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ULTRAVIOLET, OPTICAL, AND X-RAY OBSERVATIONS OF THE TYPE Ia SUPERNOVA 2005am WITH *SWIFT*

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ABSTRACT

We present ultraviolet and optical light curves in six broadband filters and grism spectra obtained by *Swift*'s Ultraviolet/Optical Telescope for the Type Ia supernova SN 2005am. The data were collected beginning about 4 days before the *B*-band maximum, with excellent coverage of the rapid decline phase and later observations extending out to 69 days after the peak. The optical and near-UV light curve match well those of SN 1992A. The other UV observations constitute the first set of light curves shorter than 2500 Å and allow us to compare the light curve evolution in three UV bands. One interesting feature is that the decay in the intermediate UVM2 band is shallower than in the filters on either side and may result from the bump in the interstellar extinction curve. The UV behavior of this and other low-redshift supernovae can be used to constrain theories of progenitor evolution or to interpret optical light curves of high-redshift supernovae. Using *Swift*'s X-Ray Telescope, we also report the upper limit to SN 2005am's X-ray luminosity to be 6×10^{39} ergs s^{-1} in the 0.3–10 keV. This result is derived from 58 ks of exposure time spread out over 7 weeks beginning 4 days before the *B*-band maximum.

Subject heading: supernovae: individual (SN 2005am)

1. INTRODUCTION

Type Ia supernovae (SNe Ia) are among the brightest of astrophysical events, making them useful as probes of the distant universe. Because SNe Ia have similar luminosities at their peak, and a well-established relationship between their peak brightness and rate of decay, they are excellent standardizable candles. The dispersion in absolute magnitudes can be reduced to approximately 15% by calibrating the peak luminosity to other observable parameters, such as the *B*-band decline rate $\Delta m_{15}(B)$ (Phillips 1993; Phillips et al. 1999). SNe Ia gave the first evidence that the expansion of the universe is accelerating (Riess et al. 1998), and they are used to constrain certain cosmological parameters (Perlmutter et al. 1999).

UV observations are important for understanding the behavior of SNe. For local ($z \approx 0$) SNe, observations in the UV can be used to distinguish between different explosion models, as the UV emission probes the metallicity of the progenitor, as well as the degree of mixing of the synthesized ^{56}Ni (Blinnikov & Sorokina 2000). For SNe observed at high redshifts, the rest-frame UV is redshifted into the optical bands, so understanding the rest-frame UV behavior of SNe is critical to understanding the nature of more distant SNe Ia.

Unfortunately, observations of local SNe in their rest-frame UV are limited because they require space-based observatories. The *International Ultraviolet Explorer* (*IUE*) obtained UV spectroscopy of 12 SNe Ia, and the *Hubble Space Telescope* (*HST*) continues to obtain valuable UV spectroscopy and photometry (see Panagia 2003 for a review of SN observations in the UV). One of the best-observed SNE Ia is 1992A, which was observed by both *IUE* and *HST* (Kirshner et al. 1993). There is also a Cycle 13 *HST* program (PI: A. Filippenko) that has obtained UV observations of SN 2004dt, SN 2004ef, and SN 2005M (L. Wang 2005, in preparation). A larger sample is needed to determine how uniform SNe Ia are in the UV.

SN 2005am was discovered by R. Martin et al. (2005) in images from 2005 February 22 and 24 (all dates UT). The reported position was R.A. $= 9^{\rm h}16^{\rm m}12\overset{\rm s}{.}47$ and decl. $= -16^\circ18'16''$ (J2000.0) in NGC 2811 ($z = 0.007899$; Theureau et al. 1998). It was confirmed a week later by K. Itagaki, by which time it had brightened by about 3.5 mag (Yamaoka 2005). Modjaz et al. (2005) classified it from spectra as an early SN Ia on 2005 March 3, and the observations with the *Swift* spacecraft reported here began the next day. In this paper we present UV and optical photometry, grism spectroscopy, and an upper limit to the X-ray luminosity.

2. OBSERVATIONS AND REDUCTIONS

Observations of SN 2005am were made with the *Swift* spacecraft (Gehrels et al. 2004) between 2005 March 4 and May 17.

Swift's Ultraviolet/Optical Telescope (UVOT; Roming et al. 2005) is a 30 cm telescope equipped with two grisms and six broadband filters. The UV grism produces spectra from approximately 2000 to 3400 Å, and the *V* (optical) grism produces spectra from approximately 3000 to 6000 Å. The filters and their corresponding central wavelengths are UVW2 (1800 Å), UVM2 (2200 Å), UVW1 (2600 Å), *U* (3600 Å), *B* (4200 Å), and *V* (5500 Å). To understand where in the spectrum of a SN these filters correspond, Figure 1 shows the effective area curves for the six broadband filters superimposed on a combined spectrum of SN 2005am using both the UV and optical grisms.

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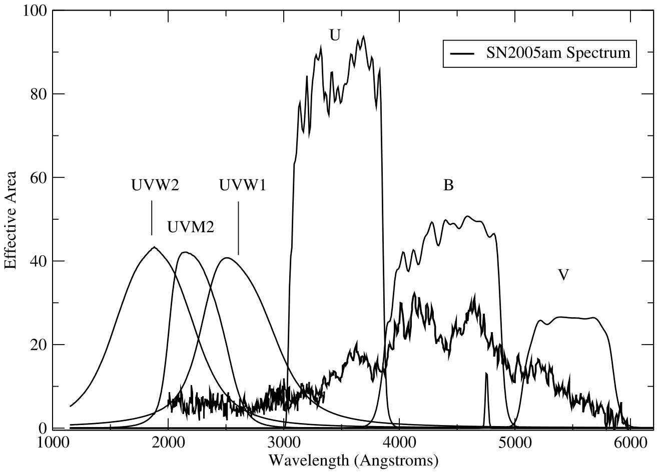

Fig. 1.—Effective area curves (in cm^2) of UVOT's six broadband filters, superimposed on a spectrum of SN 2005am.

The X-Ray Telescope (XRT; Burrows et al. 2005) on *Swift* is sensitive to photons in the 0.2–10 keV energy range. It has an effective area of 110 cm^2 at 1.5 keV. During the UVOT observations, the XRT was gathering data in its photon-counting mode.

Observations began while the spacecraft was still in its commissioning phase, and some calibrations are still ongoing. Because of this, the photometric zero points used will be explicitly given, in the event that future calibrations require an adjustment of those values.

2.1. *Photometry*

SN 2005am is located in the outer edge of the visible disc of the host galaxy NGC 2811 and 6.″3 from a foreground star ($V = 14.55 \pm 0.04$). This star, and the diffuse light from the host galaxy, complicate precision photometry. High-precision photometry will have to wait until the SN has faded and the underlying diffuse light from NGC 2811 can be subtracted. It is anticipated that UVOT will reobserve NGC 2811 at that time.

We performed aperture photometry in a circular aperture with a radius of 3.″5, centered on the SN. A sky annulus with an inner radius of 20″ and a width of 5″ was used to estimate the local background. We found that these choices minimized contamination from the host galaxy and the nearby bright source while including most of the light from the supernova.

The UVOT is a photon-counting detector, so it suffers from coincidence losses for sources with high count rates. This occurs when the count rate approaches the frame rate and all photons are not counted, and for very high count rates the number of photons missed cannot be calculated. This corresponds to saturation magnitudes of $V_{\rm coinc} = 12.94$, $B_{\rm coinc} = 14.23$, $U_{\rm coinc} = 13.45$, $\mathrm{UVW1}_{\rm coinc} = 12.93$, $\mathrm{UVM2}_{\rm coinc} = 12.30$, and $\mathrm{UVW2}_{\rm coinc} = 12.93$. Coincidence corrections were applied to all of our data, although the nearby star may have caused the coincidence losses to have been underestimated. At the SN's peak brightness, our observations in the *B* were above the calculated saturation point and are treated as lower limits to the true *B*-band magnitudes. In addition, the *U* and *V*-band observations near maximum have larger errors (∼0.1 mag) due to coincidence losses.

The magnitudes were transformed to Vega magnitudes using Landolt standards for the optical bands (Landolt 1992) and white dwarfs observed by *IUE* for the UV bands (Wegner & Swanson 1991). The following preliminary flight photometric zero points were applied: $\mathrm{ZP}_V = 17.83 \pm 0.09$, $\mathrm{ZP}_B = 19.12 \pm 0.08$, $\mathrm{ZP}_U = 18.34 \pm 0.16$, $\mathrm{ZP}_{\rm UVW1} = 17.82 \pm 0.23$, $\mathrm{ZP}_{\rm UVM2} = 17.19 \pm 0.26$, and $\mathrm{ZP}_{\rm UVW2} = 17.82 \pm 0.27$. Color terms have not been calibrated, so they were not applied to the photometry. The photometry is presented in Table 1.

2.2. *Grism Spectroscopy*

Table 2 lists the grism exposures taken by UVOT. The epoch column lists the number of days after maximum light in the B band. The spectra of SN 2005am (integrated from both the UV and *V* grism exposures) were extracted using the SWIFTTOOLS software included in the standard HEASOFT software package.

Care was taken to perform the background subtraction of the grism data using clean regions, but this was hard to achieve due to the crowding of the field. Sequence IDs 00030010007 and 00030010011 were particularly affected by this problem. All of the *V* grism observations suffer from a high background level due to the neighboring galaxy, but, since both the background and the spectral regions are likewise affected, the one should cancel the other. Contamination of the first-order spectra by close and overlapping zeroth-order spectra adversely affected the quality of the spectra from sequence IDs 00030010003 and 30010004. In order to circumvent the contamination in these regions, a narrow source width was specified for the spectral extraction from sequence IDs 00030010003 and 00030010007. This may have resulted in some loss of flux.

2.3. *X-Ray Data*

All XRT data between 2005 March 4 and April 22 (sequences 00030010001 to 00030010073) were consistently processed with SWIFTTOOLS 2.0, using the default GTI-screening parameters. The photon-counting mode event lists were then coadded, producing a total exposure time of 58,117 s. No source was detected at the coordinates of the SN, with a 3 σ upper limit of 5.4×10^{-4} counts s^{-1}, over the 0.2–10 keV band.

3. RESULTS

The light curves are presented in Figure 2. For comparison we have overlaid template curves for the *B* and *V* bands from SN 1992A (Hamuy et al. 1996) and for the UVW1 band from SNe 1992A and 1990N (Kirshner et al. 1993).

3.1. *Optical Light Curves*

Because of the saturation in the *B* band, the time of $B_{\rm max}$ and the value of $\Delta m_{15}(B)$ are not well determined by our data alone. To estimate their values, the SN 2005am light curves in the *B* and *V* bands were compared to templates from Hamuy et al. (1996). Due to the scatter, our light curves are consistent with SN 1992A [$\Delta m_{15}(B) = 1.47$] or the template of SNe 1992bo/1993H [$\Delta m_{15}(B) = 1.69$]. Ground-based data confirm an intermediate value for $\Delta m_{15}(B)$ (M. Hamuy, 2005, private communication). We estimate that $B_{\rm max}$ occurred on JD 2453438 ± 1 day (2005 March 8).

We note that our *B*-band data are systematically fainter than the ground-based data presented by Li et al. (2006) by about 0.15 mag. This difference could be due to the different zero points and aperture sizes or unaccounted-for coincidence losses from the nearby star. Host galaxy contamination in our larger aperture could also explain the difference between our *B* and *V* magnitudes and those independently derived by Li et al. (2006) for some of the late-time UVOT observations, as well as our deviation from the templates at late times. Subtracting template images of the

TABLE 1

Optical and Ultraviolet Light Curves of SN 2005am

Julian Date	UVW2	UVM2	UVW1	*U*	*B*	*V*
2453434.442..............	17.69 ± 0.072	19.00 ± 0.237	15.79 ± 0.043	13.53 ± 0.013	14.24 ± 0.019	13.91 ± 0.023
2453438.186..............	17.56 ± 0.081	19.06 ± 0.127	15.93 ± 0.024	13.82 ± 0.008	<14.23 ± 0.006	13.75 ± 0.011
2453438.586..............	17.63 ± 0.038	18.86 ± 0.110	15.96 ± 0.024	13.78 ± 0.008	<14.23 ± 0.006	13.76 ± 0.010
2453438.922..............	17.63 ± 0.037	18.77 ± 0.103	16.02 ± 0.025	13.88 ± 0.008	<14.23 ± 0.006	13.76 ± 0.010
2453439.257..............	17.62 ± 0.040	18.75 ± 0.110	16.06 ± 0.026	13.919 ± 0.009	<14.23 ± 0.005	13.75 ± 0.011
2453439.512..............	17.71 ± 0.040	...	...	...	...	...
2453439.851..............	...	...	...	...	...	13.80 ± 0.024
2453441.527..............	17.77 ± 0.053	18.71 ± 0.132	16.35 ± 0.037	14.24 ± 0.013	<14.23 ± 0.009	13.78 ± 0.014
2453441.868..............	17.85 ± 0.042	19.01 ± 0.119	16.31 ± 0.028	14.26 ± 0.010	<14.23 ± 0.006	13.77 ± 0.010
2453442.271..............	17.98 ± 0.048	18.74 ± 0.109	16.39 ± 0.031	14.32 ± 0.011	<14.23 ± 0.006	13.78 ± 0.011
2453443.463..............	17.98 ± 0.096	18.81 ± 0.230	16.55 ± 0.067	14.49 ± 0.025	14.64 ± 0.028	13.96 ± 0.025
2453443.744..............	18.12 ± 0.048	18.84 ± 0.108	16.59 ± 0.032	14.52 ± 0.012	14.48 ± 0.008	13.92 ± 0.011
2453444.414..............	18.13 ± 0.048	19.12 ± 0.129	16.67 ± 0.034	14.64 ± 0.013	14.45 ± 0.008	13.98 ± 0.012
2453444.959..............	18.11 ± 0.130	18.45 ± 0.242	16.73 ± 0.095	14.73 ± 0.037	14.72 ± 0.028	14.03 ± 0.034
2453445.69................	18.31 ± 0.061	19.05 ± 0.143	16.77 ± 0.041	14.82 ± 0.017	14.59 ± 0.010	14.01 ± 0.014
2453446.024..............	18.34 ± 0.062	18.75 ± 0.120	16.92 ± 0.044	14.93 ± 0.018	14.58 ± 0.010	13.99 ± 0.014
2453446.224..............	18.39 ± 0.058	19.01 ± 0.125	16.86 ± 0.039	14.91 ± 0.016	14.70 ± 0.010	14.05 ± 0.013
2453446.627..............	18.39 ± 0.059	18.96 ± 0.125	16.96 ± 0.041	15.00 ± 0.017	14.75 ± 0.010	14.11 ± 0.014
2453446.962..............	18.55 ± 0.067	18.98 ± 0.133	16.99 ± 0.044	15.04 ± 0.018	14.68 ± 0.010	14.10 ± 0.014
2453447.628..............	18.51 ± 0.060	19.25 ± 0.141	17.08 ± 0.042	15.15 ± 0.017	14.96 ± 0.011	14.24 ± 0.014
2453447.965..............	18.58 ± 0.060	19.07 ± 0.122	17.04 ± 0.040	15.22 ± 0.018	14.84 ± 0.009	14.14 ± 0.013
2453448.302..............	18.64 ± 0.062	19.16 ± 0.131	...	...	...	14.13 ± 0.013
2453448.302..............	18.64 ± 0.062	19.16 ± 0.131	...	...	...	14.13 ± 0.013
2453451.976..............	19.20 ± 0.123	19.11 ± 0.179	17.91 ± 0.091	16.02 ± 0.039	15.65 ± 0.026	14.47 ± 0.022
2453452.044..............	...	19.65 ± 0.247	18.16 ± 0.105	15.99 ± 0.039	15.48 ± 0.023	14.44 ± 0.022
2453452.655..............	19.23 ± 0.132	19.16 ± 0.253	17.71 ± 0.111	...	15.59 ± 0.051	14.51 ± 0.031
2453452.725..............	...	19.87 ± 0.310	17.70 ± 0.088	...	15.69 ± 0.034	14.67 ± 0.027
2453453.85................	19.49 ± 0.166	>20.13 ± 0.435	17.98 ± 0.107	16.24 ± 0.05	15.85 ± 0.034	14.63 ± 0.028
2453453.918..............	...	19.72 ± 0.284	17.81 ± 0.095	16.17 ± 0.047	15.94 ± 0.035	14.66 ± 0.027
2453454.533..............	19.29 ± 0.101	19.77 ± 0.209	18.03 ± 0.075	16.27 ± 0.035	15.88 ± 0.021	14.59 ± 0.019
2453454.867..............	19.12 ± 0.088	19.61 ± 0.183	17.89 ± 0.069	16.34 ± 0.035	15.92 ± 0.020	14.68 ± 0.019
2453455.999..............	19.49 ± 0.112	19.96 ± 0.232	18.24 ± 0.085	...	16.10 ± 0.024	14.69 ± 0.020
2453456.541..............	19.46 ± 0.133	20.03 ± 0.347	18.15 ± 0.173	16.58 ± 0.058	16.29 ± 0.062	14.88 ± 0.031
2453456.588..............	...	...	18.30 ± 0.163	16.65 ± 0.051	16.15 ± 0.031	14.82 ± 0.025
2453456.6..................	...	19.56 ± 0.220	18.22 ± 0.100	...	...	...
2453457.741..............	19.48 ± 0.132	19.77 ± 0.343	18.05 ± 0.124	16.67 ± 0.071	16.25 ± 0.052	14.81 ± 0.034
2453457.806..............	...	19.61 ± 0.221	18.29 ± 0.104	16.72 ± 0.053	16.42 ± 0.031	15.02 ± 0.028
2453464.979..............	20.14 ± 0.147	20.00 ± 0.206	19.01 ± 0.116	17.27 ± 0.055	17.03 ± 0.036	15.61 ± 0.029
2453466.858..............	20.22 ± 0.299	>20.17 ± 0.566	19.09 ± 0.173	17.36 ± 0.057	17.13 ± 0.041	15.75 ± 0.032
2453470.597..............	20.32 ± 0.275	20.04 ± 0.344	19.35 ± 0.236	17.37 ± 0.090	17.17 ± 0.081	15.89 ± 0.065
2453470.656..............	20.43 ± 0.240	20.19 ± 0.315	19.10 ± 0.165	17.60 ± 0.088	17.23 ± 0.060	15.89 ± 0.046
2453482.593..............	20.78 ± 0.263	>20.71 ± 0.562	19.91 ± 0.251	18.10 ± 0.307	...	16.44 ± 0.056
2453507.639..............	>20.75 ± 0.868	>20.37 ± 1.822	>20.08 ± 4.513	18.71 ± 0.244	17.86 ± 0.117	17.41 ± 0.161

Note.—Errors quoted do not include any systematic error in the zero point or errors due to coincidence losses. Lower limits to the brightness due to coincidence saturation and 3 σ upper limits are indicated.

TABLE 2

UVOT Grism Observations

Sequence ID	Grism Used	Date and Time (UT)	Epoch (Days past $B_{\max}$)	Exposure Length (s)
00030010003.............	*V*	2005 Mar 08 17:47:10	−1	1812.7
00030010004.............	UV	2005 Mar 07 23:07:34	0	2781.7
00030010007.............	UV	2005 Mar 09 14:29:01	+1	2369.9
000300100011............	*V*	2005 Mar 10 14:36:01	+2	2332.4
000300100024............	*V*	2005 Mar 15 23:21:01	+7	1828.9
000300100035............	*V*	2005 Mar 17 20:21:41	+9	1828.3
000300100054............	*V*	2005 Mar 23 01:50:01	+15	1838.5

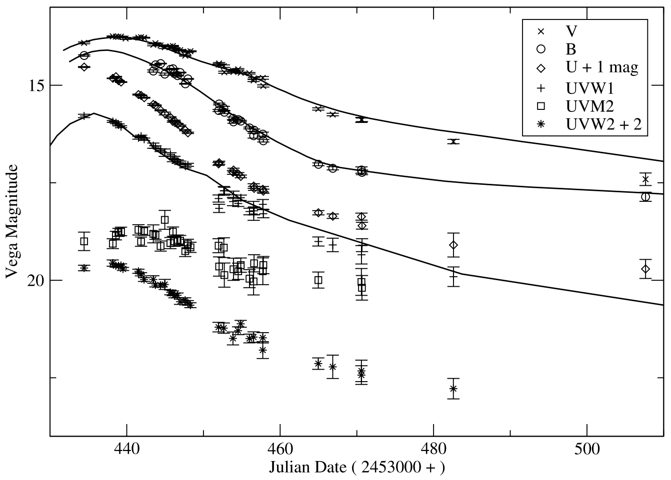

FIG. 2.—UV and optical light curves of SN 2005am obtained by UVOT. For visual clarity, the *U* curve has been shifted by +1 mag and the UVW2 curve by +2 mag. Overlaid are *B* and *V* templates of SN 1992A (Hamuy et al. 1996) and the *F275W template from SNe 1992A/1990N (for our UVW1 curve; Kirshner et al. 1993).

host galaxy after the SN has faded will improve the photometry most for these later observations.

3.2. *Ultraviolet Light Curves*

The UV photometry presented here is a unique set. The only two other SNe Ia with UV photometry available in the literature are SNe 1992A and 1990N. Using those two SNe, Kirshner et al. (1993) composed a template light curve using *HST*'s F275W filter and the flux extracted from *IUE* spectra over a similar range, but cut off at 3400 Å. This band, named *F275W in the above paper, covers a wavelength range similar to that of the UVOT UVW1 filter, so this template is compared to the UVOT data in Figure 2. Our observations agree very well with the template. This is reassuring, since the optical light curves of SNe 2005am and 1992A are similar. SN 1990N had a shallower decay in the optical [$\Delta m_{15}(B) = 1.07$; Phillips et al. 1999], and in Figure 3 of Kirshner et al. (1993) appears to be slightly broader, but the observations do not extend past four days after $B_{\rm max}$. UV observations of SNe with a variety of values of $\Delta m_{15}(B)$ using *HST*, *Swift*, or other space-based observatories would be valuable in calibrating a peak luminosity-width relationship in the UV, which will be useful for cosmology.

Blueward of 2500 Å, only a few data points are available for SN 1992A, which marginally matched a *U*-band template (Kirshner et al. 1993). The UVW2 and UVM2 curves presented here are the first opportunity to see the photometric evolution in this spectral range. One feature is that the decay rate in the UV is actually shallower than in the *U* and *B* bands. To quantify this, a subsection of the photometry beginning 3 days after maximum and extending to day 20 is used to calculate the decay rate in each band. The decay rates (in magnitudes per day) over this period are $D_V = 0.0684 \pm 0.0008$, $D_B = 0.135 \pm 0.001$, $D_U = 0.158 \pm 0.001$, $D_{\rm UVW1} = 0.129 \pm 0.002$, $D_{\rm UVM2} = 0.069 \pm 0.007$, and $D_{\rm UVW2} = 0.114 \pm 0.003$. An interesting feature is that the decay rate in the UVM2 filter is shallower than the decay rate in the UV filters overlapping with it on both sides. This shallow decay and the general faintness in the UVM2 filter may be a result of interstellar extinction, which has not been corrected for in the magnitudes presented here. The 2175 Å bump present in the extinction curve of the Milky Way (Pei 1992) is nearly centered on the UVM2 filter bandpass.

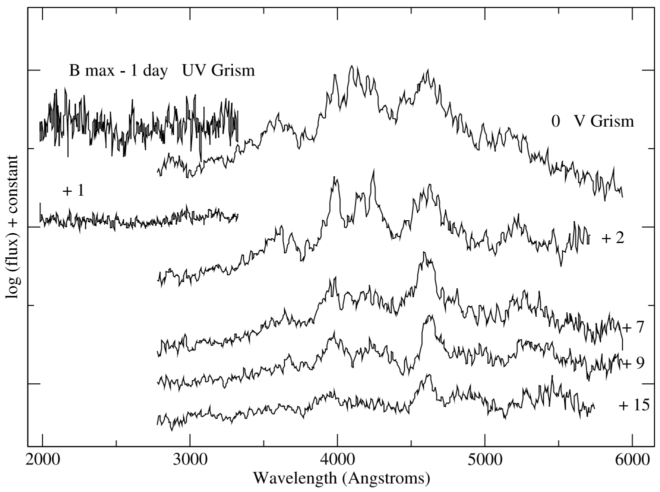

FIG. 3.—UVOT grism spectra of SN 2005am. Each spectrum is labeled with its epoch in days from $B_{\rm max}$. The vertical scale is given in logarithmic units of ergs s^{-1} cm^{-2} Å^{-1}. The spectra have been trimmed from their full size to avoid contamination by other spectral orders.

UV observations of SNe such as these could be useful for interpreting high-redshift SNe observed in the optical bands. For example, Kirshner et al. (1993) noted that the light curve of a nearby SN observed in the *F275W filter would be similar to that of a SN at $z = 0.6$ observed in the *B* band. The same would be true of UVOT's UVW1 filter. Similarly, a rest-frame SN observed with UVOT's UVW2 filter should match a *B*-band observation of a SN at a redshift of $z \approx 1.5$. Time dilation would need to be taken into account, as well as *K* corrections, which have not been done in the UV.

3.3. *Spectra*

The grism spectra are presented in Figure 3. The optical spectra are typical of Type Ia SNe, featuring P-Cygni line profiles superimposed on a roughly thermal continuum. The UV continuum is suppressed by deep absorption from blends of iron peak elements. Broad peaks on either side of 3000 Å resemble those seen in other SNe observed in the UV (Benvenuti et al. 1982) and identified by Branch & Venkatakrishna (1986) as blended lines of Fe II and Co II. A more detailed analysis of these spectra will be performed after better calibrations are available.

3.4. *X-Ray Luminosity*

At early epochs, hard X-rays are created in Type Ia SNe by gamma rays, produced in the decays of ^{56}Ni synthesized in the SN explosion. These gamma rays scatter off of electrons in the ejecta via Compton scattering. The down-scattered photons can either escape the ejecta, be further down-scattered, or be absorbed via bound-free absorption. Further, energetic electrons created by the interaction of these gamma-ray photons slow in the ejecta, generating bremsstrahlung emission that produces photons in the 0.1–100 keV energy range. X-rays in SNe are also caused by shocks of the expanding SN shell interacting with the nearby medium. Type Ia SNe are not expected to be bright in shock-induced X-ray emission because older, degenerate systems are expected to contain very little circumstellar material.

Assuming a flat power-law spectrum (photon index 0.5) similar to Pinto et al. (2001), the upper limit on SN 2005am's count rate corresponds to an unabsorbed flux of 4.4×10^{-14} ergs s^{-1} cm^{-2} in the 0.3–10 keV range. At a redshift of 0.007899, this corresponds to an upper limit to the unabsorbed luminosity in this range of 6.0×10^{39} ergs s^{-1}. In the 0.5–2 keV range the luminosity is less than 4.7×10^{38} ergs s^{-1}. This is about 1 order of magnitude higher than the luminosities predicted by Chandrasekhar and sub-Chandrasekhar models studied by Pinto et al. (2001). (That work included only X-rays created by the Compton scattering and bremsstrahlung mechanisms.) The luminosity limit is comparable to upper limits for other young supernova remnants (SNRs) studied by Bregman et al. (2003), albeit at a much earlier observation time.

4. CONCLUSIONS

SN 2005am appears to be a normal Type Ia SN. Its light curves resemble those of SN 1992A in both the optical and near-UV. The UV and optical spectra resemble those of other normal SNe Ia. No X-ray flux is detected from this SN. However, the expected flux levels from ^{56}Ni decay related keV emission and from shock-induced emission are below the X-ray flux upper limits.

The observations reported here show the power of *Swift*'s UVOT for studying the UV behavior of SNe. UVOT can obtain low-resolution grism spectra of bright SNe and follow their light curve decay in three UV passbands. Another of *Swift*'s unique characteristics is its short-term scheduling, allowing observations to be made within days or even hours. This allows UV observations to be made at earlier epochs than with other UV instruments past or present.

This paper presents a unique set of UV light curves for SN 2005am that are better sampled in time and cover a wider wavelength range than any previous UV observations of a SN Ia. This SN was also well observed in the optical and near-infrared wavelength ranges. Comparisons between the combined UV–optical–near-infrared light curves of SN 2005am and radiation transport simulations of various theoretical explosion models for SNE Ia will enhance our understanding of thermonuclear SN events.

Further *Swift* UV observations of local SNe Ia will help us understand the range in the UV properties of SNe Ia and enhance their use as standardizable candles. This in turn will allow observations of high-redshift SNe Ia to better constrain the cosmological parameters governing the expansion of the universe.

This work made use of the NASA/IPAC Extragalactic Database.

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