eldridge et al. 2008).

Smith et al. (2011) note that single star models use constant rates of wind-driven mass loss substantially greater than those observed, although episodic mass loss may speed loss of the outer envelopes. Lower wind-loss rates would imply a diminished fraction of single progenitors.

Splitting our sample in two at $z = 0.015$, the same trends persist in both the low and high redshift subsamples, providing some evidence that they do not result from luminosity-dependent selection effects.

9. TESTS AND POTENTIAL SYSTEMATIC EFFECTS

9.1. *Fiber Aperture Coverage*

SDSS spectroscopic fiber apertures have a fixed radius of 1.5”. At increasing redshift, this aperture radius corresponds to larger physical scales: 0.3 kpc at $z = 0.01$; 0.6 kpc at $z = 0.02$; and 1.17 kpc at $z = 0.04$. For a sample of 11 NGC spiral galaxies, van Zee et al. (1998) found a mean radial abundance gradient of -0.052 dex kpc^{-1}. While metallicity gradients vary among galaxies and have some dependence on, for example, host galaxy morphology (e.g., Kewley et al. 2006) and the metallicity calibration (e.g., Moustakas et al. 2010), we use this as a representative value.

Within the targeted sample ($z < 0.023$), nuclear spectroscopic fibers extend at most 0.68 kpc away from the host center, corresponding to systematic shifts of order only $\sim$0.025 dex. Galaxy-impartial SN discoveries (to $z < 0.08$) account for a significant fraction of only the SN Ic-BL sample. The difference between the median abundances for SN Ic-BL and SN Ic hosts is $\sim$0.5 dex, substantially greater than an aperture effect may yield.

9.2. *Classification*

There may be variation among the classification practices of the different surveys that contribute to our samples. A concern is that surveys that monitor different host galaxy populations (e.g., galaxy-impartial and targeted) could have different classification practices, such as use of automated classification tools (e.g., SNID) or multi-epoch spectroscopic follow up. For instance, the helium lines that identify SN Ib often emerge only after a couple of weeks (e.g., Li et al. 2011b).

9.3. *Fiber Targeting*

The SDSS object detection algorithm mistakenly split many galaxies of large angular size into two or more components [see Fig. 9 of Blanton et al. (2005)]. The SDSS targeting algorithm then placed fibers on these false components, sometimes at significant offset from the true galaxy center. The error rate of these algorithms could depend on galaxy morphology (e.g., irregularity or an interacting neighbor), and we checked whether the offsets of fiber measurements depend on SN type. However, we found no evidence of strong variation with SN type.

SDSS fibers often target the local maxima of galaxy light distributions, including host nuclei and bright HII regions. In our sample, fibers have mean offset of $0.45 \times r_{half-light}$, while matched fibers (where $|r_{env} - r_{fiber}| < 3$ kpc) have mean offset of $0.55 \times r_{half-light}$. Therefore, fiber sites are highly likely to be more metal-rich on average than they would be if SDSS fibers sampled galaxy light distributions more democratically. However, the fibers’ offset distribution does not vary strongly with SN type.

The lifetimes of HII regions may be shorter than the those of the progenitors (private communication; N. Smith), and the signal at the SN site may be too weak. Programs that take host spectra at the location of the SN (e.g., Anderson et al. 2010; Modjaz et al. 2011; Leloudas et al. 2011) may only extract a metallicity estimate when there is sufficient nebular emission through the slit. Any such S/N requirement could possibly act as a type-dependent selection effect. The SDSS targets bright nuclei or HII regions, moderating any such effect in our analysis.

10. DISCUSSION

Our study of the host environments of core-collapse SN reported to the IAU or discovered by the PTF has revealed several statistically significant patterns. While we have constructed the sample to limit the influence of potential selection effects, we have a limited knowledge of the contributing SN search programs (e.g., cadence, limiting magnitude, classification methods). We have found that the u'-z' colors of the SN IIb and SN Ic-BL (without an associated LGRB) environments are blue in comparison to those of other stripped-envelope SN environments (see representative images in Figures 8, 9, and 10. The host specific SFR (SFR $M_{\odot}^{-1}$ yr^{-1}) is higher, on average, for types whose SN spectra indicate more complete loss of the progenitor's outer envelopes (i.e., SN Ib, SN Ic, SN Ic-BL). Spectroscopy also shows that, in our sample, SN Ic-BL host galaxies are more metal-poor than the hosts of normal SN Ic explosions, while SN IIb hosts also are more metal-poor (for one of two abundance diagnostics) and have less extinction, on average, than SN Ib or SN Ic host galaxies.

A surprising effect is that spectroscopic contamination by AGN is higher among SN II hosts than SN (Ib+Ic) hosts. This is important to the correct interpretation of host galaxy properties from SDSS spectroscopy.

This study is statistical, and we have shown only that samples are drawn from differing underlying distributions in our comparisons. The distinctions we present are consistent with even considerable variation among the environments of individual examples of each SN type.

10.1. *Synthesizing Patterns*

There are strong connections among the type-dependent patterns in host galaxy photometry and spectroscopy:

- Host galaxies of SN Ic-BL in the sample generally have low mass and high specific SFR, helping to explain the blue colors at broad-lined SN Ic explosion sites. The SN IIb typically are found beyond the g'-band half-light radius in massive hosts, offering explanation for the blue colors of their sites. The SN Ic-BL and SN IIb host galaxy fiber spectra have lower abundances than SN Ic and SN Ib host galaxy fiber spectra closest in radius to the explosion site, respectively, although the SN IIb-SN Ib difference is significant for only one of two strong-line diagnostics.

- SN Ic often erupt at small offsets in massive galaxies with strong specific SFR, high oxygen abundance, and high extinction measured from fiber spectra. These fibers generally collect light from within the host's g'-band half-light radius. These explosion sites help to explain the high surface brightnesses near SN Ic explosion sites. High interstellar reddening helps to explain why the colors near SN Ic sites have colors similar to those of SN II, despite their hosts' high specific SFR.

The u'-z' color and u' surface brightness near SN explosion sites considerably separate SN IIb, SN Ic, and SN Ic (see Figure 2). SN Ic sites predominantly have high surface brightness, while SN IIb populate lower-surface brightness but extremely blue environments. SN Ib largely occupy the parameter space between the SN IIb and the SN Ic. By contrast, however, the explosion sites of SN II have no specific locus in the color-brightness plane.

These patterns suggest that the fraction of the overall stripped-envelope SN (Ib+Ic+IIb) to Type II SN may not vary strongly with environment. Perhaps the stars that may explode as one stripped-envelope species at one value of mass in one environment instead exploded as another stripped-envelope species in other environments where, for example, the chemistry is different.

10.2. *SN Ib, SN IIb, and SN II Environments*

The best-studied example of a Type IIb, SN 1993J, exploded at a distance of only 3.6 Mpc in M81 (Filippenko et al. 1993; Matheson et al. 2000), and archival imaging revealed that its progenitor was a K-type supergiant (Aldering et al. 1994). HST imaging after the SN disappeared found evidence for a B-type supergiant binary companion (Van Dyk et al. 2002; Maund et al. 2004). More recent studies of the sites of other SN IIb suggest, however, that a fraction of the SN IIb population may erupt from massive single stars (e.g., Crockett et al. 2008). Chevalier & Soderberg (2010) analyzed the radio emission, optical shock breakout, and nebular emission of a sample of SN IIb to constrain the extent of their progenitors' envelopes and the properties of their circumstellar material. They favor two progenitor populations: (a) extended progenitors (SN 1993J, SN 2001gd) with hydrogen envelope mass greater than $\sim 0.1 M_{\odot}$ and slow, dense winds and (b) more compact and massive Wolf-Rayet progenitors (SN 1996cb, SN 2001ig, SN 2003bg, SN 2008ax, and SN 2008bo) with a less massive hydrogen envelope and lower density winds. PTF11eon/SN 2011dh, a SN IIb (Arcavi et al. 2011; Marion et al. 2011), was recently discovered by amateur astronomer Amadee Riou in M51, where pre-explosion HST imaging exists of the SN site. Analysis of the archival images finds evidence for a supergiant with $T_{eff} \approx 6000$ K at or near the SN site (Van Dyk et al. 2011; Maund et al. 2011). Radio and X-ray observations (Soderberg et al. 2012) and the optical spectroscopic and photometric evolution (Arcavi et al. 2011; Marion et al. 2012, in preparation) both favor a compact progenitor, however, suggesting that this star may be a binary companion or not associated with the SN.

Our analysis finds three statistically significant, plausibly related patterns in the host environments of SN IIb: SN IIb environments are bluer than the environments of SN Ib, SN Ic, and SN II; their explosion sites may be more metal-poor than those of SN Ib or SN Ic (significant for one of two abundance diagnostics); and their host galaxy interstellar extinction is less than that of SN (Ib+Ic). These trends are statistically significant even when we analyze only the locations of targeted SN.

An unambiguous implication of the exceptionally blue colors of SN IIb environments is that the Type IIb progenitor population is distinct from that of Type Ib explosions. Lack of hydrogen features near maximum light in SN Ib spectra may reflect a more extensive loss of the progenitor's hydrogen envelope. Comparatively metal-poor SN IIb host galaxies suggest that metals may play an important role in achieving this loss of the outer envelope.

The SN IIb population may erupt from a combination of massive single stars and progenitors in close binary systems, so a possibility is that the blue colors of SN IIb environments indicate higher binary fractions. Although the current examples of each class are few, future efforts may be able to draw distinctions between the environments of the compact and extended SN IIb progenitors proposed by Chevalier & Soderberg (2010).

Li et al. (2011a) recently reported that the hosts of SN IIb detected by LOSS had greater K-band luminosities than SN II-P hosts (with $p = 6.9\%$). Lower SN IIb progenitor metallicities are consistent with the PTF's diminished fraction of SN IIb and SN Ic-BL in 'giant,' presumably metal-rich galaxies, than in 'dwarf' galaxies: 1 SN Ib, 3 SN IIb, and 2 SN Ic-BL, and 9 SN II in 'dwarf' galaxies, and 2 SN Ib, 2 SN IIb, 7 SN Ic, 1 SN Ic-BL and 42 SN II in 'giant' galaxies (Arcavi et al. 2010).

10.3. *SN Ic-BL Environments*

Type Ic-BL are the SN that have been associated with coincident LGRB explosions (Galama et al. 1998; Matheson et al. 2003; Stanek et al. 2003; Hjorth et al. 2003; Malesani et al. 2004; Modjaz et al. 2006; Sanders et al. 2012b; see Woosley & Bloom 2006 and Modjaz 2011 for reviews). Modjaz et al. (2008) showed that SN Ic-BL with associated LGRB prefer more metal-poor environments than do SN Ic-BL without an LGRB (but see Levesque et al. 2010).

We find that host galaxies of SN Ic-BL (without an associated LGRB) follow a significantly more metal-poor distribution than the hosts of normal SN Ic (or SN Ib) explosions, even when only galaxy-impartial discoveries are considered. The colors of SN Ic-BL local environments also follow a bluer distribution than those of SN Ic, further evidence for different progenitor populations. SN Ic-BL host galaxies have strong specific SFRs, similar to those of normal SN Ic.

Lower Type Ic-BL progenitor oxygen abundances may imply reduced rates of wind-driven mass loss, potentially enabling SN Ic-BL progenitor to retain greater angular momentum (e.g., Kudritzki 2002; Heger et al. 2003; Eldridge & Tout 2004; Vink & de Koter 2005). High angular momentum before the explosion may be important to the production of high velocity ejecta (Woosley et al. 1993; Thompson et al. 2004). Nonetheless, the means by which SN Ic-BL progenitors shed their outer envelopes, if not through their high metallicity, needs explanation and may involve Roche lobe overflow (Podsiadlowski et al. 1992; Nomoto et al. 1995), stellar mergers (Podsiadlowski et al. 2010), or perhaps deep mixing.

Here our measurements support a picture where both SN Ib and SN Ic have more metal-rich hosts on average than SN Ic-BL, consistent with the host galaxy magnitudes measured by Arcavi et al. (2010). It presents a contrast with the results of Modjaz et al. (2011) who recently measured the oxygen abundances at the *sites* of SN Ic-BL, SN (Ib+IIb), and SN Ic. There the SN Ic-BL distribution falls intermediate between those of SN (Ib+IIb) and SN Ic, although it is more similar to the comparatively metal-poor SN (Ib+IIb) distribution and neither comparison is statistically significant. These contrasting trends may relate to fact that Modjaz et al. (2011) constructed their samples for each SN type from approximately equal numbers of galaxy-impartial and targeted SN discoveries, or the inclusion of SN IIb (which we find inhabit metal-poor environments) with SN Ib. Modjaz et al. (2011) measurements were also taken at the explosion site, which may often differ significantly from the host abundance measured from SDSS fiber spectra (0.13 dex average disagreement with *nuclear* fiber measurements).

Svensson et al. (2010) found that host galaxies of LGRBs had smaller star masses than core-collapse SN hosts and had high surface brightness and more massive stellar populations. The only SN-LGRB that met our sample criteria, SN 2006aj, has low host stellar mass and comparatively blue u'-z' color near the explosion site.

10.4. *SN Ib, SN Ic, and SN II Environments*

In an earlier paper (Kelly et al. 2008), we showed that, while the positions of the other core-collapse SN follow the distribution of their hosts' light, Type Ic SN trace the brightest regions of their host galaxies in a pattern similar to that followed by LGRB (Fruchter et al. 2006). Possible explanations for this pattern include shorter lifetimes and higher masses of SN Ic progenitors (Raskin et al. 2008; Leloudas et al. 2010; Eldridge et al. 2011) as well as preference for metal-rich regions near the centers of hosts. Anderson & James (2008) showed, subsequently, that SN Ic also track their hosts' Hα emission more closely than SN II (their comparison with SN Ib lacked statistical significance).

The SDSS fiber spectra of core-collapse host galaxies, which generally sample inside of the g'-band half-light radius, reveal an increasing progression of specific SFR from SN II to SN Ib to SN Ic (and SN Ic-BL) hosts. This pattern persists when we study only the spectra from fibers targeting the host nucleus. SN Ic explode at comparatively small host offset, linking them to the strong star formation near their hosts' centers.

We find that the central star formation that yields SN Ic generally has high chemical abundance and extinction from interstellar dust. A SN Ic progenitor population tracking high metallicity would be expected to explode in massive galaxies with strong star formation in metal-rich gas near their centers, the pattern we observe.

The colors of SN Ib and SN Ic explosion sites may offer evidence that their progenitors are also younger and more massive than the progenitors of SN II. The distribution of the apparent u'-z' color at SN Ib and SN Ic sites is similar to that at SN II sites. However, we find that SN (Ib+Ic) host galaxies have higher interstellar extinction ($\Delta A_V \approx 0.5$ mag). This suggests that SN (Ib+Ic) sites have intrinsically bluer color than SN II sites, perhaps indicative of younger progenitor stellar populations.

SN Ib explosion sites have higher u'-band surface brightnesses than SN II sites, while SN Ib host galaxies generally have lower abundance than SN Ic in our sample. There is no statistically significant difference between the SN Ib and SN Ic host offset distributions in our sample ($p = 67\%$), which may imply that host offset cannot, on its own, explain the uniquely strong association of SN Ic with bright host galaxy pixels (Kelly et al. 2008).

While analyses of pre- and post-explosion imaging have not yet identified a progenitor of a SN Ib or SN Ic, red supergiants have been found at the sites of SN II-P explosions (e.g., Barth et al. 1996; Van Dyk et al. 1999, 2003b, 2003a, 2012; Smartt et al. 2001, 2003, 2004; Li et al. 2005, 2007; Maund & Smartt 2005). Smartt et al. (2009) favor a 8.5-16.5 $M_{\odot}$ mass range for SN II progenitors, although extinction along the line of sight to the progenitors is not well constrained (e.g., Walmswell & Eldridge 2011). Smith et al. (2011) note that Wolf Rayet stars in binary systems, possible progenitors of SN Ib and SN Ic, are expected to be less luminous than single Wolf Rayet stars. Brighter companions may outshine Wolf Rayet progenitors, although mass-gaining companions may, in some cases, explode first (Podsiadlowski et al. 1992; Eldridge et al. 2011). Even for progenitors with close binary companions, metallicity and mass are expected to be important in determining the composition of the outer envelope, even though substantial mass loss may occur through Roche lobe overflow (Smith et al. 2011; Yoon et al. 2010; Eldridge et al. 2011).

Prantzos & Boissier (2003) and Boissier & Prantzos (2009) found that SN (Ib+Ib/c+Ic) hosts have greater absolute M_B luminosities than SN II hosts. Prieto et al. (2008) presented the first comparison between the oxygen abundances of SN (Ib+Ic) and SN II host galaxies with large sample sizes. Using the T04 metallicities available for the SDSS DR4 spectra, they found $p = 5\%$ evidence for a difference (the sample may not have been large enough to determine the effect of AGN contamination). Van den Bergh 1997, Tsvetkov et al. (2004), Hakobyan et al. (2009), Anderson & James (2009), and Leaman et al. (2011) have found that SN (Ib+Ib/c+Ic) occur preferentially toward galaxy centers, where oxygen abundances are generally higher. Habergham et al. (2010), examining 178 host galaxies for evidence of interaction, and Anderson et al. (2011), in a study of SN sites in Arp 299, have explored explanations for these patterns.

Modjaz et al. (2011) find a significant difference (∼0.2 dex on average) between the oxygen abundances at the sites of 12 SN Ic and a mixed sample of 16 SN (Ib+IIb) for one of three oxygen abundance calibrations (although see Anderson et al. (2010) and Leloudas et al. (2011)). When only abundances measured at the SN site from these three studies are compared, a significant difference between SN Ib and SN Ic metallicities computed with the Pettini & Pagel (2004) diagnostic is evident (M. Modjaz, private comm. and in preparation).

10.5. *SN IIn Environments*

Among our set of host measurements, we find no statistically significant differences between the characteristics of SN IIn host environments and those of normal SN II. Anderson & James (2009), who have also studied SN IIn explosion sites, found no significant difference between the mean radial offsets of 12 SN IIn and 35 SN IIP from the host galaxy center.

Narrow line emission characterizes SN IIn spectra (Schlegel 1990) and is thought to be the result of the interaction of the ejecta with high density surrounding material. The existence of dense circumstellar material likely indicates strong pre-explosion mass loss (e.g., Chugai & Danziger 1994) and can increase the optical luminosity of the SN by thermalizing the emerging blast wave (e.g., Woosley et al. 2007; Smith et al. 2011; van Marle et al. 2010).

Luminous Blue Variable (LBV) stars (e.g., η Car), with their high mass loss rates ($> 10^{-4} M_{\odot}$ yr^{-1}), have been suggested as candidate progenitors, although standard stellar modeling positions the LBV period before an ultimate Wolf-Rayet phase (e.g., Langer 1993; Maeder et al. 2005). Dwarkadas (2011) has recently suggested that observations may only present a convincing case for an LBV progenitor in the case of SN 2005gl (Gal-Yam et al. 2007; Gal-Yam & Leonard 2009). Other means of potentially producing regions of high density circumstellar material include, for example, pulsation-driven superwinds from red supergiants (RSGs) (Yoon & Cantiello 2010).

11. CONCLUSIONS

We have analyzed the properties of the environments of nearby SN reported by targeted and galaxy-impartial searches. Most of our data come from a small number of well-defined surveys, but we have included supernovae discovered by many individuals and groups. It is not possible for us to characterize the systematic effects introduced by each search. However, we have characterized the searches by their fundamental techniques and applied reasonable redshift limits to limit the strength of possible bias. We show that these details do not dominate the patterns we find.

The SN IIb and SN Ic-BL in our sample erupt in environments with exceptionally blue color. SN IIb sites often have large host offsets, while SN Ic-BL generally have comparatively low mass host galaxies. By contrast, SN Ib and especially SN Ic environments have less extreme colors, similar to those of SN II sites, but with exceptionally high u'-band surface brightness. SN Ib and SN Ic generally erupt from regions within the g'-band half-light radii of high stellar mass galaxies. The colors and surface brightnesses of SN II as well as SN IIn environments show no strong distinguishing pattern.

The centers of SN Ic host galaxies are generally dusty, metal-rich, and have high specific SFR. Stronger interstellar extinction associated with SN Ic sites may explain why they are not bluer than SN II sites, despite higher specific SFR. The central regions of SN Ib host galaxies are less metal-rich and have smaller specific SFR than those of SN Ic hosts.

We find that the SN IIb host galaxy spectra closest in radius to the explosion site in our sample are more metal poor than the SN Ib host galaxy spectra, although this difference is statistically significant for only one of two strong-line diagnostics. SN Ic-BL host galaxies are also less metal-rich than SN Ic host galaxies, even among only galaxy-impartial discoveries.

The specific SFR measured from fiber spectra is higher, on average, for types whose SN spectra indicate more complete loss of the progenitor's outer envelopes (e.g., SN Ic, SN Ic-BL). Even among only spectra of galaxy nuclei, SN (Ib+Ic) host spectra have stronger specific SFR than SN II host spectra.

The non-negligible fraction of stripped-envelope SN in low-metallicity host galaxies may indicate that some stripped-envelope SN have binary progenitors or, alternatively, single progenitors that collapse to a black hole.

Drout et al. (2011) have estimated the line-of-sight extinction instead inferred from the colors of SN light curves. The interstellar reddening we find from SDSS fiber spectra of SN Ib and SN Ic hosts yield consistent values of A_V, although the SDSS fibers are generally positioned away from the explosion site.

AGN emission, which makes spectra unusable for abundance measurements and is found primarily in high-metallicity galaxies, leads us to exclude a larger fraction of SN II (20±3% (36/156)) than SN (Ib+Ic) host spectra (9±4% (5/55)). This produces an overestimate of SN (Ib+Ic) / SN II in high-metallicity environments from SDSS spectra alone. The ratio is lower when we use host stellar mass as an oxygen abundance proxy, impervious to AGN.

Stellar mass estimates, robust to AGN contamination, provide evidence that SN (Ib+Ic) / SN II increases in more massive, metal-rich galaxies, a trend that retains significance when we consider only targeted SN discoveries.

None of the host measurements reveals a strong difference between SN IIn and normal SN II explosion environments.

The accelerating rate of SN discovery promises to yield, over the next decade, much larger samples of each of the core-collapse species that we study in this paper. We urge the public archiving of spectra so that analyses can assign SN to consistent spectroscopic classes. Future study of explosion sites, aided by improved position information and uniform classification, will be a powerful tool to study progenitor properties and the evolution of massive stars.

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TABLE 7
Host Galaxy Measurements

SN	Type	z	Discov. Method	Discov. Pro/Am	Discoverer
PTF09axi	II	0.064	I	P	PTF
PTF09bce	II	0.023	I	P	PTF
PTF09cjq	II	0.019	I	P	PTF
PTF09cvi	II	0.030	I	P	PTF
PTF09dra	II	0.077	I	P	PTF
PTF09ebq	II	0.024	I	P	PTF
PTF09ecm	II	0.029	I	P	PTF
PTF09fbf	II	0.021	I	P	PTF
PTF09fmk	II	0.063	I	P	PTF
PTF09fqa	II	0.030	I	P	PTF
PTF09hdo	II	0.047	I	P	PTF
PTF09hzg	II	0.028	I	P	PTF
PTF09iex	II	0.020	I	P	PTF
PTF09ige	II	0.064	I	P	PTF
PTF09ism	II	0.029	I	P	PTF
PTF09sh	II	0.038	I	P	PTF
PTF09tm	II	0.035	I	P	PTF
PTF09uj	II	0.065	I	P	PTF
PTF10bau	II	0.026	I	P	PTF
PTF10bgl	II	0.030	I	P	PTF
PTF10cd	II	0.045	I	P	PTF
PTF10con	II	0.033	I	P	PTF
PTF10cqh	II	0.041	I	P	PTF
PTF10cwx	II	0.073	I	P	PTF
PTF10cxq	II	0.047	I	P	PTF
PTF10cxx	II	0.034	I	P	PTF
PTF10czn	II	0.045	I	P	PTF
PTF10dk	II	0.074	I	P	PTF
PTF10hv	II	0.052	I	P	PTF
2007rw	II[1]	0.009	T	P	Madison, Li (LOSS)
1990ah	II	0.017	T	P	Pollas
1991ao	II	0.016	T	P	Pollas
1992I	II	0.012	T	P	Buil
1992ad	II	0.004	T	P	Evans
1993W	II	0.018	T	P	Pollas
1993ad	II	0.017	T	P	Pollas
1994P	II	0.004	T	P	Sackett
1994ac	II	0.018	T	P	McNaught
1995H	II	0.005	T	P	Mueller
1995J	II	0.010	T	A	Johnson
1995V	II	0.005	T	A	Evans
1995Z	II	0.016	T	P	Mueller
1995ab	II	0.019	T	P	Pollas
1995ag	II	0.005	T	P	Mueller
1995ah	II	0.015	T	P	Popescu et al.
1995ai	II	0.018	T	P	Pollas
1996B	II	0.014	T	A	Gabrijelcic
1996an	II	0.005	T	A	Aoki
1996bw	II	0.018	T	P	BAO Supernova Survey
1996cc	II	0.007	T	A	Sasaki
1997W	II	0.018	T	P	Berlind, Garnavich
1997aa	II	0.012	T	P	BAO Supernova Survey
1997bn	II	0.014	T	P	BAO Supernova Survey
1997bo	II	0.012	T	P	BAO Supernova Survey
1997co	II	0.023	T	P	BAO Supernova Search
1997cx	II	0.005	T	A	Schwartz
1997db	II	0.005	T	A	Schwartz
1997dn	II	0.004	T	A	Boles
1997ds	II	0.009	T	P	BAO Supernova Search
1998R	II	0.007	T	P	Berlind, Carter
1998W	II	0.012	T	P	LOSS
1998Y	II	0.013	T	P	LOSS
1998ar	II	0.012	T	P	BAO Supernova Survey
1998bm	II	0.005	T	P	LOSS
1998dn	II	0.001	T	P	BAO
1999D	II	0.010	T	P	BAO Supernova Search
1999an	II	0.005	T	P	BAO Supernova Survey
1999ap	II	0.040	I	P	SCP
1999cd	II	0.014	T	P	LOSS
1999dh	II	0.011	T	P	LOSS
1999et	II	0.016	T	P	Cappellaro
1999ge	II	0.019	T	P	LOSS
1999gg	II	0.014	T	A	Boles
1999gk	II	0.008	T	P	Berlind

TABLE 7 — *Continued*

SN	Type	z	Discov. Method	Discov. Pro/Am	Discoverer
1999gl	II	0.017	T	A	Boles
2000I	II	0.022	T	A	Puckett
2000au	II	0.020	T	A	Puckett, Langoussis
2000cb	II	0.006	T	P	LOSS
2000el	II	0.010	T	A	Puckett, George
2000ez	II	0.011	T	A	Armstrong
2000fe	II	0.014	T	P	LOTOSS
2001H	II	0.018	T	A	Holmes
2001J	II	0.013	T	P	LOTOSS
2001K	II	0.011	T	P	BAO
2001Q	II	0.012	T	P	LOTOSS
2001aa	II	0.021	T	A	Armstrong
2001ab	II	0.017	T	P	LOTOSS
2001ae	II	0.023	T	P	LOTOSS
2001ax	II	0.020	I	P	Schaefer, QUEST
2001bk	II	0.043	I	P	QUEST
2001cl	II	0.016	T	P	LOTOSS
2001cm	II	0.011	T	P	Beijing Observatory
2001cx	II	0.016	T	P	LOTOSS
2001cy	II	0.016	T	P	LOTOSS
2001ee	II	0.015	T	A	Armstrong
2001fb	II	0.032	I	P	SDSS
2001fc	II	0.017	T	A	Puckett, Cox
2001ff	II	0.013	T	P	LOTOSS
2001hg	II	0.009	T	A	Puckett, Sehgal
2002an	II	0.013	T	A	Sano
2002aq	II	0.017	T	P	LOTOSS
2002bh	II	0.017	T	P	LOTOSS
2002bx	II	0.008	T	P	LOTOSS; Boles
2002ca	II	0.011	T	A	Puckett, Kerns; LOTOSS
2002ce	II	0.007	T	A	Arbour
2002ej	II	0.016	T	A	Puckett, Kerns
2002em	II	0.014	T	A	Armstrong
2002ew	II	0.030	I	P	NEAT/Wood-Vasey et al.
2002gd	II	0.009	T	A	Klotz; Puckett, Langoussis
2002hg	II	0.010	T	A	Boles
2002hj	II	0.024	I	P	NEAT/Wood-Vasey et al.
2002hm	II	0.012	T	A	Boles
2002ig	II	0.077	I	P	SDSS
2002in	II	0.076	I	P	SDSS
2002ip	II	0.079	I	P	SDSS
2002iq	II	0.056	I	P	SDSS
2002jl	II	0.064	I	P	NEAT/Wood-Vasey et al.
2003C	II	0.017	T	A	Puckett, Cox
2003O	II	0.016	T	A	Rich
2003bk	II	0.004	T	P	LOTOSS
2003bl	II	0.014	T	P	LOTOSS
2003cn	II	0.018	T	P	LOTOSS
2003da	II	0.014	T	A	Boles
2003dq	II	0.046	I	P	NEAT/Wood-Vasey et al.
2003ej	II	0.017	T	P	LOTOSS
2003hg	II	0.014	T	P	LOTOSS
2003hk	II	0.023	T	A	Boles; LOTOSS
2003hl	II	0.008	T	P	LOTOSS
2003iq	II	0.008	T	A	Llapasset
2003jc	II	0.019	T	P	LOSS
2003kx	II	0.006	T	A	Armstrong
2003ld	II	0.014	T	A	Puckett, Cox
2003lp	II	0.008	T	A	Puckett, Toth
2004D	II	0.021	T	P	LOSS
2004G	II	0.005	T	A	Kushida
2004T	II	0.021	T	P	LOSS
2004Z	II	0.023	T	A	Boles
2004bn	II	0.022	T	P	LOSS
2004ci	II	0.014	T	A	LOSS
2004dh	II	0.019	T	P	LOSS
2004ei	II	0.019	T	A	Boles
2004ek	II	0.017	T	A	Boles; Puckett, Cox
2004em	II	0.015	T	A	Armstrong
2004er	II	0.015	T	P	LOSS
2004gy	II	0.027	I	P	Quimby et al.
2004ht	II	0.067	I	P	Frieman, SDSS
2004hv	II	0.061	I	P	Frieman, SDSS Collaboration
2004hx	II	0.014	I	P	Frieman, SDSS Collaboration
2004hy	II	0.058	I	P	Frieman, SDSS Collaboration
2005H	II	0.013	T	P	LOSS

TABLE 7 — *Continued*

SN	Type	z	Discov. Method	Discov. Pro/Am	Discoverer
2005I	II	0.018	T	P	LOSS
2005Y	II	0.016	T	P	LOSS
2005Z	II	0.019	T	P	LOSS
2005aa	II	0.021	T	P	LOSS
2005ab	II	0.015	T	A	Itagaki
2005au	II	0.018	T	A	Arbour
2005bb	II	0.009	T	P	LOSS
2005bn	II	0.028	I	P	SubbaRao, SDSS Collaboration
2005ci	II	0.008	T	P	LOSS
2005dp	II	0.009	T	A	Itagaki
2005dq	II	0.022	T	A	Armstrong
2005dz	II	0.019	T	A	LOSS
2005eb	II	0.015	T	P	LOSS
2005en	II	0.017	T	A	LOSS
2005gi	II	0.050	I	P	SDSS
2005gm	II	0.022	T	P	Luckas, Trondal, Schwartz
2005ip	II	0.007	T	A	Boles
2005kb	II	0.015	I	P	SDSS
2005kh	II	0.007	T	P	LOSS
2005kk	II	0.017	T	P	LOSS
2005lb	II	0.030	I	P	SDSS
2005lc	II	0.010	I	P	SDSS
2005mg	II	0.013	T	A	Newton, Puckett
2006J	II	0.019	T	P	LOSS
2006O	II	0.019	T	A	Rich
2006V	II	0.016	T	P	Chen, Taiwan Supernova Survey
2006at	II	0.015	T	A	Dintinjana, Mikuz
2006be	II	0.007	T	P	LOSS
2006bj	II	0.038	I	P	Quimby
2006bx	II	0.019	T	P	LOSS
2006by	II	0.019	T	P	LOSS
2006cx	II	0.019	T	P	LOSS
2006dk	II	0.016	T	A	Migliardi
2006dp	II	0.019	T	A	Monard
2006ed	II	0.017	T	P	LOSS
2006ee	II	0.015	T	P	LOSS
2006ek	II	0.020	T	P	LOSS
2006fg	II	0.030	I	P	SDSS II
2006gs	II	0.019	T	A	Itagaki
2006iu	II	0.022	T	P	LOSS
2006iw	II	0.030	I	P	SDSS II
2006kh	II	0.060	I	P	SDSS
2006pc	II	0.060	I	P	SDSS
2006qn	II	0.022	T	P	Joubert, Li (LOSS)
2006st	II	0.011	T	P	Winslow, Li (LOSS)
2007L	II	0.018	T	P	Mostardi, Li (LOSS)
2007T	II	0.013	T	P	Madison, Li (LOSS)
2007am	II	0.010	T	P	Joubert, Li (LOSS)
2007an	II	0.011	T	A	Migliardi
2007be	II	0.013	T	A	Moretti, Tomaselli
2007fp	II	0.019	T	P	Liou, Chen, et al. (Taiwan Supernova Survey)
2007gw	II	0.016	T	A	Itagaki
2007ib	II	0.030	I	P	SDSS
2007il	II	0.021	T	P	Chu, Li (LOSS)
2007jn	II	0.060	I	P	SDSS
2007kw	II	0.070	I	P	SDSS
2007ky	II	0.070	I	P	SDSS
2007lb	II	0.060	I	P	SDSS
2007ld	II	0.030	I	P	SDSS
2007lj	II	0.040	I	P	SDSS
2007lx	II	0.057	I	P	SDSS
2007md	II	0.050	I	P	SDSS
2007sz	II	0.020	I	P	ESSENCE
2007tn	II	0.050	I	P	ESSENCE
2008N	II	0.008	T	P	Winslow, Li, Filippenko (LOSS)
2008aa	II	0.022	T	P	Madison, Li, Filippenko (LOSS)
2008ak	II	0.008	T	A	Boles; Londero
2008bh	II	0.015	T	P	Pignata et al. (CHASE); Narla, Li, Filippenko (LOSS)
2008bj	II	0.019	I	P	Yuan et al. (ROTSE)
2008bl	II	0.015	T	A	Duszanowicz
2008bx	II	0.008	T	A	Puckett, Gagliano
2008ch	II	0.013	T	P	LOSS
2008dw	II	0.013	T	P	LOSS
2008ej	II	0.021	T	P	LOSS
2008gd	II	0.059	I	P	Yuan et al. (ROTSE)

TABLE 7 — *Continued*

SN	Type	z	Discov. Method	Discov. Pro/Am	Discoverer
2008gz	II	0.006	T	A	Itagaki
2009H	II	0.005	T	P	LOSS
2009af	II	0.009	T	A	Cortini
2009at	II	0.005	T	A	Noguchi
2009ay	II	0.022	T	A	Puckett, Peoples
2009bj	II	0.027	I	P	Palomar TF
2009bk	II	0.039	I	P	Palomar TF
2009bl	II	0.040	I	P	Palomar TF
2009ct	II	0.060	I	P	Palomar Transient Factory
2009dd	II	0.002	T	A	Cortini
2009fe	II	0.047	I	P	Kasliwal et al. (PTF)
2009hd	II	0.002	T	A	Monard
2009jd	II	0.025	I	P	Catelan, Drake et al. (CRTS)
2009jw	II	0.020	T	P	LOSS
2009ls	II	0.003	T	A	Nishiyama, Kabashima
2009nu	II	0.040	I	P	Prieto, Drake et al. (CRTS)
2010K	II	0.020	I	P	Prieto, Drake et al. (CRTS)
2010aw	II	0.023	T	P	LOSS
2010gq	II	0.018	I	P	Novoselnik et al. (La Sagra Sky Survey)
2010gs	II	0.027	I	P	Novoselnik et al. (La Sagra Sky Survey)
2010ib	II	0.019	T	P	Cenko et al. (LOSS)
2010id	II	0.017	T	P	Cenko et al. (LOSS)
1993G	II L	0.010	T	P	Treffers, Leibundgut, Filippenko, Richmond
2006W	II L	0.016	T	P	LOSS
1990H	II P	0.005	T	P	Perlmutter, Pennypacker, et al.
1991G	II P	0.002	T	P	Mueller
1998bv	II P	0.005	T	P	Kniazev et al.
1998dl	II P	0.005	T	P	LOSS
1999ev	II P	0.003	T	A	Boles
1999gi	II P	0.002	T	A	Kushida
1999gn	II P	0.005	T	A	Dimai
1999gq	II P	0.001	T	P	LOSS
2000db	II P	0.002	T	A	Aoki
2001R	II P	0.014	T	P	LOTOSS
2001X	II P	0.005	T	P	BAO
2001dc	II P	0.007	T	A	Armstrong
2001dk	II P	0.018	T	A	Boles
2001fv	II P	0.005	T	A	Armstrong
2001ij	II P	0.038	I	P	SDSS
2002ik	II P	0.032	I	P	SDSS
2003J	II P	0.003	T	A	Puckett, Newton; Kushida
2003Z	II P	0.004	T	P	Qiu, Hu
2003aq	II P	0.018	T	A	Boles
2003gd	II P	0.002	T	A	Evans
2003ie	II P	0.002	T	A	Arbour
2004A	II P	0.003	T	A	Itagaki
2004am	II P	0.001	T	P	LOSS
2004cm	II P	0.004	I	P	SDSS
2004dd	II P	0.013	T	P	LOSS
2004dg	II P	0.005	T	A	Vagnozzi et al.
2004dj	II P	0.000	T	A	Itagaki
2004du	II P	0.017	T	P	LOSS
2004ez	II P	0.005	T	A	Itagaki
2004fc	II P	0.006	T	P	LOSS
2005ad	II P	0.005	T	A	Itagaki
2005ay	II P	0.003	T	A	Rich
2005cs	II P	0.002	T	A	Kloehr
2006bp	II P	0.003	T	A	Itagaki
2006fq	II P	0.070	I	P	SDSS II
2006my	II P	0.003	T	A	Itagaki
2006ov	II P	0.005	T	A	Itagaki
2007aa	II P	0.005	T	A	Doi
2007aq	II P	0.021	T	P	Winslow, Li (LOSS)
2007av	II P	0.005	T	A	Arbour
2007bf	II P	0.018	T	A	Puckett, Guido
2007jf	II P	0.070	I	P	SDSS
2007nw	II P	0.060	I	P	SDSS
2007od	II P	0.006	T	A	Maticic (PIKA)
2008F	II P	0.018	T	A	Puckett, Sostero
2008X	II P	0.007	T	P	Boles; Winslow, Li, Filippenko (LOSS)
2008az	II P	0.010	T	A	Newton, Gagliano, Puckett
2008ea	II P	0.015	T	P	Martinelli, Biagietti, Iafrate; LOSS
2008hx	II P	0.022	T	P	LOSS
2008in	II P	0.005	T	A	Itagaki
2009A	II P	0.017	T	P	Pignata et al. (CHASE)

TABLE 7 — *Continued*

SN	Type	z	Discov. Method	Discov. Pro/Am	Discoverer
2009E	II P	0.007	T	A	Boles
2009W	II P	0.017	I	P	Drake et al. (CRTS)
2009am	II P	0.012	T	P	LOSS
2009ao	II P	0.011	T	P	Pignata et al. (CHASE)
2009bz	II P	0.011	T	P	LOSS
2009dh	II P	0.060	I	P	Drake et al. (CRTS)
2009ga	II P	0.011	T	A	Itagaki
2009hf	II P	0.013	T	A	Monard
2009hq	II P	0.007	T	A	Monard
2009ie	II P	0.018	T	P	LOSS
2009lx	II P	0.027	I	P	Drake et al. (CRTS)
2009md	II P	0.004	T	A	Itagaki
2009my	II P	0.011	T	P	LOSS
2010aj	II P	0.021	T	A	Newton, Puckett
2010fx	II P	0.017	T	A	Newton, Puckett
2010gf	II P	0.019	T	P	Cenko et al. (LOSS)
2010hm	II P	0.020	T	P	Cenko et al. (LOSS)
2010jc	II P	0.024	I	P	Howerton et al. (CRTS); Puckett, Newton
1999br	II P pec	0.003	T	P	LOSS
2000em	II pec	0.019	T	P	Nearby Galaxies Supernova Search
2001dj	II pec	0.018	T	P	LOTOSS
2003cv	II pec	0.028	I	P	NEAT/Wood-Vasey et al.
2004by	II pec	0.012	T	A	Armstrong
2004gg	II pec	0.020	T	P	LOSS
2007ms	II pec	0.040	I	P	SDSS
2006G	II/IIb	0.017	T	P	LOSS
PTF09dxv	IIb	0.033	I	P	PTF
PTF09fae	IIb	0.067	I	P	PTF
2005U	IIb[1]	0.010	T	P	Mattila et al., Nuclear Supernova Search
1996cb	IIb	0.002	T	A	Aoki
1997dd	IIb	0.015	T	A	Aoki
2001ad	IIb	0.011	T	P	BAO
2001gd	IIb	0.003	T	A	Itagaki; Dimai
2003ed	IIb	0.004	T	A	Itagaki
2004ex	IIb	0.017	T	P	LOSS
2004gj	IIb	0.021	T	P	LOSS
2005la	IIb[1]	0.019	I	P	Quimby, Mondol
2006dl	IIb	0.022	T	P	LOSS
2006iv	IIb	0.008	T	A	Duszanowicz
2006qp	IIb	0.012	T	A	Itagaki
2006ss	IIb	0.012	T	A	Boles
2007ay	IIb	0.015	T	P	Mostardi, Li (LOSS)
2008ax	IIb	0.002	T	P	Mostardi, Li, Filippenko (LOSS); Itagaki
2008cw	IIb	0.032	I	P	Yuan et al. (ROTSE)
2008cx	IIb	0.019	T	A	Monard
2008ie	IIb	0.014	T	P	Pignata et al. (CHASE); Hirose
2009K	IIb	0.012	T	P	Pignata et al. (CHASE)
2009ar	IIb	0.026	I	P	Mahabal, Drake et al. (CRTS)
2009fi	IIb	0.016	T	A	Boles
2009jv	IIb	0.016	T	A	Gorelli, Newton, Puckett
2010am	IIb	0.020	I	P	Drake et al. (CRTS)
1994Y	IIn	0.009	T	P	Wren
1995G	IIn	0.016	T	A	Evans, Shobbrook, Beaman
1996ae	IIn	0.005	T	A	Vagnozzi, Piermarini, Russo
1996bu	IIn	0.004	T	A	Kushida
1997ab	IIn	0.013	T	P	Hagen, Reimers
1998S	IIn	0.003	T	P	BAO Supernova Survey
1999eb	IIn	0.018	T	P	LOSS
1999gb	IIn	0.017	T	P	LOSS
2000ev	IIn	0.015	T	A	Manzini
2001I	IIn	0.017	T	P	LOTOSS
2001fa	IIn	0.017	T	P	LOTOSS
2002ea	IIn	0.014	T	A	Puckett, Newton
2002fj	IIn	0.015	T	A	Monard
2003G	IIn	0.011	T	P	LOTOSS
2003dv	IIn	0.008	T	P	LOTOSS
2003ke	IIn	0.021	T	P	LOSS
2004F	IIn	0.017	T	P	LOSS
2005cp	IIn	0.022	T	P	LOSS
2005db	IIn	0.015	T	A	Monard
2005gl	IIn	0.016	T	A	Puckett, Ceravolo
2006aa	IIn	0.021	T	P	LOSS
2006am	IIn	0.009	T	P	LOSS
2006bo	IIn	0.015	T	A	Boles
2006cy	IIn	0.036	I	P	Quimby, Mondol

TABLE 7 — *Continued*

SN	Type	z	Discov. Method	Discov. Pro/Am	Discoverer
2006db	IIn	0.023	I	P	Quimby, Mondol
2006gy	IIn	0.019	I	P	Quimby
2006jd	IIn[1]	0.019	T	P	LOSS
2006tf	IIn	0.074	I	P	Quimby, Castro, Mondol
2007K	IIn	0.022	T	P	Madison, Li (LOSS)
2007cm	IIn	0.016	T	A	Kloehr
2007rt	IIn	0.022	T	P	Li (LOSS)
2008B	IIn	0.019	T	P	Itagaki
2008fm	IIn	0.039	I	P	Yuan et al. (ROTSE)
2008gm	IIn	0.012	T	P	Pignata et al. (CHASE)
2008ip	IIn	0.015	T	A	Kobayashi
2008ja	IIn	0.069	I	P	Catelan, Drake et al. (CRTS)
2009nn	IIn	0.046	I	P	Zheng, Yuan et al. (ROTSE)
2010jl	IIn	0.011	T	A	Newton, Puckett
1994W	IIn P	0.004	T	A	Cortini, Villi
2007pk	IIn pec	0.017	T	P	Parisky, Li (LOSS)
2010al	IIn pec	0.017	T	A	Rich
PTF09awk	Ib	0.062	I	P	PTF
PTF09dfk	Ib	0.016	I	P	PTF
1995F	Ib[1]	0.005	T	P	Lane, Gray
1997X	Ib[1]	0.004	T	A	Aoki
2005bf	Ib[1]	0.019	T	A	LOSS
2006fo	Ib[1]	0.021	I	P	SDSS II
2006lc	Ib[2]	0.016	I	P	SDSS
2007kj	Ib[1]	0.018	T	A	Itagaki
1991ar	Ib	0.015	T	P	McNaught, Russell
1997dc	Ib	0.011	T	P	BAO Supernova Survey
1998T	Ib	0.010	T	P	BAO Supernova Survey
1998cc	Ib	0.014	T	P	LOSS
1999di	Ib	0.016	T	A	Puckett, Langoussis
1999dn	Ib	0.009	T	P	Beijing Observatory Supernova Survey (Y. L. Qiu et al.)
1999eh	Ib	0.007	T	A	Armstrong
2000de	Ib	0.008	T	A	Migliardi
2000dv	Ib	0.014	T	P	LOSS
2000fn	Ib	0.016	T	A	Holmes
2002dg	Ib	0.047	I	P	NEAT/Wood-Vasey et al.
2002hz	Ib	0.018	T	P	LOTOSS
2003I	Ib	0.018	T	A	Puckett, Langoussis
2003bp	Ib	0.020	T	P	LOTOSS
2003gk	Ib	0.011	T	P	LOTOSS
2004ao	Ib	0.006	T	P	LOSS
2004bs	Ib	0.017	T	A	Armstrong
2004gv	Ib	0.020	T	P	Chen
2005O	Ib	0.019	T	P	Chen
2005hl	Ib	0.020	I	P	SDSS
2005hm	Ib	0.030	I	P	SDSS
2005mn	Ib	0.050	I	P	SDSS
2006ep	Ib	0.015	T	P	LOSS; Itagaki
2007ag	Ib	0.021	T	A	Puckett, Gagliano
2007ke	Ib	0.017	T	P	Chu, Li (LOSS)
2007qx	Ib	0.060	I	P	SDSS
2007uy	Ib	0.007	T	A	Hirose
2008D	Ib	0.007	T	P	Soderberg,Berger,Page
2008ht	Ib	0.022	T	P	LOSS
2009ha	Ib	0.015	T	A	Monard
2009jf	Ib	0.008	T	P	LOSS
2010O	Ib	0.010	T	A	Newton, Puckett
2002hy	Ib pec	0.013	T	A	Monard
2006jc	Ib pec[1]	0.006	T	A	Itagaki; Puckett, Gorelli
2009lw	Ib/IIb	0.016	T	P	LOSS
2010P	Ib/IIb	0.010	T	P	Mattila, Kankare
2002dz	Ib/c	0.018	T	P	LOTOSS
2003A	Ib/c	0.022	T	P	LOTOSS
2003ih	Ib/c	0.017	T	A	Armstrong
2006lv	Ib/c[1]	0.008	T	A	Duszanowicz
2007sj	Ib/c	0.040	I	P	SDSS
2008fn	Ib/c	0.030	I	P	Yuan et al. (ROTSE)
2008fs	Ib/c	0.039	I	P	Yuan et al. (ROTSE)
2010br	Ib/c	0.002	T	A	Nevski
2010gr	Ib/c	0.017	T	P	Cenko et al. (LOSS)
2010is	Ib/c	0.021	T	P	Cenko et al. (LOSS)
2001co	Ib/c pec	0.017	T	P	LOTOSS
PTF10bhu	Ic	0.036	I	P	PTF
PTF10bip	Ic	0.051	I	P	PTF

TABLE 7 — *Continued*

SN	Type	z	Discov. Method	Discov. Pro/Am	Discoverer
2004ib	Ic[2]	0.056	I	P	Frieman, SDSS Collaboration
2005az	Ic[3]	0.009	I	P	Quimby et al.
1990B	Ic	0.008	T	P	Perlmutter, Pennypacker
1990U	Ic	0.008	T	P	Pennypacker, Perlmutter, Marvin
1991N	Ic	0.003	T	P	Perlmutter, Pennypacker, et al.
1994I	Ic	0.002	T	A	Puckett, Armstrong; Johnson, Millar; Berry; Kushida
1995bb	Ic[1]	0.006	T	P	Tokarz, Garnavich
1996D	Ic	0.016	T	P	Drissen, Robert, Dutil, Roy
1996aq	Ic	0.005	T	A	Aoki
1997ei	Ic	0.011	T	A	Aoki
1999bc	Ic	0.021	I	P	SCP
1999bu	Ic	0.009	T	P	LOSS
2000C	Ic	0.013	T	A	Foulkes; Migliardi
2000cr	Ic	0.012	T	A	Migliardi, Dimai
2000ew	Ic	0.003	T	A	Puckett, Langoussis
2001ch	Ic	0.010	T	P	LOTOSS
2001ci	Ic	0.004	T	P	LOTOSS
2002J	Ic	0.013	T	P	LOTOSS
2002ao	Ic	0.005	T	P	LOTOSS
2002hn	Ic	0.017	T	P	LOTOSS
2002ho	Ic	0.008	T	A	Boles
2002jj	Ic	0.014	T	P	LOTOSS
2003L	Ic	0.021	T	A	Boles; LOTOSS
2003el	Ic	0.019	T	P	LOTOSS
2003hp	Ic	0.021	T	P	LOTOSS
2004C	Ic	0.006	T	P	Dudley, Fischer
2004aw	Ic	0.016	T	A	Boles; Itagaki
2004bf	Ic	0.017	T	P	LOSS
2004bm	Ic	0.004	T	P	LOSS
2004cc	Ic	0.008	T	P	LOSS
2004dc	Ic	0.021	T	P	LOSS
2004fe	Ic	0.018	T	P	LOSS
2004gn	Ic	0.006	T	P	LOSS
2005aj	Ic	0.008	T	A	Puckett, Newton
2005eo	Ic	0.017	T	A	LOSS
2005kl	Ic	0.003	T	A	Migliardi
2006dg	Ic	0.014	T	P	LOSS
2007cl	Ic	0.022	T	A	Puckett, Sostero
2007nm	Ic	0.046	I	P	Djorgovski et al. (Palomar-Quest)
2007rz	Ic	0.013	T	P	Parisky, Li (LOSS)
2008ao	Ic	0.015	T	A	Migliardi, Londero
2008du	Ic	0.016	T	P	LOSS
2008ew	Ic	0.020	T	P	LOSS
2008fo	Ic	0.030	I	P	Yuan et al. (ROTSE)
2008hh	Ic	0.019	T	A	Puckett, Crowley
2008hn	Ic	0.011	T	P	LOSS
2009em	Ic	0.006	T	A	Monard
2009lj	Ic	0.015	T	P	LOSS
2010Q	Ic	0.055	I	P	Graham, Drake et al. (CRTS)
2010do	Ic	0.014	T	P	Monard; Cenko et al. (LOSS)
2010gk	Ic	0.014	T	P	Li, Cenko et al. (LOSS)
2010io	Ic	0.007	T	A	Duszanowicz
2003id	Ic pec	0.008	T	P	LOTOSS
PTF09sk	Ic-bl	0.035	I	P	PTF
1997dq	Ic-bl	0.003	T	A	Aoki
1997ef	Ic-bl	0.012	T	A	Sano
1998ey	Ic-bl	0.016	T	A	Arbour
2002ap	Ic-bl	0.002	T	A	Hirose
2002bl	Ic-bl	0.016	T	A	Armstrong
2003jd	Ic-bl	0.019	T	P	LOSS
2004bu	Ic-bl	0.018	T	A	Boles
2005nb	Ic-bl	0.024	I	P	Quimby et al.
2006aj	Ic-bl	0.033	I	P	Cusumano et al.
2006nx	Ic-bl	0.050	I	P	SDSS
2006qk	Ic-bl	0.060	I	P	SDSS
2007I	Ic-bl	0.022	T	P	Lee, Li (LOSS)
2007bg	Ic-bl	0.034	I	P	Quimby, Rykoff, Yuan
2007ce	Ic-bl	0.046	I	P	Quimby
2010ah	Ic-bl	0.050	I	P	Ofek et al. (Palomar Transient Factory)
2010ay	Ic-bl	0.067	I	P	Drake et al. (CRTS)

TABLE 7 — *Continued*

SN	Type	z	Discov. Method	Discov. Pro/Am	Discoverer

NOTE. — Discov. Method notes whether the SN was discovered by a targeted (T) or a galaxy-impartial (I) search program. Discov. Pro/Am classifies the discoverers as professional (P) or amateur (A). A superscript number next to a type provides the origin of any spectroscopic reclassification (1: Modjaz et al. 2012, in prep.; 2: Sanders et al. 2012a; 3: this work). Discoverer is taken from the IAU classification[a].

[a] http://www.cfa.harvard.edu/iau/lists/Supernovae.html

TABLE 8
HOST GALAXY MEASUREMENTS

SN	Type	Offset Norm.	Log M (dex)	Fib. Off. (AGN)	SSFR	Fib. Off. (Metal)	T04 (dex)	PP04 (dex)	A_V (mag)	u'-z' (local)
PTF09axi	II	0.63	$9.29^{+0.09}_{-0.09}$							1.56
PTF09bce	II	0.95	$10.59^{+0.31}_{-0.11}$							2.47
PTF09cjq	II	0.69	$10.76^{+0.18}_{-0.47}$	0.08	$-12.09^{+0.86}_{-1.20}$				$-0.36^{+0.23}_{-0.23}$	2.63
PTF09cvi	II	1.61	$7.64^{+0.29}_{-0.35}$							1.81
PTF09dra	II	0.96	$10.59^{+0.07}_{-0.10}$	0.18	$-10.33^{+0.25}_{-0.24}$	0.18	$8.98^{+0.04}_{-0.04}$	$8.71^{+0.04}_{-0.04}$	$0.98^{+0.12}_{-0.12}$	1.57
PTF09ebq	II	0.21								
PTF09ecm	II	0.76								
PTF09fbf	II	0.65	$10.11^{+0.32}_{-0.09}$	1.08	$-7.82^{+0.12}_{-0.17}$	1.08	$8.73^{+0.01}_{-0.01}$	$8.24^{+0.01}_{-0.01}$	$0.26^{+0.03}_{-0.03}$	1.76
PTF09fmk	II	1.00	$10.39^{+0.10}_{-0.11}$							2.15
PTF09fqa	II	0.49								
PTF09hdo	II	1.04								
PTF09hzg	II	0.56	$10.49^{+0.06}_{-0.33}$							3.04
PTF09iex	II	0.66	$8.33^{+0.37}_{-0.58}$							1.27
PTF09ige	II	1.31	$9.79^{+0.09}_{-0.08}$	0.25	$-9.85^{+0.13}_{-0.12}$	0.25	$8.85^{+0.02}_{-0.03}$	$8.63^{+0.02}_{-0.02}$	$0.56^{+0.05}_{-0.05}$	1.15
PTF09ism	II	2.14	$9.50^{+0.08}_{-0.31}$	0.83	$-10.19^{+0.24}_{-0.19}$	0.83	$8.84^{+0.07}_{-0.07}$	$8.61^{+0.06}_{-0.06}$	$-0.13^{+0.15}_{-0.15}$	2.40
PTF09sh	II	1.25	$9.97^{+0.18}_{-0.11}$	0.12	$-9.86^{+0.12}_{-0.15}$	0.12	$9.01^{+0.01}_{-0.03}$	$8.73^{+0.01}_{-0.01}$	$0.65^{+0.04}_{-0.04}$	1.54
PTF09tm	II	0.55	$10.41^{+0.18}_{-0.14}$							2.76
PTF09uj	II	0.54	$9.79^{+0.09}_{-0.08}$	0.26	$-10.14^{+0.29}_{-0.26}$	0.26	$8.83^{+0.06}_{-0.09}$	$8.63^{+0.06}_{-0.06}$	$1.13^{+0.21}_{-0.21}$	1.74
PTF10bau	II	0.80	$10.35^{+0.28}_{-0.11}$	1.22	$-9.14^{+0.16}_{-0.20}$	1.22	$9.11^{+0.01}_{-0.04}$	$8.77^{+0.02}_{-0.02}$	$0.57^{+0.04}_{-0.04}$	2.34
PTF10bgl	II	0.83	$10.69^{+0.19}_{-0.11}$	0.94	$-8.61^{+0.26}_{-0.23}$	0.94	$8.91^{+0.01}_{-0.01}$	$8.54^{+0.01}_{-0.01}$	$0.86^{+0.02}_{-0.02}$	1.74
PTF10cd	II	0.70	$8.75^{+0.12}_{-0.14}$							0.57
PTF10con	II	0.17		0.05	$-10.29^{+0.24}_{-0.24}$	0.05	$8.86^{+0.05}_{-0.05}$	$8.64^{+0.04}_{-0.04}$	$0.72^{+0.12}_{-0.12}$	
PTF10cqh	II	1.32	$10.83^{+0.12}_{-0.12}$							1.83
PTF10cwx	II	0.70	$9.66^{+0.08}_{-0.08}$							1.26
PTF10cxq	II	0.39	$8.95^{+0.15}_{-0.08}$							1.65
PTF10cxx	II	0.58	$10.29^{+0.17}_{-0.14}$	0.28	$-9.84^{+0.15}_{-0.15}$	0.28	$9.05^{+0.01}_{-0.01}$	$8.78^{+0.02}_{-0.02}$	$1.19^{+0.05}_{-0.05}$	2.28
PTF10czn	II	1.63	$10.51^{+0.16}_{-0.17}$							0.63
PTF10dk	II	0.66	$8.32^{+0.16}_{-0.17}$							1.40
PTF10hv	II	0.09	$10.30^{+0.13}_{-0.06}$	0.08	$-10.17^{+0.17}_{-0.17}$	0.08	$8.84^{+0.04}_{-0.07}$	$8.61^{+0.03}_{-0.03}$	$0.59^{+0.09}_{-0.09}$	1.61
2007rw	II[1]	0.99	$9.54^{+0.05}_{-0.04}$	0.15	$-9.39^{+0.25}_{-0.41}$	0.15	$8.69^{+0.01}_{-0.01}$	$8.47^{+0.01}_{-0.01}$	$0.08^{+0.04}_{-0.04}$	0.87
1990ah	II	0.67	$9.87^{+0.08}_{-0.55}$							1.21
1991ao	II	1.42	$9.59^{+0.07}_{-0.56}$							2.15
1992I	II	3.71	$10.47^{+0.53}_{-0.10}$							3.57
1992ad	II	1.12	$10.17^{+0.07}_{-0.17}$							0.97
1993W	II	0.71	$9.62^{+0.19}_{-0.50}$							1.97
1993ad	II	1.48	$10.34^{+0.13}_{-0.53}$							1.78
1994P	II	2.01	$9.94^{+0.04}_{-0.04}$							1.70
1994ac	II	0.29	$9.01^{+0.55}_{-0.09}$							1.45
1995H	II	0.66	$9.96^{+0.05}_{-0.05}$							1.20
1995J	II	1.58	$9.50^{+0.04}_{-0.04}$	0.12	$-10.17^{+0.21}_{-0.19}$	0.12	$8.64^{+0.05}_{-0.06}$	$8.58^{+0.03}_{-0.03}$	$0.26^{+0.09}_{-0.09}$	0.67
1995V	II	0.76	$10.84^{+0.04}_{-0.04}$	0.30	$-8.42^{+0.25}_{-0.22}$	0.30	$9.11^{+0.01}_{-0.01}$	$8.80^{+0.01}_{-0.01}$	$0.92^{+0.02}_{-0.02}$	1.77
1995Z	II	0.96	$10.05^{+0.13}_{-0.54}$							2.45
1995ab	II	1.48	$8.80^{+0.56}_{-0.08}$							0.56
1995ag	II	0.53	$10.76^{+0.04}_{-0.05}$							1.61
1995ah	II	0.86	$8.72^{+0.10}_{-0.54}$	0.35	$-9.57^{+0.13}_{-0.13}$	0.35	$8.27^{+0.14}_{-0.12}$	$8.25^{+0.02}_{-0.02}$	$0.18^{+0.05}_{-0.05}$	1.12
1995ai	II	1.44	$10.77^{+0.12}_{-0.55}$							1.54
1996B	II	0.60	$10.90^{+0.15}_{-0.52}$							2.34
1996an	II	0.77	$11.04^{+0.05}_{-0.05}$	0.88	$-8.58^{+0.21}_{-0.27}$	0.88	$8.91^{+0.01}_{-0.01}$	$8.63^{+0.01}_{-0.01}$	$0.83^{+0.02}_{-0.02}$	1.30
1996bw	II	1.50	$10.61^{+0.18}_{-0.50}$							1.90
1996cc	II	0.87	$9.80^{+0.05}_{-0.05}$							1.63
1997W	II	1.55	$10.61^{+0.18}_{-0.50}$							1.69
1997aa	II	1.91	$9.47^{+0.57}_{-0.05}$							1.08
1997bn	II	0.36	$10.31^{+0.06}_{-0.57}$							2.07
1997bo	II	0.80	$8.23^{+0.54}_{-0.11}$	0.37	$-8.50^{+0.14}_{-0.20}$	0.37	$7.92^{+0.06}_{-0.06}$	$7.99^{+0.01}_{-0.01}$	$0.04^{+0.02}_{-0.02}$	1.78
1997co	II	0.64	$11.16^{+0.25}_{-0.25}$	0.15	$-11.72^{+0.65}_{-1.30}$				$1.28^{+0.23}_{-0.23}$	2.50
1997cx	II	0.60	$9.70^{+0.04}_{-0.04}$							1.26

TABLE 8 — *Continued*

SN	Type	Offset Norm.	Log M (dex)	Fib. Off. (AGN)	SSFR	Fib. Off. (Metal)	T04 (dex)	PP04 (dex)	A_V (mag)	u'-z' (local)
1997db	II	0.92	$10.75^{+0.04}_{-0.04}$							0.97
1997dn	II	1.36	$10.05^{+0.04}_{-0.05}$	0.88	$-7.76^{+0.33}_{-0.32}$	0.88	$8.98^{+0.04}_{-0.01}$	$8.52^{+0.01}_{-0.01}$	$1.28^{+0.02}_{-0.02}$	1.77
1997ds	II	0.53	$9.68^{+0.05}_{-0.05}$							1.89
1998R	II	0.44	$9.86^{+0.07}_{-0.13}$	0.18	$-9.86^{+0.14}_{-0.13}$	0.18	$8.97^{+0.01}_{-0.01}$	$8.69^{+0.01}_{-0.01}$	$1.11^{+0.04}_{-0.04}$	2.57
1998W	II	1.02	$10.02^{+0.53}_{-0.11}$							1.88
1998Y	II	0.73	$10.18^{+0.56}_{-0.08}$							1.24
1998ar	II	1.39	$10.80^{+0.41}_{-0.33}$	0.05	$-12.15^{+0.74}_{-1.23}$				$0.06^{+0.18}_{-0.18}$	1.70
1998bm	II	0.96	$8.66^{+0.05}_{-0.06}$	0.23	$-7.89^{+0.13}_{-0.13}$	0.23	$8.43^{+0.06}_{-0.08}$	$8.08^{+0.01}_{-0.01}$	$0.48^{+0.02}_{-0.02}$	0.35
1998dn	II	2.04	$10.12^{+0.04}_{-0.04}$							1.91
1999D	II	1.79	$8.79^{+0.10}_{-0.05}$							1.80
1999an	II	0.35	$9.46^{+0.04}_{-0.04}$	0.21	$-9.24^{+0.19}_{-0.18}$	0.21	$8.62^{+0.01}_{-0.02}$	$8.32^{+0.01}_{-0.01}$	$0.12^{+0.03}_{-0.03}$	0.82
1999ap	II	0.47	$9.48^{+0.11}_{-0.19}$	0.16					$0.43^{+0.23}_{-0.23}$	1.57
1999cd	II	1.28	$11.36^{+0.09}_{-0.56}$	1.07	$-8.50^{+0.27}_{-0.23}$	1.07	$8.99^{+0.01}_{-0.01}$	$8.65^{+0.01}_{-0.01}$	$1.04^{+0.02}_{-0.02}$	1.50
1999dh	II	0.96	$9.88^{+0.57}_{-0.09}$							1.17
1999et	II	1.18	$9.41^{+0.06}_{-0.05}$							1.66
1999ge	II	0.49		0.03	$-10.94^{+0.42}_{-0.54}$				$0.72^{+0.08}_{-0.08}$	
1999gg	II	0.67	$9.61^{+0.56}_{-0.08}$							1.74
1999gk	II	1.21	$10.39^{+0.04}_{-0.05}$	0.03	$-10.78^{+0.26}_{-0.23}$	0.03	$9.05^{+0.05}_{-0.05}$	$8.76^{+0.04}_{-0.04}$	$0.50^{+0.10}_{-0.10}$	1.21
1999gl	II	0.09	$11.03^{+0.12}_{-0.54}$							2.45
2000I	II	0.70	$10.96^{+0.22}_{-0.23}$	0.95	$-9.33^{+0.17}_{-0.18}$	0.95	$9.17^{+0.01}_{-0.01}$	$8.89^{+0.02}_{-0.02}$	$0.78^{+0.05}_{-0.05}$	2.23
2000au	II	1.45	$10.05^{+0.53}_{-0.18}$	0.08	$-12.19^{+0.76}_{-1.20}$				$-0.54^{+0.26}_{-0.26}$	2.09
2000cb	II	1.14								
2000el	II	0.29	$9.92^{+0.05}_{-0.05}$							2.46
2000ez	II	0.87	$9.84^{+0.57}_{-0.08}$	0.96	$-8.70^{+0.17}_{-0.29}$	0.96	$8.67^{+0.02}_{-0.01}$	$8.30^{+0.01}_{-0.01}$	$0.02^{+0.03}_{-0.03}$	1.10
2000fe	II	1.28		0.08	$-10.57^{+0.39}_{-0.38}$				$3.02^{+0.07}_{-0.07}$	
2001H	II	0.24	$10.43^{+0.07}_{-0.57}$							2.16
2001J	II	1.00	$9.59^{+0.55}_{-0.08}$	0.17	$-10.12^{+0.14}_{-0.14}$	0.17	$8.80^{+0.02}_{-0.01}$	$8.67^{+0.02}_{-0.02}$	$0.21^{+0.05}_{-0.05}$	0.95
2001K	II	0.88	$10.00^{+0.54}_{-0.10}$			0.07				2.21
2001Q	II	1.04								
2001aa	II	1.91	$10.86^{+0.09}_{-0.29}$	0.08	$-10.55^{+0.34}_{-0.30}$				$1.16^{+0.07}_{-0.07}$	2.49
2001ab	II	0.95	$10.43^{+0.20}_{-0.49}$							2.28
2001ae	II	1.83	$10.63^{+0.25}_{-0.16}$	0.15	$-9.42^{+0.16}_{-0.16}$	0.15	$9.22^{+0.01}_{-0.07}$	$8.88^{+0.01}_{-0.01}$	$1.27^{+0.03}_{-0.03}$	0.45
2001ax	II	1.56	$10.58^{+0.31}_{-0.63}$							3.32
2001bk	II	0.95	$8.82^{+0.13}_{-0.12}$							2.01
2001cl	II	1.33	$10.83^{+0.08}_{-0.62}$							2.30
2001cm	II	1.08	$11.45^{+0.10}_{-0.54}$	0.42	$-11.67^{+0.77}_{-1.00}$				$1.72^{+0.30}_{-0.30}$	2.38
2001cx	II	1.54	$10.25^{+0.50}_{-0.14}$							2.06
2001cy	II	0.37	$10.75^{+0.13}_{-0.53}$							2.67
2001ee	II	1.29	$10.97^{+0.20}_{-0.51}$							1.91
2001fb	II	1.21		1.22	$-9.30^{+0.13}_{-0.14}$	1.22	$8.61^{+0.04}_{-0.03}$	$8.38^{+0.02}_{-0.02}$	$0.97^{+0.06}_{-0.06}$	
2001fc	II	0.67	$10.31^{+0.21}_{-0.45}$							2.98
2001ff	II	0.32	$10.46^{+0.16}_{-0.50}$	0.15	$-10.34^{+0.21}_{-0.21}$	0.15	$8.99^{+0.02}_{-0.03}$	$8.77^{+0.03}_{-0.03}$	$1.31^{+0.08}_{-0.08}$	2.81
2001hg	II	1.41	$10.48^{+0.05}_{-0.05}$	0.79	$-9.02^{+0.26}_{-0.27}$	0.79	$9.13^{+0.01}_{-0.01}$	$8.83^{+0.02}_{-0.02}$	$0.69^{+0.04}_{-0.04}$	1.37
2002an	II	1.56	$10.71^{+0.13}_{-0.55}$							1.68
2002aq	II	2.96	$9.88^{+0.51}_{-0.14}$							2.71
2002bh	II	1.37								
2002bx	II	2.02		0.13	$-10.91^{+0.48}_{-0.51}$				$1.48^{+0.09}_{-0.09}$	
2002ca	II	1.33	$10.52^{+0.23}_{-0.50}$	0.08	$-9.74^{+0.14}_{-0.15}$	0.08	$9.05^{+0.03}_{-0.01}$	$8.83^{+0.01}_{-0.01}$	$0.90^{+0.03}_{-0.03}$	2.26
2002ce	II	0.67		0.23	$-8.80^{+0.35}_{-0.18}$	0.23	$8.97^{+0.01}_{-0.01}$	$8.57^{+0.01}_{-0.01}$	$0.48^{+0.02}_{-0.02}$	
2002ej	II	0.91								
2002em	II	1.80	$10.72^{+0.05}_{-0.58}$							2.48
2002ew	II	1.35	$9.44^{+0.28}_{-0.11}$	0.39	$-9.64^{+0.14}_{-0.17}$	0.39	$8.72^{+0.07}_{-0.02}$	$8.56^{+0.02}_{-0.02}$	$0.16^{+0.05}_{-0.05}$	1.40
2002gd	II	1.71	$10.14^{+0.05}_{-0.05}$							1.43
2002hg	II	0.95	$9.99^{+0.06}_{-0.06}$	1.05	$-9.09^{+0.15}_{-0.23}$	1.05	$8.85^{+0.01}_{-0.01}$	$8.56^{+0.01}_{-0.01}$	$0.49^{+0.04}_{-0.04}$	1.75
2002hj	II	1.39	$9.39^{+0.30}_{-0.08}$							1.03
2002hm	II	0.86	$9.28^{+0.56}_{-0.07}$	0.22	$-9.31^{+0.13}_{-0.13}$	0.22	$8.71^{+0.04}_{-0.02}$	$8.45^{+0.01}_{-0.01}$	$0.06^{+0.03}_{-0.03}$	0.49
2002ig	II	0.41								
2002in	II	0.41	$9.16^{+0.09}_{-0.09}$	0.41	$-9.95^{+0.21}_{-0.21}$	0.41	$8.37^{+0.21}_{-0.20}$	$8.39^{+0.06}_{-0.06}$	$0.32^{+0.18}_{-0.18}$	2.01
2002ip	II	0.50								
2002iq	II	0.42		0.63	$-9.55^{+0.14}_{-0.15}$	0.63	$8.29^{+0.15}_{-0.12}$	$8.25^{+0.03}_{-0.03}$	$0.14^{+0.07}_{-0.07}$	
2002jl	II	0.03	$8.01^{+0.14}_{-0.15}$							1.82
2003C	II	0.91	$10.59^{+0.11}_{-0.56}$							1.63
2003O	II	1.54								
2003bk	II	0.28	$10.62^{+0.04}_{-0.04}$	0.10	$-11.36^{+0.74}_{-1.07}$				$1.80^{+0.14}_{-0.14}$	3.62
2003bl	II	1.13		0.04	$-8.98^{+0.13}_{-0.13}$	0.04	$9.26^{+0.04}_{-0.01}$	$8.89^{+0.01}_{-0.01}$	$1.99^{+0.02}_{-0.02}$	
2003cn	II	2.15	$9.75^{+0.54}_{-0.09}$	0.09	$-10.06^{+0.15}_{-0.16}$	0.09	$9.09^{+0.01}_{-0.01}$	$8.81^{+0.02}_{-0.02}$	$0.60^{+0.05}_{-0.05}$	0.53
2003da	II	0.59	$9.60^{+0.54}_{-0.11}$	0.27	$-10.16^{+0.21}_{-0.20}$	0.27	$8.86^{+0.02}_{-0.02}$	$8.64^{+0.02}_{-0.02}$	$1.39^{+0.08}_{-0.08}$	2.12
2003dq	II	0.40								
2003ej	II	1.46	$9.74^{+0.56}_{-0.07}$	0.05	$-10.48^{+0.34}_{-0.31}$	0.05	$8.95^{+0.05}_{-0.08}$	$8.75^{+0.05}_{-0.05}$	$0.93^{+0.14}_{-0.14}$	0.85

TABLE 8 — *Continued*

SN	Type	Offset Norm.	Log M (dex)	Fib. Off. (AGN)	SSFR	Fib. Off. (Metal)	T04 (dex)	PP04 (dex)	A_V (mag)	u'-z' (local)
2003hg	II	0.29	$11.55^{+0.09}_{-0.56}$							3.04
2003hk	II	0.70	$11.10^{+0.27}_{-0.14}$							2.42
2003hl	II	0.52	$11.45^{+0.05}_{-0.05}$							2.67
2003iq	II	1.09	$11.44^{+0.06}_{-0.08}$							2.65
2003jc	II	1.82	$9.10^{+0.56}_{-0.06}$							-0.38
2003kx	II	0.53	$9.79^{+0.05}_{-0.04}$							2.55
2003ld	II	0.24	$10.03^{+0.55}_{-0.10}$	0.54	$-8.73^{+0.17}_{-0.24}$	0.54	$8.78^{+0.01}_{-0.02}$	$8.44^{+0.01}_{-0.01}$	$0.65^{+0.02}_{-0.02}$	1.95
2003lp	II	0.97	$9.67^{+0.06}_{-0.06}$							1.56
2004D	II	0.85		0.10	$-10.39^{+0.27}_{-0.25}$	0.10	$9.08^{+0.05}_{-0.03}$	$8.77^{+0.04}_{-0.04}$	$1.08^{+0.10}_{-0.10}$	
2004G	II	1.30	$10.38^{+0.05}_{-0.04}$	0.87	$-9.03^{+0.19}_{-0.31}$	0.87	$8.71^{+0.05}_{-0.01}$	$8.42^{+0.02}_{-0.02}$	$-0.12^{+0.04}_{-0.04}$	1.31
2004T	II	0.93	$10.58^{+0.32}_{-0.07}$	0.08	$-11.28^{+0.58}_{-1.15}$				$0.16^{+0.20}_{-0.20}$	2.30
2004Z	II	1.20	$10.02^{+0.19}_{-0.29}$							2.09
2004bn	II	1.10	$10.54^{+0.29}_{-0.12}$	0.18	$-10.00^{+0.16}_{-0.15}$	0.18	$9.17^{+0.01}_{-0.01}$	$8.82^{+0.02}_{-0.02}$	$1.02^{+0.05}_{-0.05}$	1.65
2004ci	II	0.93		0.81	$-8.43^{+0.14}_{-0.13}$	0.81	$9.17^{+0.01}_{-0.01}$	$8.86^{+0.01}_{-0.01}$	$2.16^{+0.03}_{-0.03}$	
2004dh	II	0.77								
2004ei	II	0.09	$10.15^{+0.57}_{-0.06}$							3.13
2004ek	II	3.85	$10.28^{+0.52}_{-0.13}$							2.08
2004em	II	1.54								
2004er	II	1.48	$9.89^{+0.56}_{-0.08}$							1.25
2004gy	II	1.16								
2004ht	II	1.28	$10.31^{+0.11}_{-0.10}$	0.17	$-10.32^{+0.36}_{-0.32}$				$1.30^{+0.05}_{-0.05}$	2.09
2004hv	II	1.47	$8.81^{+0.10}_{-0.10}$							0.65
2004hx	II	2.17	$8.64^{+0.54}_{-0.10}$							0.97
2004hy	II	1.44	$9.81^{+0.10}_{-0.10}$	0.40	$-10.15^{+0.30}_{-0.22}$	0.40	$8.69^{+0.10}_{-0.11}$	$8.55^{+0.08}_{-0.08}$	$0.03^{+0.23}_{-0.23}$	1.76
2005H	II	0.72	$10.33^{+0.52}_{-0.11}$	0.19	$-9.06^{+0.13}_{-0.14}$	0.19	$9.11^{+0.01}_{-0.01}$	$8.74^{+0.01}_{-0.01}$	$1.15^{+0.02}_{-0.02}$	2.06
2005I	II	0.90								
2005Y	II	0.56	$9.15^{+0.58}_{-0.09}$	0.16	$-9.83^{+0.16}_{-0.16}$	0.16	$8.82^{+0.01}_{-0.02}$	$8.61^{+0.02}_{-0.02}$	$0.69^{+0.05}_{-0.05}$	1.62
2005Z	II	0.59		0.08	$-9.75^{+0.24}_{-0.25}$	0.08	$9.26^{+0.06}_{-0.07}$	$8.79^{+0.03}_{-0.03}$	$1.90^{+0.09}_{-0.09}$	
2005aa	II	0.93	$10.37^{+0.17}_{-0.29}$							2.65
2005ab	II	1.14	$10.49^{+0.56}_{-0.09}$	0.31	$-9.70^{+0.20}_{-0.23}$	0.31	$9.11^{+0.04}_{-0.04}$	$8.79^{+0.03}_{-0.03}$	$2.31^{+0.11}_{-0.11}$	1.43
2005au	II	0.76	$10.05^{+0.57}_{-0.09}$	0.98	$-8.86^{+0.20}_{-0.26}$	0.98	$8.92^{+0.01}_{-0.05}$	$8.59^{+0.01}_{-0.01}$	$0.68^{+0.04}_{-0.04}$	1.47
2005bb	II	0.41	$9.93^{+0.06}_{-0.06}$	0.57	$-8.92^{+0.15}_{-0.15}$	0.57	$8.86^{+0.01}_{-0.02}$	$8.58^{+0.01}_{-0.01}$	$1.28^{+0.03}_{-0.03}$	2.60
2005bn	II	0.06	$9.18^{+0.29}_{-0.11}$	0.34	$-10.08^{+0.14}_{-0.14}$	0.34	$9.05^{+0.01}_{-0.01}$	$8.78^{+0.02}_{-0.02}$	$0.78^{+0.05}_{-0.05}$	2.42
2005ci	II	0.45	$9.63^{+0.05}_{-0.05}$	0.13	$-9.78^{+0.16}_{-0.16}$	0.13	$8.72^{+0.02}_{-0.05}$	$8.57^{+0.02}_{-0.02}$	$0.60^{+0.05}_{-0.05}$	1.71
2005dp	II	1.29	$9.77^{+0.05}_{-0.05}$	0.11	$-9.67^{+0.13}_{-0.13}$	0.11	$8.73^{+0.02}_{-0.01}$	$8.55^{+0.01}_{-0.01}$	$0.67^{+0.04}_{-0.04}$	1.09
2005dq	II	0.70								
2005dz	II	1.68	$9.76^{+0.57}_{-0.09}$							2.12
2005eb	II	0.59	$10.67^{+0.07}_{-0.58}$							2.72
2005en	II	0.64	$10.54^{+0.50}_{-0.17}$	0.20	$-9.55^{+0.14}_{-0.15}$	0.20	$9.22^{+0.01}_{-0.07}$	$8.80^{+0.01}_{-0.01}$	$2.36^{+0.05}_{-0.05}$	1.46
2005gi	II	1.13	$8.99^{+0.16}_{-0.18}$							0.67
2005gm	II	1.94	$10.78^{+0.22}_{-0.29}$	0.14	$-11.91^{+0.72}_{-1.31}$				$1.27^{+0.23}_{-0.23}$	1.71
2005ip	II	1.09	$10.68^{+0.06}_{-0.05}$	1.17	$-9.10^{+0.24}_{-0.18}$	1.17	$9.13^{+0.03}_{-0.01}$	$8.86^{+0.01}_{-0.01}$	$0.55^{+0.03}_{-0.03}$	2.06
2005kb	II	0.72	$8.84^{+0.55}_{-0.09}$	0.16	$-10.26^{+0.16}_{-0.17}$	0.16	$8.32^{+0.14}_{-0.13}$	$8.38^{+0.02}_{-0.02}$	$0.34^{+0.06}_{-0.06}$	1.56
2005kh	II	3.82	$10.40^{+0.05}_{-0.07}$							1.72
2005kk	II	1.81	$9.62^{+0.55}_{-0.08}$			0.10				1.10
2005lb	II	0.71	$8.71^{+0.26}_{-0.35}$							2.18
2005lc	II	1.03	$8.18^{+0.56}_{-0.08}$	0.25	$-9.70^{+0.43}_{-0.29}$	0.25	$8.32^{+0.36}_{-0.27}$	$8.37^{+0.07}_{-0.07}$	$-0.31^{+0.18}_{-0.18}$	1.57
2005mg	II	0.74								
2006J	II	0.44	$9.58^{+0.55}_{-0.11}$							1.82
2006O	II	1.04	$10.27^{+0.24}_{-0.42}$							1.56
2006V	II	2.03	$10.14^{+0.56}_{-0.07}$							2.38
2006at	II	0.85								
2006be	II	0.95	$9.98^{+0.05}_{-0.05}$	0.61	$-9.75^{+0.26}_{-0.27}$	0.61	$8.83^{+0.02}_{-0.06}$	$8.54^{+0.02}_{-0.02}$	$0.64^{+0.05}_{-0.05}$	2.10
2006bj	II	0.31	$9.45^{+0.15}_{-0.16}$	0.19	$-10.23^{+0.27}_{-0.23}$	0.19	$8.79^{+0.06}_{-0.09}$	$8.64^{+0.05}_{-0.05}$	$0.62^{+0.16}_{-0.16}$	2.07
2006bx	II	4.48	$10.13^{+0.22}_{-0.43}$							0.42
2006by	II	0.31	$10.67^{+0.21}_{-0.53}$	0.06	$-10.53^{+0.33}_{-0.41}$				$2.83^{+0.03}_{-0.03}$	2.77
2006cx	II	0.37	$9.99^{+0.55}_{-0.08}$							2.05
2006dk	II	0.89	$10.60^{+0.14}_{-0.51}$	0.07	$-12.31^{+0.80}_{-1.15}$				$0.77^{+0.20}_{-0.20}$	2.43
2006dp	II	0.66	$10.90^{+0.12}_{-0.54}$							2.77
2006ed	II	0.91	$10.20^{+0.19}_{-0.56}$	0.08	$-9.74^{+0.20}_{-0.19}$	0.08	$9.01^{+0.03}_{-0.01}$	$8.75^{+0.02}_{-0.02}$	$1.85^{+0.07}_{-0.07}$	1.74
2006ee	II	1.26	$11.18^{+0.05}_{-0.58}$							3.06
2006ek	II	4.26								
2006fg	II	0.22	$7.92^{+0.27}_{-0.32}$							1.63
2006gs	II	0.84	$10.44^{+0.09}_{-0.57}$	0.08	$-12.10^{+0.78}_{-1.13}$				$-0.29^{+0.30}_{-0.30}$	2.39
2006iu	II	0.31								
2006iw	II	0.87	$9.70^{+0.14}_{-0.21}$	0.18	$-10.24^{+0.29}_{-0.23}$	0.18	$8.82^{+0.06}_{-0.09}$	$8.61^{+0.05}_{-0.05}$	$0.44^{+0.16}_{-0.16}$	1.98
2006kh	II	0.52	$9.50^{+0.08}_{-0.12}$	0.58	$-9.95^{+0.14}_{-0.15}$	0.58	$9.04^{+0.01}_{-0.05}$	$8.74^{+0.02}_{-0.02}$	$0.45^{+0.04}_{-0.04}$	2.10
2006pc	II	1.13	$10.01^{+0.11}_{-0.13}$	0.37	$-9.70^{+0.22}_{-0.23}$	0.37	$8.71^{+0.07}_{-0.06}$	$8.59^{+0.04}_{-0.04}$	$1.61^{+0.14}_{-0.14}$	2.23
2006qn	II	0.39	$10.11^{+0.30}_{-0.09}$							2.06

TABLE 8 — *Continued*

SN	Type	Offset Norm.	Log M (dex)	Fib. Off. (AGN)	SSFR	Fib. Off. (Metal)	T04 (dex)	PP04 (dex)	A_V (mag)	u'-z' (local)
2006st	II	3.44	$10.54^{+0.09}_{-0.53}$							1.23
2007L	II	1.82	$10.03^{+0.11}_{-0.53}$	0.08	$-10.74^{+0.45}_{-0.76}$				$0.23^{+0.23}_{-0.23}$	1.64
2007T	II	1.28	$10.35^{+0.20}_{-0.50}$	0.08	$-11.43^{+0.57}_{-1.17}$				$0.67^{+0.17}_{-0.17}$	1.73
2007am	II	0.60	$10.68^{+0.05}_{-0.05}$	0.07	$-9.63^{+0.43}_{-0.42}$				$0.90^{+0.01}_{-0.01}$	1.64
2007an	II	1.18	$10.53^{+0.10}_{-0.54}$	0.84	$-8.29^{+0.20}_{-0.28}$	0.84	$8.99^{+0.01}_{-0.01}$	$8.69^{+0.01}_{-0.01}$	$1.11^{+0.03}_{-0.03}$	1.23
2007be	II	1.55	$10.09^{+0.56}_{-0.09}$	0.14	$-10.33^{+0.21}_{-0.22}$	0.14	$9.05^{+0.04}_{-0.04}$	$8.79^{+0.02}_{-0.02}$	$1.71^{+0.08}_{-0.08}$	2.73
2007fp	II	0.36	$10.64^{+0.11}_{-0.55}$	1.08	$-9.31^{+0.14}_{-0.14}$	1.08	$9.11^{+0.01}_{-0.01}$	$8.83^{+0.02}_{-0.02}$	$0.86^{+0.04}_{-0.04}$	2.14
2007gw	II	0.72	$10.60^{+0.14}_{-0.51}$	0.07	$-12.31^{+0.80}_{-1.15}$				$0.77^{+0.20}_{-0.20}$	2.38
2007ib	II	1.83	$9.93^{+0.19}_{-0.10}$	0.14	$-10.02^{+0.13}_{-0.14}$	0.14	$9.01^{+0.01}_{-0.01}$	$8.76^{+0.02}_{-0.02}$	$0.51^{+0.05}_{-0.05}$	0.94
2007il	II	1.08	$10.31^{+0.31}_{-0.09}$	0.08	$-10.36^{+0.22}_{-0.22}$	0.08	$9.08^{+0.02}_{-0.04}$	$8.78^{+0.03}_{-0.03}$	$0.71^{+0.08}_{-0.08}$	1.57
2007jn	II	3.57	$9.08^{+0.14}_{-0.14}$							1.10
2007kw	II	1.83	$10.80^{+0.11}_{-0.10}$							1.43
2007ky	II	1.19	$10.90^{+0.14}_{-0.11}$							2.53
2007lb	II	0.57	$7.98^{+0.17}_{-0.17}$							0.60
2007ld	II	0.62	$8.01^{+0.25}_{-0.35}$							0.79
2007lj	II	0.61	$8.02^{+0.21}_{-0.24}$							1.53
2007lx	II	1.23	$10.71^{+0.08}_{-0.13}$	1.53	$-9.16^{+0.16}_{-0.18}$	1.53	$8.70^{+0.03}_{-0.06}$	$8.45^{+0.03}_{-0.03}$	$-0.02^{+0.07}_{-0.07}$	1.55
2007md	II	1.10	$10.79^{+0.16}_{-0.19}$							2.71
2007sz	II	1.46	$9.10^{+0.37}_{-0.58}$							0.96
2007tn	II	1.34	$10.10^{+0.13}_{-0.22}$							2.17
2008N	II	0.41	$10.53^{+0.05}_{-0.05}$	0.27	$-8.91^{+0.15}_{-0.17}$	0.27	$9.13^{+0.01}_{-0.01}$	$8.84^{+0.01}_{-0.01}$	$1.41^{+0.03}_{-0.03}$	2.38
2008aa	II	0.82	$10.96^{+0.14}_{-0.26}$							2.44
2008ak	II	0.78	$10.26^{+0.04}_{-0.05}$							1.79
2008bh	II	1.06	$11.02^{+0.21}_{-0.50}$							1.92
2008bj	II	0.71	$8.51^{+0.57}_{-0.06}$	0.17	$-9.93^{+0.20}_{-0.16}$	0.17	$8.37^{+0.17}_{-0.17}$	$8.38^{+0.04}_{-0.04}$	$-0.03^{+0.10}_{-0.10}$	1.23
2008bl	II	0.81	$9.69^{+0.57}_{-0.09}$	0.06	$-10.27^{+0.17}_{-0.15}$	0.06	$9.07^{+0.01}_{-0.02}$	$8.84^{+0.04}_{-0.04}$	$0.25^{+0.07}_{-0.07}$	1.14
2008bx	II	0.53	$9.36^{+0.04}_{-0.05}$							1.04
2008ch	II	0.70	$11.10^{+0.14}_{-0.51}$							2.79
2008dw	II	0.45	$9.61^{+0.07}_{-0.55}$	0.18	$-9.48^{+0.17}_{-0.17}$	0.18	$8.42^{+0.12}_{-0.14}$	$8.36^{+0.02}_{-0.02}$	$0.40^{+0.06}_{-0.06}$	0.86
2008ej	II	0.36	$10.86^{+0.07}_{-0.32}$							3.73
2008gd	II	1.50	$9.95^{+0.11}_{-0.09}$	0.23	$-10.28^{+0.30}_{-0.28}$	0.23	$8.84^{+0.07}_{-0.08}$	$8.66^{+0.06}_{-0.06}$	$0.73^{+0.18}_{-0.18}$	1.33
2008gz	II	0.51	$11.01^{+0.06}_{-0.07}$							2.02
2009H	II	0.96	$11.04^{+0.05}_{-0.05}$	0.88	$-8.58^{+0.21}_{-0.27}$	0.88	$8.91^{+0.01}_{-0.01}$	$8.63^{+0.01}_{-0.01}$	$0.83^{+0.02}_{-0.02}$	2.56
2009af	II	0.55	$9.98^{+0.05}_{-0.06}$							2.12
2009at	II	0.73	$10.74^{+0.06}_{-0.07}$	0.07	$-10.33^{+0.27}_{-0.28}$	0.07	$8.97^{+0.04}_{-0.05}$	$8.73^{+0.04}_{-0.04}$	$1.82^{+0.13}_{-0.13}$	2.68
2009ay	II	0.94	$10.76^{+0.20}_{-0.22}$							2.19
2009bj	II	5.55	$8.99^{+0.17}_{-0.26}$							2.22
2009bk	II	8.77	$9.64^{+0.19}_{-0.09}$	0.20	$-10.19^{+0.12}_{-0.15}$	0.20	$8.70^{+0.03}_{-0.04}$	$8.60^{+0.03}_{-0.03}$	$0.23^{+0.07}_{-0.07}$	0.60
2009bl	II	1.10	$9.90^{+0.14}_{-0.10}$	0.20	$-10.39^{+0.18}_{-0.17}$	0.20	$8.78^{+0.04}_{-0.07}$	$8.63^{+0.04}_{-0.04}$	$0.51^{+0.10}_{-0.10}$	1.27
2009ct	II	1.98	$10.58^{+0.13}_{-0.17}$							1.85
2009dd	II	0.19	$11.26^{+0.07}_{-0.07}$	0.72	$-8.20^{+0.13}_{-0.14}$	0.72	$9.09^{+0.01}_{-0.01}$	$8.76^{+0.01}_{-0.01}$	$2.13^{+0.02}_{-0.02}$	2.75
2009fe	II	0.73	$10.77^{+0.05}_{-0.18}$							2.42
2009hd	II	0.72	$11.88^{+0.05}_{-0.06}$	0.46	$-9.54^{+0.14}_{-0.16}$	0.46	$9.15^{+0.01}_{-0.01}$	$8.84^{+0.01}_{-0.01}$	$0.84^{+0.03}_{-0.03}$	1.81
2009jd	II	2.39	$9.37^{+0.31}_{-0.08}$							1.09
2009jw	II	0.35	$9.82^{+0.12}_{-0.07}$	0.15	$-10.26^{+0.16}_{-0.17}$	0.15	$9.04^{+0.04}_{-0.04}$	$8.77^{+0.02}_{-0.02}$	$0.99^{+0.05}_{-0.05}$	2.60
2009ls	II	0.58	$10.73^{+0.05}_{-0.05}$	0.08	$-10.98^{+0.22}_{-0.17}$	0.08	$8.96^{+0.04}_{-0.05}$	$8.77^{+0.04}_{-0.04}$	$0.16^{+0.10}_{-0.10}$	1.93
2009nu	II	1.82	$9.21^{+0.17}_{-0.25}$							0.47
2010K	II	0.53	$8.33^{+0.37}_{-0.58}$							1.16
2010aw	II	1.59	$10.11^{+0.32}_{-0.09}$	1.20	$-8.20^{+0.15}_{-0.22}$	1.20	$8.62^{+0.04}_{-0.02}$	$8.29^{+0.01}_{-0.01}$	$0.51^{+0.03}_{-0.03}$	1.36
2010gq	II	0.47	$9.92^{+0.54}_{-0.13}$	0.67	$-10.10^{+0.16}_{-0.16}$	0.67	$9.13^{+0.01}_{-0.01}$	$8.84^{+0.02}_{-0.02}$	$0.93^{+0.06}_{-0.06}$	2.59
2010gs	II	1.19	$10.22^{+0.31}_{-0.07}$	0.07	$-10.69^{+0.44}_{-0.57}$				$1.22^{+0.09}_{-0.09}$	2.15
2010ib	II	0.64	$9.40^{+0.54}_{-0.09}$							1.44
2010id	II	7.52	$10.91^{+0.08}_{-0.57}$							-0.36
1993G	II L	0.86	$10.57^{+0.57}_{-0.07}$	0.14	$-9.38^{+0.54}_{-0.79}$				$2.21^{+0.02}_{-0.02}$	2.05
2006W	II L	1.07	$10.37^{+0.15}_{-0.51}$							2.70
1990H	II P	0.45	$10.94^{+0.07}_{-0.08}$	0.04	$-10.95^{+0.41}_{-0.55}$	1.04			$1.34^{+0.08}_{-0.08}$	2.80
1991G	II P	1.11	$11.26^{+0.07}_{-0.07}$	1.23	$-7.71^{+0.18}_{-0.30}$	1.23	$8.99^{+0.01}_{-0.01}$	$8.51^{+0.01}_{-0.01}$	$1.12^{+0.02}_{-0.02}$	2.28
1998bv	II P	1.26	$8.36^{+0.04}_{-0.05}$	0.23	$-9.26^{+0.19}_{-0.21}$	0.23	$8.11^{+0.04}_{-0.09}$	$8.18^{+0.01}_{-0.01}$	$-0.01^{+0.03}_{-0.03}$	1.14
1998dl	II P	0.88	$11.04^{+0.05}_{-0.05}$	0.88	$-8.58^{+0.21}_{-0.27}$	0.88	$8.91^{+0.01}_{-0.01}$	$8.63^{+0.01}_{-0.01}$	$0.83^{+0.02}_{-0.02}$	2.10
1999ev	II P	1.08	$11.64^{+0.04}_{-0.03}$							3.17
1999gi	II P	0.65	$11.13^{+0.05}_{-0.05}$	0.74	$-8.32^{+0.13}_{-0.20}$	0.74	$9.19^{+0.01}_{-0.01}$	$8.90^{+0.01}_{-0.01}$	$0.90^{+0.02}_{-0.02}$	1.21
1999gn	II P	0.86	$11.48^{+0.05}_{-0.08}$	0.83	$-8.24^{+0.44}_{-0.33}$	0.83	$9.25^{+0.01}_{-0.01}$	$8.84^{+0.01}_{-0.01}$	$0.53^{+0.02}_{-0.02}$	1.16
1999gq	II P	1.06	$9.95^{+0.04}_{-0.04}$	1.25	$-9.81^{+0.07}_{-0.10}$	1.25	$7.86^{+0.08}_{-0.05}$	$8.21^{+0.01}_{-0.01}$	$0.31^{+0.02}_{-0.02}$	1.03
2000db	II P	0.76	$10.72^{+0.05}_{-0.05}$	0.98	$-8.10^{+0.24}_{-0.25}$	0.98	$8.87^{+0.01}_{-0.01}$	$8.46^{+0.01}_{-0.01}$	$0.79^{+0.02}_{-0.02}$	1.30
2001R	II P	1.59	$11.07^{+0.24}_{-0.48}$							2.07
2001X	II P	0.88		0.82	$-9.15^{+0.20}_{-0.22}$	0.82	$9.15^{+0.01}_{-0.01}$	$8.84^{+0.01}_{-0.01}$	$0.80^{+0.04}_{-0.04}$	
2001dc	II P	0.73		0.13	$-11.69^{+0.72}_{-1.19}$				$2.03^{+0.10}_{-0.10}$	
2001dk	II P	1.29	$9.73^{+0.55}_{-0.06}$							2.09

TABLE 8 — *Continued*

SN	Type	Offset Norm.	Log M (dex)	Fib. Off. (AGN)	SSFR	Fib. Off. (Metal)	T04 (dex)	PP04 (dex)	A_V (mag)	u'-z' (local)
2001fv	II P	1.47	$10.37^{+0.05}_{-0.06}$	0.12	$-11.19^{+0.53}_{-0.93}$				$-0.05^{+0.14}_{-0.14}$	2.15
2001ij	II P	0.85		0.75		0.75	$8.99^{+0.02}_{-0.04}$	$8.75^{+0.04}_{-0.04}$	$0.27^{+0.09}_{-0.09}$	
2002ik	II P	1.56	$10.56^{+0.16}_{-0.18}$	0.16	$-10.68^{+0.41}_{-0.43}$				$1.32^{+0.15}_{-0.15}$	2.05
2003J	II P	0.57	$11.27^{+0.04}_{-0.04}$	0.72	$-9.75^{+0.24}_{-0.28}$	0.72	$8.95^{+0.05}_{-0.03}$	$8.71^{+0.04}_{-0.04}$	$2.17^{+0.16}_{-0.16}$	3.39
2003Z	II P	1.37		0.04	$-10.43^{+0.21}_{-0.20}$	0.04	$9.06^{+0.04}_{-0.02}$	$8.74^{+0.02}_{-0.02}$	$1.08^{+0.08}_{-0.08}$	
2003aq	II P	0.88	$9.27^{+0.54}_{-0.09}$	0.09	$-9.57^{+0.15}_{-0.17}$	0.09	$8.95^{+0.01}_{-0.01}$	$8.70^{+0.01}_{-0.01}$	$0.43^{+0.02}_{-0.02}$	1.61
2003gd	II P	1.66	$11.52^{+0.05}_{-0.05}$							0.94
2003ie	II P	1.22	$11.18^{+0.09}_{-0.14}$	1.09	$-8.90^{+0.13}_{-0.18}$	1.09	$9.09^{+0.01}_{-0.01}$	$8.80^{+0.01}_{-0.01}$	$0.55^{+0.03}_{-0.03}$	0.84
2004A	II P	1.90	$10.55^{+0.04}_{-0.05}$							2.03
2004am	II P	0.22	$12.39^{+0.05}_{-0.15}$	0.05	$-8.45^{+0.07}_{-1.20}$				$4.63^{+0.03}_{-0.03}$	4.82
2004cm	II P	0.09	$9.61^{+0.04}_{-0.05}$	0.09	$-9.19^{+0.11}_{-0.13}$	0.09	$8.73^{+0.07}_{-0.05}$	$8.48^{+0.05}_{-0.05}$	$3.75^{+0.18}_{-0.18}$	1.96
2004dd	II P	0.91	$9.82^{+0.58}_{-0.07}$							1.29
2004dg	II P	1.04	$10.97^{+0.10}_{-0.14}$	0.18					$1.14^{+0.12}_{-0.12}$	1.99
2004dj	II P	1.33		1.57	$-11.03^{+0.02}_{-0.02}$	1.57	$8.52^{+0.05}_{-0.20}$	$8.55^{+0.04}_{-0.04}$	$-0.15^{+0.10}_{-0.10}$	
2004du	II P	0.65								
2004ez	II P	1.64	$10.67^{+0.05}_{-0.06}$	0.99	$-8.04^{+0.35}_{-0.43}$	0.99	$9.07^{+0.01}_{-0.01}$	$8.69^{+0.01}_{-0.01}$	$0.79^{+0.02}_{-0.02}$	1.85
2004fc	II P	0.16	$10.62^{+0.05}_{-0.06}$	0.19	$-10.03^{+0.16}_{-0.17}$	0.19	$9.01^{+0.01}_{-0.01}$	$8.75^{+0.02}_{-0.02}$	$1.03^{+0.05}_{-0.05}$	2.98
2005ad	II P	1.96	$10.16^{+0.04}_{-0.05}$	0.79	$-8.84^{+0.21}_{-0.32}$	0.79	$8.91^{+0.01}_{-0.01}$	$8.58^{+0.01}_{-0.01}$	$0.16^{+0.04}_{-0.04}$	1.24
2005ay	II P	1.02	$11.13^{+0.05}_{-0.07}$	0.83	$-8.88^{+0.12}_{-0.12}$	0.83	$9.10^{+0.01}_{-0.01}$	$8.74^{+0.01}_{-0.01}$	$0.74^{+0.03}_{-0.03}$	1.34
2005cs	II P	0.62	$12.11^{+0.12}_{-0.10}$	0.62	$-10.17^{+0.14}_{-0.12}$	0.62	$9.05^{+0.04}_{-0.04}$	$8.78^{+0.03}_{-0.03}$	$0.13^{+0.07}_{-0.07}$	1.11
2006bp	II P	1.60	$11.59^{+0.05}_{-0.08}$							2.16
2006fq	II P	0.42	$10.04^{+0.10}_{-0.09}$	0.31	$-9.68^{+0.10}_{-0.11}$	0.31	$8.99^{+0.01}_{-0.01}$	$8.69^{+0.01}_{-0.01}$	$0.58^{+0.04}_{-0.04}$	1.66
2006my	II P	1.08	$11.13^{+0.06}_{-0.06}$	0.50	$-9.53^{+0.16}_{-0.17}$	0.50	$9.05^{+0.01}_{-0.01}$	$8.82^{+0.01}_{-0.01}$	$1.11^{+0.04}_{-0.04}$	2.36
2006ov	II P	0.85	$11.48^{+0.05}_{-0.08}$	0.82	$-8.24^{+0.44}_{-0.33}$	0.82	$9.25^{+0.01}_{-0.01}$	$8.84^{+0.01}_{-0.01}$	$0.53^{+0.02}_{-0.02}$	1.13
2007aa	II P	1.63		1.17	$-8.83^{+0.19}_{-0.17}$	1.17	$9.23^{+0.01}_{-0.01}$	$8.87^{+0.01}_{-0.01}$	$0.70^{+0.02}_{-0.02}$	
2007aq	II P	3.25	$10.81^{+0.14}_{-0.28}$	0.06	$-10.15^{+0.17}_{-0.16}$	0.06	$9.14^{+0.01}_{-0.03}$	$8.79^{+0.02}_{-0.02}$	$1.03^{+0.05}_{-0.05}$	1.22
2007av	II P	0.20	$10.58^{+0.04}_{-0.04}$	0.11	$-10.46^{+0.25}_{-0.25}$	0.11	$9.01^{+0.04}_{-0.02}$	$8.77^{+0.03}_{-0.03}$	$1.50^{+0.11}_{-0.11}$	3.35
2007bf	II P	1.60	$10.16^{+0.23}_{-0.53}$	0.09	$-12.07^{+0.76}_{-1.16}$				$0.52^{+0.24}_{-0.24}$	1.60
2007jf	II P	0.89	$9.48^{+0.13}_{-0.13}$	0.34	$-10.05^{+0.15}_{-0.15}$	0.34	$8.42^{+0.14}_{-0.17}$	$8.43^{+0.04}_{-0.04}$	$0.25^{+0.12}_{-0.12}$	1.93
2007nw	II P	0.75	$10.31^{+0.14}_{-0.14}$							2.19
2007od	II P	3.37	$8.87^{+0.05}_{-0.05}$							2.19
2008F	II P	1.93								
2008X	II P	0.61	$9.22^{+0.05}_{-0.05}$	0.12	$-10.31^{+0.29}_{-0.24}$	0.12	$8.59^{+0.07}_{-0.06}$	$8.57^{+0.05}_{-0.05}$	$0.31^{+0.14}_{-0.14}$	1.39
2008az	II P	0.42	$10.01^{+0.06}_{-0.06}$							2.26
2008ea	II P	0.88	$10.81^{+0.14}_{-0.51}$							2.08
2008hx	II P	0.80	$10.84^{+0.18}_{-0.27}$	0.36	$-8.95^{+0.12}_{-0.12}$	0.36	$9.09^{+0.01}_{-0.01}$	$8.79^{+0.01}_{-0.01}$	$1.86^{+0.02}_{-0.02}$	2.79
2008in	II P	1.83	$11.47^{+0.06}_{-0.12}$	2.17	$-7.60^{+0.13}_{-0.25}$	2.17	$8.91^{+0.01}_{-0.01}$	$8.37^{+0.01}_{-0.01}$	$0.77^{+0.02}_{-0.02}$	2.25
2009A	II P	1.37	$8.64^{+0.57}_{-0.07}$							0.55
2009E	II P	1.34	$9.22^{+0.05}_{-0.05}$	0.12	$-10.31^{+0.29}_{-0.24}$	0.12	$8.59^{+0.07}_{-0.06}$	$8.57^{+0.05}_{-0.05}$	$0.31^{+0.14}_{-0.14}$	0.21
2009W	II P	2.45	$8.81^{+0.10}_{-0.55}$							0.15
2009am	II P	1.33	$10.60^{+0.55}_{-0.10}$	0.67	$-9.92^{+0.25}_{-0.25}$	0.67	$9.09^{+0.03}_{-0.04}$	$8.82^{+0.03}_{-0.03}$	$1.66^{+0.10}_{-0.10}$	2.95
2009ao	II P	0.82	$10.96^{+0.12}_{-0.55}$	0.09	$-10.03^{+0.20}_{-0.19}$	0.09	$9.15^{+0.04}_{-0.04}$	$8.78^{+0.02}_{-0.02}$	$1.82^{+0.06}_{-0.06}$	2.39
2009bz	II P	1.09	$9.08^{+0.56}_{-0.07}$	0.10	$-9.94^{+0.13}_{-0.12}$	0.10	$8.58^{+0.04}_{-0.03}$	$8.42^{+0.02}_{-0.02}$	$-0.02^{+0.05}_{-0.05}$	1.19
2009dh	II P	1.34	$8.05^{+0.17}_{-0.17}$							2.29
2009ga	II P	0.76								
2009hf	II P	1.58	$11.06^{+0.11}_{-0.54}$							2.28
2009hq	II P	1.43	$10.28^{+0.05}_{-0.05}$	1.50	$-8.45^{+0.20}_{-0.31}$	1.50	$8.84^{+0.01}_{-0.03}$	$8.50^{+0.01}_{-0.01}$	$0.58^{+0.03}_{-0.03}$	1.39
2009ie	II P	2.54	$10.06^{+0.04}_{-0.04}$							1.07
2009lx	II P	2.35	$10.61^{+0.17}_{-0.24}$	0.11	$-10.68^{+0.35}_{-0.35}$				$1.54^{+0.06}_{-0.06}$	1.81
2009md	II P	0.85	$10.35^{+0.04}_{-0.04}$	0.22	$-10.12^{+0.14}_{-0.15}$	0.22	$9.01^{+0.01}_{-0.01}$	$8.77^{+0.02}_{-0.02}$	$0.78^{+0.04}_{-0.04}$	1.70
2009my	II P	1.06	$10.41^{+0.11}_{-0.53}$			0.20				1.17
2010aj	II P	1.17	$10.67^{+0.25}_{-0.24}$							1.19
2010fx	II P	1.60	$9.85^{+0.55}_{-0.09}$							1.55
2010gf	II P	1.01	$10.28^{+0.23}_{-0.46}$							1.56
2010hm	II P	1.48	$10.50^{+0.28}_{-0.10}$							2.62
2010jc	II P	2.29	$10.77^{+0.19}_{-0.25}$	0.06	$-11.95^{+0.73}_{-1.32}$				$-0.16^{+0.34}_{-0.34}$	0.56
1999br	II P pec	1.21	$10.71^{+0.05}_{-0.05}$	1.07	$-8.43^{+0.14}_{-0.25}$	1.07	$9.03^{+0.01}_{-0.01}$	$8.65^{+0.01}_{-0.01}$	$0.46^{+0.02}_{-0.02}$	1.95
2000em	II pec	0.43	$9.96^{+0.18}_{-0.49}$							2.60
2001dj	II pec	3.41	$10.63^{+0.55}_{-0.09}$							2.90
2003cv	II pec	0.92	$8.34^{+0.31}_{-0.08}$							1.17
2004by	II pec	1.51	$10.03^{+0.54}_{-0.11}$							1.14
2004gg	II pec	1.40								
2007ms	II pec	0.25	$8.61^{+0.20}_{-0.24}$							0.94
2006G	II/IIb	1.23	$10.97^{+0.50}_{-0.16}$							2.94
PTF09dxv	IIb	1.29								
PTF09fae	IIb	0.86	$8.39^{+0.11}_{-0.13}$							0.65
2005U	IIb[1]	0.27	$10.57^{+0.57}_{-0.07}$	0.13	$-9.38^{+0.54}_{-0.79}$				$2.21^{+0.02}_{-0.02}$	0.98
1996cb	IIb	1.19	$9.79^{+0.04}_{-0.04}$	0.13	$-9.68^{+0.14}_{-0.15}$	0.13	$8.54^{+0.03}_{-0.12}$	$8.39^{+0.01}_{-0.01}$	$0.38^{+0.04}_{-0.04}$	0.96

TABLE 8 — *Continued*

SN	Type	Offset Norm.	Log M (dex)	Fib. Off. (AGN)	SSFR	Fib. Off. (Metal)	T04 (dex)	PP04 (dex)	A_V (mag)	u'-z' (local)
1997dd	IIb	2.21	$11.07^{+0.19}_{-0.46}$	0.86	$-8.34^{+0.18}_{-0.19}$	0.86	$9.23^{+0.01}_{-0.01}$	$8.69^{+0.01}_{-0.01}$	$0.99^{+0.03}_{-0.03}$	0.62
2001ad	IIb	2.01	$9.53^{+0.55}_{-0.08}$	0.07	$-10.52^{+0.24}_{-0.19}$	0.07	$8.81^{+0.05}_{-0.05}$	$8.70^{+0.04}_{-0.04}$	$0.16^{+0.11}_{-0.11}$	-0.76
2001gd	IIb	1.78	$11.46^{+0.07}_{-0.12}$	2.63	$-9.47^{+0.15}_{-0.15}$	2.63	$8.87^{+0.01}_{-0.01}$	$8.59^{+0.02}_{-0.02}$	$0.72^{+0.06}_{-0.06}$	1.23
2003ed	IIb	0.51		1.47	$-8.60^{+0.16}_{-0.18}$	1.47	$8.93^{+0.01}_{-0.01}$	$8.55^{+0.01}_{-0.01}$	$1.02^{+0.02}_{-0.02}$	
2004ex	IIb	1.85	$10.59^{+0.50}_{-0.13}$							1.82
2004gj	IIb	1.29		0.31	$-9.41^{+0.14}_{-0.16}$	0.31	$8.99^{+0.01}_{-0.01}$	$8.69^{+0.01}_{-0.01}$	$0.84^{+0.03}_{-0.03}$	
2005la	IIb[1]	1.25	$8.71^{+0.05}_{-0.05}$							1.23
2006dl	IIb	1.03	$10.23^{+0.27}_{-0.12}$	0.08	$-9.80^{+0.17}_{-0.17}$	0.08	$9.05^{+0.02}_{-0.01}$	$8.79^{+0.02}_{-0.02}$	$0.98^{+0.06}_{-0.06}$	1.89
2006iv	IIb	0.94	$9.24^{+0.04}_{-0.04}$	0.13	$-10.19^{+0.13}_{-0.12}$	0.13	$8.53^{+0.03}_{-0.08}$	$8.43^{+0.02}_{-0.02}$	$0.05^{+0.05}_{-0.05}$	1.10
2006qp	IIb	1.47	$10.74^{+0.13}_{-0.54}$	0.07	$-11.48^{+0.56}_{-1.13}$				$0.79^{+0.09}_{-0.09}$	2.00
2006ss	IIb	1.21	$9.85^{+0.57}_{-0.06}$	0.32	$-10.23^{+0.18}_{-0.16}$	0.32	$8.96^{+0.02}_{-0.06}$	$8.73^{+0.03}_{-0.03}$	$0.29^{+0.07}_{-0.07}$	0.79
2007ay	IIb	0.99	$10.07^{+0.07}_{-0.59}$							1.32
2008ax	IIb	1.07	$11.18^{+0.05}_{-0.05}$	1.14	$-8.38^{+0.14}_{-0.07}$	1.14	$8.71^{+0.01}_{-0.01}$	$8.21^{+0.01}_{-0.01}$	$0.49^{+0.02}_{-0.02}$	1.78
2008cw	IIb	0.14	$9.33^{+0.09}_{-0.20}$	0.26	$-9.51^{+0.10}_{-0.12}$	0.26	$8.32^{+0.17}_{-0.17}$	$8.34^{+0.02}_{-0.02}$	$0.22^{+0.06}_{-0.06}$	1.21
2008cx	IIb	1.64	$11.00^{+0.11}_{-0.54}$	0.04	$-10.94^{+0.42}_{-0.54}$				$0.72^{+0.08}_{-0.08}$	0.60
2008ie	IIb	1.24	$10.91^{+0.58}_{-0.19}$							2.94
2009K	IIb	0.36	$11.30^{+0.13}_{-0.53}$							3.05
2009ar	IIb	0.22	$7.21^{+0.16}_{-0.17}$							1.31
2009fi	IIb	0.91	$9.17^{+0.56}_{-0.07}$	0.21	$-9.82^{+0.17}_{-0.16}$	0.21	$8.66^{+0.03}_{-0.02}$	$8.52^{+0.02}_{-0.02}$	$0.38^{+0.06}_{-0.06}$	1.09
2009jv	IIb	0.39	$10.33^{+0.12}_{-0.54}$	0.10	$-9.63^{+0.16}_{-0.16}$	0.10	$9.00^{+0.02}_{-0.01}$	$8.76^{+0.01}_{-0.01}$	$2.27^{+0.05}_{-0.05}$	1.61
2010am	IIb	1.80	$9.26^{+0.08}_{-0.36}$							0.77
1994Y	IIn	0.67	$11.14^{+0.06}_{-0.07}$	1.10	$-8.28^{+0.20}_{-0.31}$	1.10	$9.13^{+0.01}_{-0.01}$	$8.79^{+0.01}_{-0.01}$	$0.71^{+0.02}_{-0.02}$	2.53
1995G	IIn	1.37	$10.04^{+0.55}_{-0.08}$							1.42
1996ae	IIn	0.93	$11.18^{+0.05}_{-0.05}$	0.06	$-10.64^{+0.49}_{-0.66}$				$2.92^{+0.17}_{-0.17}$	3.36
1996bu	IIn	2.19	$11.00^{+0.05}_{-0.05}$							2.34
1997ab	IIn	0.86	$8.14^{+0.58}_{-0.07}$	0.20	$-9.87^{+0.23}_{-0.18}$	0.20	$8.40^{+0.09}_{-0.11}$	$8.36^{+0.05}_{-0.05}$	$0.07^{+0.12}_{-0.12}$	1.53
1998S	IIn	0.93	$11.27^{+0.05}_{-0.05}$	0.60	$-9.77^{+0.30}_{-0.28}$	0.60	$9.09^{+0.05}_{-0.04}$	$8.82^{+0.04}_{-0.04}$	$1.56^{+0.12}_{-0.12}$	2.38
1999eb	IIn	0.57	$10.61^{+0.18}_{-0.50}$							1.79
1999gb	IIn	0.93		0.46	$-9.03^{+0.17}_{-0.22}$	0.46	$9.12^{+0.04}_{-0.01}$	$8.84^{+0.02}_{-0.02}$	$0.73^{+0.04}_{-0.04}$	
2000ev	IIn	0.92	$9.43^{+0.55}_{-0.09}$							1.34
2001I	IIn	0.78								
2001fa	IIn	0.67	$10.36^{+0.56}_{-0.08}$							2.07
2002ea	IIn	0.62	$10.87^{+0.18}_{-0.51}$	0.07	$-10.15^{+0.18}_{-0.19}$	0.07	$9.15^{+0.04}_{-0.04}$	$8.78^{+0.02}_{-0.02}$	$1.23^{+0.06}_{-0.06}$	2.53
2002fj	IIn	0.71	$11.02^{+0.21}_{-0.50}$							2.03
2003G	IIn	0.53								
2003dv	IIn	2.53	$9.18^{+0.05}_{-0.05}$							1.11
2003ke	IIn	0.83	$10.65^{+0.14}_{-0.26}$	0.11	$-9.88^{+0.20}_{-0.20}$	0.11	$9.08^{+0.04}_{-0.04}$	$8.75^{+0.02}_{-0.02}$	$1.98^{+0.08}_{-0.08}$	2.26
2004F	IIn	0.56	$10.16^{+0.57}_{-0.09}$	0.82	$-8.80^{+0.21}_{-0.32}$	0.82	$8.99^{+0.01}_{-0.01}$	$8.69^{+0.01}_{-0.01}$	$0.67^{+0.02}_{-0.02}$	2.08
2005cp	IIn	0.51	$10.39^{+0.16}_{-0.24}$							1.81
2005db	IIn	0.88	$11.06^{+0.21}_{-0.50}$							2.47
2005gl	IIn	0.96	$11.10^{+0.54}_{-0.10}$							1.66
2006aa	IIn	0.89	$10.96^{+0.10}_{-0.29}$	0.05	$-9.63^{+0.14}_{-0.15}$	0.05	$9.22^{+0.01}_{-0.06}$	$8.83^{+0.01}_{-0.01}$	$1.42^{+0.04}_{-0.04}$	1.90
2006am	IIn	0.95	$9.77^{+0.05}_{-0.05}$	0.11	$-9.67^{+0.13}_{-0.13}$	0.11	$8.73^{+0.02}_{-0.01}$	$8.55^{+0.01}_{-0.01}$	$0.67^{+0.04}_{-0.04}$	1.55
2006bo	IIn	1.28	$9.24^{+0.57}_{-0.07}$							1.73
2006cy	IIn	1.78	$10.31^{+0.20}_{-0.10}$							1.16
2006db	IIn	1.17	$8.74^{+0.28}_{-0.11}$	0.19	$-10.27^{+0.21}_{-0.15}$	0.19	$8.33^{+0.21}_{-0.16}$	$8.40^{+0.06}_{-0.06}$	$0.09^{+0.15}_{-0.15}$	0.98
2006gy	IIn	0.17	$10.60^{+0.43}_{-0.20}$							3.26
2006jd	IIn[1]	1.42	$9.25^{+0.56}_{-0.10}$							0.72
2006tf	IIn	0.43	$8.05^{+0.15}_{-0.16}$							0.86
2007K	IIn	0.88	$10.54^{+0.31}_{-0.09}$	0.09	$-12.47^{+0.83}_{-1.07}$				$-0.55^{+0.30}_{-0.30}$	2.82
2007cm	IIn	1.43	$10.18^{+0.53}_{-0.12}$	0.10	$-11.58^{+0.62}_{-1.21}$				$0.69^{+0.23}_{-0.23}$	2.14
2007rt	IIn	0.28	$10.42^{+0.30}_{-0.09}$	0.13	$-10.31^{+0.37}_{-0.33}$	0.13	$9.05^{+0.08}_{-0.06}$	$8.72^{+0.04}_{-0.04}$	$1.12^{+0.14}_{-0.14}$	2.05
2008B	IIn	0.86	$10.37^{+0.14}_{-0.51}$	0.18	$-9.76^{+0.17}_{-0.17}$	0.18	$9.14^{+0.03}_{-0.01}$	$8.83^{+0.02}_{-0.02}$	$1.15^{+0.06}_{-0.06}$	1.46
2008fm	IIn	1.77								
2008gm	IIn	1.42								
2008ip	IIn	2.15	$10.40^{+0.22}_{-0.52}$	0.08	$-11.92^{+0.69}_{-1.24}$				$0.89^{+0.20}_{-0.20}$	2.73
2008ja	IIn	0.56	$8.42^{+0.14}_{-0.14}$							1.57
2009nn	IIn	1.29	$9.85^{+0.14}_{-0.11}$							1.59
2010jl	IIn	0.51	$8.93^{+0.54}_{-0.09}$	0.69	$-7.89^{+0.13}_{-0.21}$	0.69	$8.12^{+0.08}_{-0.12}$	$8.15^{+0.01}_{-0.01}$	$0.53^{+0.02}_{-0.02}$	0.25
1994W	IIn P	0.96	$10.86^{+0.05}_{-0.05}$	0.11	$-10.34^{+0.34}_{-0.30}$				$1.94^{+0.04}_{-0.04}$	2.18
2007pk	IIn pec	0.63								
2010al	IIn pec	0.69	$10.36^{+0.13}_{-0.51}$	0.09	$-10.80^{+0.27}_{-0.25}$	0.09	$8.95^{+0.03}_{-0.07}$	$8.69^{+0.03}_{-0.03}$	$0.92^{+0.10}_{-0.10}$	2.01
PTF09awk	Ib	0.10	$9.59^{+0.10}_{-0.09}$	0.44	$-9.32^{+0.09}_{-0.11}$	0.44	$8.61^{+0.01}_{-0.02}$	$8.39^{+0.01}_{-0.01}$	$0.21^{+0.03}_{-0.03}$	1.51
PTF09dfk	Ib	0.65	$8.85^{+0.17}_{-0.56}$							1.32
1995F	Ib[1]	0.24	$10.47^{+0.05}_{-0.05}$	0.49	$-10.50^{+0.22}_{-0.21}$	0.49	$9.07^{+0.04}_{-0.01}$	$8.84^{+0.03}_{-0.03}$	$0.61^{+0.08}_{-0.08}$	2.54
1997X	Ib[1]	0.48	$10.95^{+0.05}_{-0.06}$	0.31	$-9.28^{+0.28}_{-0.25}$	0.31	$9.07^{+0.01}_{-0.01}$	$8.79^{+0.01}_{-0.01}$	$0.58^{+0.03}_{-0.03}$	1.86
2005bf	Ib[1]	1.31								
2006fo	Ib[1]	0.73	$10.48^{+0.11}_{-0.28}$	0.98	$-9.06^{+0.16}_{-0.19}$	0.98	$9.07^{+0.01}_{-0.02}$	$8.74^{+0.01}_{-0.01}$	$0.81^{+0.03}_{-0.03}$	2.14

TABLE 8 — *Continued*

SN	Type	Offset Norm.	Log M (dex)	Fib. Off. (AGN)	SSFR	Fib. Off. (Metal)	T04 (dex)	PP04 (dex)	A_V (mag)	u'-z' (local)
2006lc	Ib[2]	0.98	$10.72^{+0.51}_{-0.16}$	0.07	$-11.34^{+0.51}_{-1.10}$				$1.62^{+0.20}_{-0.20}$	2.69
2007kj	Ib[1]	1.83								
1991ar	Ib	0.79	$10.31^{+0.08}_{-0.57}$							1.39
1997dc	Ib	0.49	$10.74^{+0.54}_{-0.09}$							2.20
1998T	Ib	0.23	$10.57^{+0.57}_{-0.07}$	0.14	$-9.38^{+0.54}_{-0.79}$				$2.21^{+0.02}_{-0.02}$	0.95
1998cc	Ib	1.16	$11.06^{+0.24}_{-0.51}$							2.34
1999di	Ib	1.01	$11.00^{+0.13}_{-0.55}$							1.68
1999dn	Ib	1.19								
1999eh	Ib	0.75	$10.48^{+0.06}_{-0.08}$	0.09	$-9.66^{+0.15}_{-0.16}$	0.09	$8.99^{+0.01}_{-0.01}$	$8.74^{+0.02}_{-0.02}$	$2.28^{+0.06}_{-0.06}$	1.77
2000de	Ib	0.64	$9.94^{+0.05}_{-0.05}$	0.33	$-9.69^{+0.18}_{-0.19}$	0.33	$8.88^{+0.06}_{-0.01}$	$8.62^{+0.01}_{-0.01}$	$0.29^{+0.04}_{-0.04}$	1.20
2000dv	Ib	0.73	$10.59^{+0.14}_{-0.50}$							2.01
2000fn	Ib	0.95	$10.48^{+0.14}_{-0.54}$	0.79	$-10.00^{+0.32}_{-0.32}$	0.79	$8.92^{+0.04}_{-0.05}$	$8.75^{+0.04}_{-0.04}$	$0.95^{+0.12}_{-0.12}$	2.03
2002dg	Ib	1.23	$9.15^{+0.15}_{-0.09}$							0.86
2002hz	Ib	0.59	$10.40^{+0.51}_{-0.14}$							2.72
2003I	Ib	1.16	$10.21^{+0.11}_{-0.55}$	0.11	$-10.17^{+0.19}_{-0.18}$	0.11	$9.01^{+0.05}_{-0.02}$	$8.74^{+0.02}_{-0.02}$	$1.00^{+0.06}_{-0.06}$	1.70
2003bp	Ib	0.91	$10.96^{+0.15}_{-0.26}$	0.85	$-9.46^{+0.35}_{-0.33}$	0.85	$8.99^{+0.06}_{-0.04}$	$8.74^{+0.05}_{-0.05}$	$1.18^{+0.15}_{-0.15}$	1.63
2003gk	Ib	1.11	$10.32^{+0.57}_{-0.08}$							1.19
2004ao	Ib	0.52	$10.54^{+0.05}_{-0.05}$							1.40
2004bs	Ib	0.45		0.09	$-9.65^{+0.14}_{-0.16}$	0.09	$8.98^{+0.04}_{-0.03}$	$8.72^{+0.01}_{-0.01}$	$0.71^{+0.04}_{-0.04}$	
2004gv	Ib	1.13	$10.57^{+0.21}_{-0.53}$							1.83
2005O	Ib	0.57	$10.64^{+0.11}_{-0.55}$	1.08	$-9.31^{+0.14}_{-0.14}$	1.08	$9.11^{+0.01}_{-0.01}$	$8.83^{+0.02}_{-0.02}$	$0.86^{+0.04}_{-0.04}$	2.74
2005hl	Ib	1.71	$10.56^{+0.15}_{-0.27}$	0.25	$-9.85^{+0.17}_{-0.16}$	0.25	$9.16^{+0.01}_{-0.04}$	$8.83^{+0.02}_{-0.02}$	$1.29^{+0.05}_{-0.05}$	1.78
2005hm	Ib	0.26	$8.47^{+0.25}_{-0.36}$							1.77
2005mn	Ib	0.22	$9.63^{+0.11}_{-0.12}$	0.22	$-9.86^{+0.22}_{-0.22}$	0.22	$8.71^{+0.06}_{-0.06}$	$8.53^{+0.05}_{-0.05}$	$-0.07^{+0.14}_{-0.14}$	1.92
2006ep	Ib	2.20	$11.06^{+0.21}_{-0.50}$							2.37
2007ag	Ib	0.52	$10.37^{+0.15}_{-0.27}$	0.14	$-9.69^{+0.17}_{-0.16}$	0.14	$8.98^{+0.01}_{-0.02}$	$8.72^{+0.01}_{-0.01}$	$1.87^{+0.05}_{-0.05}$	2.56
2007ke	Ib	0.69	$11.49^{+0.56}_{-0.06}$							3.22
2007qx	Ib	0.58	$10.14^{+0.13}_{-0.16}$							2.05
2007uy	Ib	0.56	$10.48^{+0.06}_{-0.07}$	0.07	$-9.66^{+0.15}_{-0.16}$	0.07	$8.99^{+0.01}_{-0.01}$	$8.74^{+0.02}_{-0.02}$	$2.28^{+0.06}_{-0.06}$	1.79
2008D	Ib	1.00	$10.48^{+0.06}_{-0.08}$	0.09	$-9.66^{+0.15}_{-0.16}$	0.09	$8.99^{+0.01}_{-0.01}$	$8.74^{+0.02}_{-0.02}$	$2.28^{+0.06}_{-0.06}$	1.79
2008ht	Ib	1.21	$10.67^{+0.16}_{-0.24}$	0.08	$-11.04^{+0.49}_{-1.01}$				$0.32^{+0.10}_{-0.10}$	1.75
2009ha	Ib	0.87	$9.89^{+0.56}_{-0.08}$							1.63
2009jf	Ib	1.50	$11.11^{+0.09}_{-0.14}$							0.74
2010O	Ib	0.35	$10.57^{+0.57}_{-0.07}$	0.14	$-9.38^{+0.54}_{-0.79}$				$2.21^{+0.02}_{-0.02}$	1.89
2002hy	Ib pec	0.83	$10.95^{+0.13}_{-0.52}$							1.95
2006jc	Ib pec[1]	1.36	$9.46^{+0.05}_{-0.05}$	0.10	$-10.49^{+0.25}_{-0.18}$	0.10	$8.49^{+0.09}_{-0.15}$	$8.53^{+0.05}_{-0.05}$	$0.07^{+0.12}_{-0.12}$	1.64
2009lw	Ib/IIb	1.57	$10.70^{+0.56}_{-0.09}$							1.56
2010P	Ib/IIb	1.02	$10.14^{+0.04}_{-0.04}$	0.25	$-9.72^{+0.51}_{-0.40}$				$1.49^{+0.02}_{-0.02}$	2.15
2002dz	Ib/c	0.88	$9.90^{+0.53}_{-0.11}$							2.05
2003A	Ib/c	0.70	$10.48^{+0.20}_{-0.24}$							2.18
2003ih	Ib/c	1.39	$10.78^{+0.14}_{-0.51}$							2.01
2006lv	Ib/c[1]	0.86	$9.77^{+0.04}_{-0.05}$	1.19	$-9.42^{+0.36}_{-0.33}$	1.19	$8.58^{+0.08}_{-0.07}$	$8.52^{+0.05}_{-0.05}$	$0.51^{+0.14}_{-0.14}$	1.76
2007sj	Ib/c	0.52	$10.57^{+0.16}_{-0.13}$	0.12	$-10.41^{+0.29}_{-0.26}$	0.12	$9.10^{+0.05}_{-0.05}$	$8.76^{+0.04}_{-0.04}$	$0.93^{+0.12}_{-0.12}$	2.41
2008fn	Ib/c	0.65	$9.56^{+0.28}_{-0.12}$							3.00
2008fs	Ib/c	0.77	$10.11^{+0.11}_{-0.19}$							2.26
2010br	Ib/c	0.28	$11.17^{+0.09}_{-0.13}$	1.05	$-8.90^{+0.13}_{-0.18}$	1.05	$9.09^{+0.01}_{-0.01}$	$8.80^{+0.01}_{-0.01}$	$0.55^{+0.03}_{-0.03}$	2.88
2010gr	Ib/c	1.33	$10.07^{+0.56}_{-0.09}$							2.27
2010is	Ib/c	0.73	$10.51^{+0.28}_{-0.14}$							2.25
2001co	Ib/c pec	1.06	$10.28^{+0.55}_{-0.11}$	0.10	$-10.80^{+0.43}_{-0.49}$				$2.76^{+0.09}_{-0.09}$	2.46
PTF10bhu	Ic	0.71	$9.52^{+0.17}_{-0.12}$	0.34	$-10.32^{+0.16}_{-0.15}$	0.34	$8.61^{+0.07}_{-0.05}$	$8.53^{+0.04}_{-0.04}$	$0.42^{+0.10}_{-0.10}$	1.94
PTF10bip	Ic	0.68	$9.09^{+0.11}_{-0.10}$							1.39
2004ib	Ic[2]	0.56	$9.60^{+0.10}_{-0.10}$	0.31	$-10.05^{+0.22}_{-0.21}$	0.31	$8.48^{+0.10}_{-0.15}$	$8.48^{+0.05}_{-0.05}$	$0.58^{+0.16}_{-0.16}$	2.19
2005az	Ic[3]	0.72		0.13	$-10.61^{+0.21}_{-0.21}$	0.13	$8.81^{+0.03}_{-0.07}$	$8.71^{+0.03}_{-0.03}$	$0.63^{+0.09}_{-0.09}$	
1990B	Ic	0.42	$11.28^{+0.06}_{-0.06}$	0.04	$-9.77^{+0.10}_{-0.10}$	0.04	$9.23^{+0.04}_{-0.01}$	$8.76^{+0.01}_{-0.01}$	$3.13^{+0.05}_{-0.05}$	3.11
1990U	Ic	1.06	$11.12^{+0.08}_{-0.14}$							1.84
1991N	Ic	0.74	$10.41^{+0.04}_{-0.05}$							0.53
1994I	Ic	0.34	$12.11^{+0.12}_{-0.10}$	0.49	$-8.32^{+0.11}_{-0.09}$	0.49	$9.15^{+0.01}_{-0.01}$	$8.86^{+0.01}_{-0.01}$	$1.23^{+0.02}_{-0.02}$	2.10
1995bb	Ic[1]	0.37	$8.82^{+0.05}_{-0.05}$							1.91
1996D	Ic	0.59	$10.35^{+0.55}_{-0.09}$							2.31
1996aq	Ic	0.52	$10.52^{+0.05}_{-0.05}$	0.07	$-9.89^{+0.16}_{-0.19}$	0.07	$9.01^{+0.01}_{-0.01}$	$8.74^{+0.02}_{-0.02}$	$0.52^{+0.05}_{-0.05}$	1.27
1997ei	Ic	0.43	$11.05^{+0.13}_{-0.53}$	0.59	$-9.34^{+0.25}_{-0.25}$	0.59	$9.14^{+0.02}_{-0.03}$	$8.83^{+0.03}_{-0.03}$	$0.86^{+0.07}_{-0.07}$	2.16
1999bc	Ic	0.85		0.08	$-9.71^{+0.17}_{-0.17}$	0.08	$9.16^{+0.01}_{-0.04}$	$8.76^{+0.02}_{-0.02}$	$1.34^{+0.05}_{-0.05}$	
1999bu	Ic	0.28	$10.38^{+0.08}_{-0.05}$	0.87	$-8.71^{+0.22}_{-0.21}$	0.87	$9.09^{+0.01}_{-0.01}$	$8.76^{+0.01}_{-0.01}$	$1.15^{+0.03}_{-0.03}$	3.20
2000C	Ic	1.40								
2000cr	Ic	1.08	$11.28^{+0.19}_{-0.52}$	0.24	$-11.73^{+0.67}_{-1.11}$				$0.52^{+0.18}_{-0.18}$	2.09
2000ew	Ic	0.47	$11.02^{+0.06}_{-0.06}$	0.02	$-11.17^{+0.46}_{-0.79}$	1.88			$1.74^{+0.12}_{-0.12}$	1.78
2001ch	Ic	0.49	$9.29^{+0.05}_{-0.05}$							0.45

TABLE 8 — *Continued*

SN	Type	Offset Norm.	Log M (dex)	Fib. Off. (AGN)	SSFR	Fib. Off. (Metal)	T04 (dex)	PP04 (dex)	A_V (mag)	u'-z' (local)
2001ci	Ic	0.27								
2002J	Ic	0.72	$10.95^{+0.13}_{-0.52}$							2.38
2002ao	Ic	0.95	$9.43^{+0.05}_{-0.04}$	0.12	$-9.93^{+0.15}_{-0.14}$	0.12	$8.55^{+0.04}_{-0.08}$	$8.41^{+0.02}_{-0.02}$	$0.11^{+0.06}_{-0.06}$	0.94
2002hn	Ic	0.27	$10.40^{+0.55}_{-0.09}$	0.46	$-9.03^{+0.17}_{-0.22}$	0.46	$9.12^{+0.04}_{-0.01}$	$8.84^{+0.02}_{-0.02}$	$0.73^{+0.04}_{-0.04}$	1.70
2002ho	Ic	0.87	$10.22^{+0.11}_{-0.05}$							1.96
2002jj	Ic	0.35	$10.26^{+0.15}_{-0.56}$							2.88
2003L	Ic	0.67		0.94	$-8.47^{+0.22}_{-0.21}$	0.94	$9.11^{+0.01}_{-0.01}$	$8.74^{+0.01}_{-0.01}$	$1.24^{+0.03}_{-0.03}$	
2003el	Ic	0.94		0.06	$-9.18^{+0.14}_{-0.13}$	0.06	$9.25^{+0.01}_{-0.05}$	$8.88^{+0.01}_{-0.01}$	$2.03^{+0.04}_{-0.04}$	
2003hp	Ic	1.68	$10.05^{+0.26}_{-0.15}$							1.30
2004C	Ic	0.95	$10.81^{+0.04}_{-0.05}$	1.17	$-9.49^{+0.17}_{-0.16}$	1.17	$9.01^{+0.05}_{-0.01}$	$8.74^{+0.02}_{-0.02}$	$1.90^{+0.06}_{-0.06}$	2.75
2004aw	Ic	2.04		0.39	$-8.23^{+0.16}_{-0.23}$	0.39	$8.95^{+0.01}_{-0.01}$	$8.56^{+0.01}_{-0.01}$	$1.02^{+0.02}_{-0.02}$	
2004bf	Ic	0.71		0.50	$-8.81^{+0.15}_{-0.16}$	0.50	$8.94^{+0.04}_{-0.02}$	$8.56^{+0.01}_{-0.01}$	$1.77^{+0.03}_{-0.03}$	
2004bm	Ic	0.05		0.20	$-9.30^{+0.11}_{-0.11}$	0.20	$9.27^{+0.01}_{-0.01}$	$8.91^{+0.01}_{-0.01}$	$1.56^{+0.02}_{-0.02}$	
2004cc	Ic	0.24	$11.28^{+0.06}_{-0.06}$	0.04	$-9.77^{+0.10}_{-0.10}$	0.04	$9.23^{+0.04}_{-0.01}$	$8.76^{+0.01}_{-0.01}$	$3.13^{+0.05}_{-0.05}$	3.25
2004dc	Ic	0.54	$11.15^{+0.18}_{-0.23}$							2.89
2004fe	Ic	1.01	$10.86^{+0.12}_{-0.54}$							1.63
2004gn	Ic	0.70	$11.55^{+0.04}_{-0.03}$	0.14	$-9.41^{+0.13}_{-0.12}$	0.14	$9.11^{+0.01}_{-0.01}$	$8.84^{+0.01}_{-0.01}$	$3.62^{+0.04}_{-0.04}$	2.67
2005aj	Ic	1.27								
2005eo	Ic	1.19	$10.54^{+0.50}_{-0.17}$	0.20	$-9.55^{+0.14}_{-0.15}$	0.20	$9.22^{+0.01}_{-0.07}$	$8.80^{+0.01}_{-0.01}$	$2.36^{+0.05}_{-0.05}$	2.23
2005kl	Ic	0.50	$10.72^{+0.06}_{-0.06}$							1.40
2006dg	Ic	0.95	$10.07^{+0.56}_{-0.09}$							2.00
2007cl	Ic	0.59	$10.76^{+0.20}_{-0.22}$							1.64
2007nm	Ic	0.63	$8.37^{+0.19}_{-0.21}$							2.38
2007rz	Ic	0.89	$10.14^{+0.57}_{-0.09}$							1.80
2008ao	Ic	1.47	$9.62^{+0.55}_{-0.08}$							1.21
2008du	Ic	0.92								
2008ew	Ic	0.83	$10.83^{+0.13}_{-0.27}$	1.06	$-9.34^{+0.22}_{-0.22}$	1.06	$8.97^{+0.04}_{-0.03}$	$8.74^{+0.03}_{-0.03}$	$0.32^{+0.09}_{-0.09}$	2.43
2008fo	Ic	1.30	$9.58^{+0.31}_{-0.10}$	0.18	$-9.52^{+0.12}_{-0.13}$	0.18	$8.83^{+0.01}_{-0.02}$	$8.61^{+0.01}_{-0.01}$	$0.87^{+0.05}_{-0.05}$	1.67
2008hh	Ic	1.14								
2008hn	Ic	0.87	$10.62^{+0.51}_{-0.21}$	0.68	$-9.88^{+0.20}_{-0.20}$	0.68	$9.06^{+0.02}_{-0.01}$	$8.82^{+0.02}_{-0.02}$	$0.76^{+0.06}_{-0.06}$	1.93
2009em	Ic	0.81								
2009lj	Ic	1.77	$10.62^{+0.49}_{-0.16}$							1.91
2010Q	Ic	0.56	$7.44^{+0.17}_{-0.16}$							0.76
2010do	Ic	1.11	$10.45^{+0.51}_{-0.13}$	0.04	$-8.98^{+0.13}_{-0.13}$	0.04	$9.26^{+0.04}_{-0.01}$	$8.89^{+0.01}_{-0.01}$	$1.99^{+0.02}_{-0.02}$	1.25
2010gk	Ic	0.30	$10.35^{+0.53}_{-0.12}$	0.14	$-9.19^{+0.13}_{-0.12}$	0.14	$9.13^{+0.01}_{-0.01}$	$8.79^{+0.01}_{-0.01}$	$2.79^{+0.03}_{-0.03}$	2.62
2010io	Ic	0.32	$9.62^{+0.04}_{-0.05}$							0.61
2003id	Ic pec	1.07	$10.57^{+0.05}_{-0.05}$							1.79
PTF09sk	Ic-bl	0.77	$8.90^{+0.21}_{-0.08}$	0.38	$-9.34^{+0.10}_{-0.13}$	0.38	$8.36^{+0.12}_{-0.15}$	$8.30^{+0.01}_{-0.01}$	$0.68^{+0.04}_{-0.04}$	1.23
1997dq	Ic-bl	1.59	$11.02^{+0.06}_{-0.06}$	1.88	$-8.23^{+0.15}_{-0.12}$	1.88	$9.00^{+0.06}_{-0.01}$	$8.48^{+0.01}_{-0.01}$	$0.72^{+0.03}_{-0.03}$	1.43
1997ef	Ic-bl	1.23	$10.55^{+0.07}_{-0.56}$	0.06	$-9.36^{+0.15}_{-0.14}$	0.06	$9.13^{+0.01}_{-0.01}$	$8.86^{+0.01}_{-0.01}$	$1.41^{+0.04}_{-0.04}$	1.22
1998ey	Ic-bl	1.15	$11.13^{+0.15}_{-0.51}$							2.72
2002ap	Ic-bl	2.69	$11.52^{+0.05}_{-0.05}$							-0.16
2002bl	Ic-bl	0.94	$10.71^{+0.17}_{-0.49}$	0.10	$-9.70^{+0.16}_{-0.19}$	0.10	$9.12^{+0.04}_{-0.02}$	$8.76^{+0.02}_{-0.02}$	$2.38^{+0.09}_{-0.09}$	2.19
2003jd	Ic-bl	0.57	$9.26^{+0.56}_{-0.06}$							0.96
2004bu	Ic-bl	0.43		0.44	$-9.89^{+0.23}_{-0.23}$	0.44	$8.70^{+0.02}_{-0.06}$	$8.47^{+0.03}_{-0.03}$	$0.75^{+0.09}_{-0.09}$	
2005nb	Ic-bl	0.58	$9.63^{+0.32}_{-0.07}$	0.84	$-8.39^{+0.19}_{-0.26}$	0.84	$8.57^{+0.02}_{-0.03}$	$8.33^{+0.01}_{-0.01}$	$0.41^{+0.04}_{-0.04}$	0.86
2006aj	Ic-bl	0.77	$8.07^{+0.16}_{-0.16}$							0.88
2006nx	Ic-bl	1.22	$8.58^{+0.16}_{-0.19}$							0.87
2006qk	Ic-bl	0.19	$9.58^{+0.15}_{-0.16}$							3.28
2007I	Ic-bl	0.76	$8.93^{+0.24}_{-0.18}$	0.21	$-9.53^{+0.38}_{-0.34}$	0.21	$8.36^{+0.21}_{-0.19}$	$8.37^{+0.05}_{-0.05}$	$0.79^{+0.16}_{-0.16}$	1.32
2007bg	Ic-bl	3.58	$7.96^{+0.21}_{-0.21}$							0.97
2007ce	Ic-bl	0.90	$8.19^{+0.16}_{-0.08}$							-0.14
2010ah	Ic-bl	0.93	$8.82^{+0.12}_{-0.14}$							1.34
2010ay	Ic-bl	0.16	$8.57^{+0.09}_{-0.08}$	0.54	$-8.70^{+0.24}_{-0.25}$	0.54	$8.58^{+0.02}_{-0.03}$	$8.21^{+0.01}_{-0.01}$	$0.24^{+0.03}_{-0.03}$	0.97

NOTE. — Offset Norm. is the deprojected offset normalized by the host galaxy half-light radius. Fib. Off. (AGN) is the normalized offset of the SDSS spectroscopic fiber with offset most similar to the SN offset that has sufficient S/N to estimate dust extinction and SSFR. A superscript number next to a type provides the origin of any spectroscopic reclassification (1: Modjaz et al. 2012, in prep.; 2: Sanders et al. 2012a; 3: this work). Fib. Off. (Metal) is the normalized offset of the SDSS spectroscopic fiber with offset most similar to the SN offset that is classified as star-forming which enables an oxygen abundance estimate.