Molecular content of a Type Ia supernova host galaxy at $z = 0.6$

A.-L. Melchior$^{1,2,*}$ and F. Combes$^1$

$^1$LERMA, Observatoire de Paris, UMR8112, 61, avenue de l’Observatoire, Paris F-75014, France
$^2$Université Pierre et Marie Curie-Paris 6, 4, place Jussieu, F-75252 Paris Cedex 05, France

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**ABSTRACT**

We study the properties and the molecular content of the host of a Type Ia supernova (SN1997ey). This $z = 0.575$ host is the brightest submillimetre source of the sample of Type Ia supernova hosts observed at 450 and 850 μm by Farrah et al. Observations were performed at the Institut de Radioastronomie Millimétrique 30 m telescope (IRAM 30 m) to search for CO(2–1) and CO(3–2) lines in good weather conditions but no signal was detected. The star formation rate cannot exceed $50 \, M_\odot \, yr^{-1}$. These negative results are confronted with an optical analysis of a Keck spectrum and other data archives. We reach the conclusion that this galaxy is a late-type system ($0.7L^\odot$), with a small residual star formation activity ($0.2 \, M_\odot \, yr^{-1}$) detected in the optical. No source of heating (active galactic nucleus or starburst) is found to explain the submillimetre-continuum flux and the non-CO detection excludes the presence of a large amount of cold gas. We thus suggest that either the star formation activity is hidden in the nucleus (with $A_V \sim 4$) or this galaxy is passive or anemic, and this flux might be associated with a background galaxy.

**Key words:** methods: observational – supernovae: individual: SN1997ey – galaxies: general – radio lines: galaxies – submillimetre.

1 INTRODUCTION

Standardized Type Ia supernovae (SNeIa) have been extensively studied to probe the expansion of the Universe for the past decade (e.g. Riess, Press & Kirshner 1996; Perlmutter et al. 1997, 1999; Astier et al. 2006). The mechanisms that rule these cosmic explosions are not fully understood. A better knowledge of their environment and host galaxies is important to understand possible systematic, which could affect these cosmological probes (e.g. Combes 2004), and the progenitor systems, which are also important for the evolution of galaxies (e.g. Hamuy et al. 2003; Panagia et al. 2006; Howell et al. 2007). The known scatter of the SNIa standard candles is corrected empirically on the basis of the observed tight correlation between the peak luminosity and the decline rate of the light curve (Phillips 1993; Riess et al. 1996; Perlmutter et al. 1997).

Standardized SNeIa detected at high $z$ do not exhibit any sign of residual extinction (e.g. Riess et al. 1998; Perlmutter et al. 1999; Farrah et al. 2002; Sullivan et al. 2003), as selection effects most probably eliminate the most obscured SN.

A submillimetre survey of 31 SNIa hosts (Farrah et al. 2004; Clements et al. 2005) has detected two strong sources at 850 μm at the $7\sigma$ level. It was surprising to find submillimetre-bright galaxies in this sample of SNIa hosts. Nevertheless, this strengthens the observation of the correlation of the SNIa rate with the star formation rate (SFR) (e.g. Sadat et al. 1998; Sullivan et al. 2006), and the evidence (e.g. Mannucci, Della Valle & Panagia 2006; Sullivan et al. 2006) of the possible association of one type of SNeIa with recent star formation. In addition, according to their optical morphology (Farrah et al. 2004), these submillimetre-bright hosts look like ordinary disc galaxies. In order to try to better understand the nature of these hosts, we try to observe the CO lines of SN1997ey host, whose continuum has also been detected at 450 μm at the 6σ level.

In Section 2, we discuss the characteristics of this host galaxy relying on data archives. In Section 3, we present the CO observations performed at IRAM 30 m. In Section 4, we discuss these results.

Throughout this paper, we adopt a flat cosmology, with $\Omega_m = 0.24$, $\Omega_L = 0.76$ and $H_0 = 73 \, km \, s^{-1} \, Mpc^{-1}$ (Spergel et al. 2007).

2 CHARACTERISTICS OF SN1997EY HOST

SN1997ey host has been initially detected as the host of an SNIa (SN1997ey, Pain et al. 2002). It was first detected with ground-based photometry ($R = 21.7$, Pain, private communication). Its spectroscopic redshift ($z = 0.575$) was determined with the Keck telescope (Nugent et al. 1998). It was then observed by HST/Space Telescope Spectrograph (HST/STIS) (HST Proposal 8313). More recently, investigating its dust content, Farrah et al. (2004) detected the submillimetre continuum of this galaxy at 450 and 850 μm. We review in this section these properties in more details.

2.1 Optical spectroscopy and detection of SN1997ey

The Supernova Cosmology Project (SCP, private communication) took a spectrum of the supernova close to maximum with
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Figure 1. Optical spectrum obtained by the Supernova Cosmological Project (private communication) on the Keck telescope on 1997 December 31 (06:22 UT), while the supernova SN1997ey has been detected on 1997 December 29 (Nugent et al. 1998). This spectrum positioned on the supernova, containing both the host galaxy ($R$ $\sim$ 21.7) and the supernova fluxes ($R$ $\sim$ 22.9), provides a secure redshift at $z$ = 0.575. The detected (marginal or close to detection) emission lines are indicated with long (short) (red) dashed lines ([NeV], [OII], [Ne III], H$\gamma$, H$\beta$, [O III]) while absorption features are displayed with long (short) (blue) dotted lines (Ca H and K, G band, Mg) or dash–dotted lines (H$\zeta$, H$\eta$, H$\theta$) (see e.g. McQuade, Calzetti & Kinney 1995). The brightest night sky lines (Osterbrock et al. 1996) have been removed.

Low-Resolution Imaging Spectrometer (LRIS) on the Keck telescope on 1997 December 31, as displayed in Fig. 1. The magnitude of the supernova at discovery is $R$ = 22.9, while the $R$ magnitude of the host is $R$ $\sim$ 21.7. This spectrum, obtained with the 1 arcsec wide-slit aligned on the galaxy centre and the SN position, is a combination of the SN (approximately one-third) and the host galaxy (approximately two-third) spectra (SCP, Hook, private communication). The host spectrum contains stellar absorption lines and some emission lines (see Fig. 1). In Fig. 2, we focus on [OII], H$\beta$ and [O III] emission lines to characterize the properties of the host. We expect that most of the galaxy flux is contained in this spectrum given the position of the slit. Moreover, most of the star formation activity usually lies in the central part of the galaxy or at least in the galactic plane. Last, if we assume that this spectrum continuum contains only two-third flux from the host and scale the spectral continuum to match the observed broad-band flux in the $R$ band (factor of 1.7), we should multiply the whole spectrum by a factor of $2/3 \times 1.7 = 1.1$. In the following, we estimate that the extra 10 per cent lies within the uncertainties of this procedure and work directly on the spectrum displayed in Fig. 1. We find $L([O II]) = 2.5 \times 10^{33}$ W, $L(H\beta) = 2.9 \times 10^{33}$ W and $L([O III]) = 7.8 \times 10^{33}$ W. Relying on Kewley, Geller & Jansen (2004), this indicates a moderate on-going star formation activity of 0.2 $M_\odot$ yr$^{-1}$ (with no extinction correction) and a solar metallicity. The other Balmer lines are not detected in emission (but possibly in absorption), which might suggest some extinction. In parallel, the CaII H and K absorption lines are clearly detected and the ratio of Ca II H and H$\epsilon$ to Ca II K is larger than unity, typical for stars with spectral type later than F (Rose 1985). This host contains a significant population of stars older than $\sim$1 Gyr (e.g. Delgado et al. 2005).

We derived the rest-frame B luminosity from the $R$ magnitude of the host $L_{host}^{rest} \sim 0.15 \times 10^{10} L_\odot \sim 0.7 \times L_\odot$, where $L_\odot$ is defined with the Schechter function ($L_\odot = 2.1 \times 10^9 L_\odot$ in Marzke et al. 1998). Unfortunately, this supernova was not monitored after detection, so no light curve is available. The supernova type and phase were determined by fitting the spectrum with SN and galaxy spectral templates, as described in Howell et al. (2005). The best matches were all SNeIa with a mean epoch of +2 d and a scatter of 6 d. SN1997ey is located 2.77 arcsec from the centre of the host galaxy, which corresponds to a projected distance of 18 kpc (see fig. 1 of Farrah et al. 2004). Only two out of a sample of 15 host galaxies studied by Farrah et al. (2002) are detected at an offset larger than 15 kpc and both occurred in E/S0 host galaxies.

Figure 2. Emission lines used to estimate the [O II] (3727 Å), H$\beta$ (4861 Å) and [O III] (5007 Å) luminosities. The measured flux, after baseline subtraction, is displayed in function of the observed wavelength. From these luminosities, we derived estimates of the SFR and of the metallicity of this host galaxy (see Section 2.1).
GRB971221 has been detected at RA 73:7 and Dec. 4:7, with an error box (BATSE) of 6:3. The association of SN1997ey and GRB971221, suggested by Bosnjak et al. (2006), relies not only on this inaccurate position but also on the time coincidence of the two events. As discussed in Section A, this association is most probably a chance alignment.

2.2 Imaging

We retrieve from the *HST* archive the STIS image obtained by R. Ellis in 1999 (Proposal, 4647). We reduce the three available exposures with IRAF and used the drizzle procedure to remove the cosmic rays (Fruchter & Hook 2002). In order to better understand the nature of this host, we try to fit different profiles to the STIS/*HST* image using the software package GALFIT (Peng et al. 2002). The best fit (see Fig. 3) was obtained for one Sérsic profile with an effective (half-light) radius $r_e = 1.8$ arcsec $= 11$ kpc, a power-law index $n = 2.04$, a disciness parameter $c = -0.45$ and an axis ratio $b/a = 0.39$. We thus estimate an inclination of the order of $70^\circ$ (Paturel et al. 1997). The $10$–$20$ per cent residuals are asymmetric along the major axis. This disc structure suggests an inclined Sc spiral galaxy. There are several galaxies ($\sim$20) in the field of view ($45 \times 45$ arcsec$^2$) of this image, so this host might be member of a group or a cluster.

2.3 Optical-to-radio continuum spectrum

We derive the continuum spectrum from data archives (see Table 1) as displayed in Fig. 4. We retrieve data points in the optical and in submillimetre wavelengths as follows. (i) In the optical, one point was obtained from the SCP $R = 21.7$ measurement and the other was derived from a compilation of three ‘unified’ images ($\langle \lambda \rangle = 5861.5$ Å with FWHM = 4410 Å) from the *HST* archive. They are both consistent. (ii) In the submillimetre range, we use the $7\sigma$ and $6\sigma$ SCUBA (Submillimetre Common-User Bolometer Array) detection (Farrah et al. 2004) at 850 and 450 μm. We then derive upper limits from the released All-Sky Surveys, which observed this position, namely *galex* at 150 and 227.5 mm, 2MASS in J, H and $K_s$ (Skrutskie et al. 2006), IRAS (10, 25, 60 and 100 μm) and NRAO VLA Sky Survey (NVSS) at 1.4 GHz (Condon et al. 1998).

Table 1. Data points retrieved from various archives. We provide the observed fluxes ($\Phi_\nu$) and associated error ($\Delta \Phi_\nu$) or the $3\sigma$ upper limits obtained or derived from the mentioned archives.

| $\lambda$ (μm) | $\Phi_\nu$ (mJy) | $\Delta \Phi_\nu$ (mJy) | $3\sigma$ upper limits (mJy) | Archives |
| --- | --- | --- | --- | --- |
| 0.15 | | | $8.9 \times 10^{-3}$ | *galex* |
| 0.23 | | | $8.9 \times 10^{-3}$ | *galex* |
| 0.59 | $5.5 \times 10^{-3}$ | | | *HST*/STIS |
| 0.69 | $6.0 \times 10^{-3}$ | | | SCP |
| 1.0 | | | 0.44 | 2MASS |
| 1.7 | | | 0.65 | 2MASS |
| 2.2 | | | 0.79 | 2MASS |
| 12 | | | 60 | IRAS |
| 25 | | | 71 | IRAS |
| 60 | | | 331 | IRAS |
| 100 | | | 302 | IRAS |
| 450 | 20.80 | 3.54 | | SCUBA$^a$ |
| 850 | 7.80 | 1.10 | | SCUBA$^a$ |
| 214 × 10$^3$ | | | 0.45 | NVSS |

*Farrah et al. (2004)*

We then compare this continuum spectrum with various templates. First, we superimpose the measurements of the nearby galaxy sample of Dale et al. (2007), that we normalize to 0.01 mJy at 4500 Å and shift to the appropriate redshift. Secondly, we add starburst templates obtained by Melchior et al. (2001) by fits to HR10 (Dey et al. 1999) and NGC6090 (Calzetti et al. 2000). They correspond, respectively, to a star formation rate of 373 and $32M_\odot$ yr$^{-1}$.

![Figure 3. HST/STIS image of SN1997ey host. The left-hand panel displays the optical image of this galaxy. The right-hand panel shows the modelling obtained by GALFIT. On each panel, the crosses indicate, respectively, the positions of the galaxy centre (J200004h56m58s1 −02° 37′ 34″3) and of SN1997ey (J200004h56m58s2 −02° 37′ 37″).](image)

![Figure 4. Host galaxy continuum spectrum of the SNIa SN1997ey. The (red) symbols correspond to direct detections (bullets) and upper limits (arrow) obtained from various archives. The (red) data points display the detection and upper limits derived *galex*, SCP, *HST*/STIS, 2MASS, IRAS, SCUBA (Farrah et al. 2004) and NVSS. See details in the text. The (light blue) connected data points are from Dale et al. (2007). The full line and dashed line templates correspond to fits to the starburst galaxies: HR10 (Dey et al. 1999) and NGC6090 (Calzetti et al. 2000). They correspond, respectively, to a star formation rate of 373 and $32M_\odot$ yr$^{-1}$.](image)
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3 CO OBSERVATIONS AND REDUCTION OF THE DATA

We observed at IRAM 30 m in May 2004 the CO(2–1) line at 146.373 GHz and the CO(3–2) line at 219.55 GHz, relying on the spectroscopic redshift (z = 0.575) of the host. At these frequencies, the telescope’s half-power beam widths are, respectively, 17 and 11 arcsec. We integrated 19.53 h on this source, with typical system temperatures of 180 and 260 K (on the T2 scale). Wobbler-switching mode was used, with reference positions offset by 130 arcsec in azimuth. For each line, 1-MHz filter bank was used with a bandwidth of 512 MHz and channel spacing 1 MHz, and the VERSatile SPectrometer Assembly backend with a bandwidth of 640 MHz and channel spacing 1.25 MHz.

The reduction was performed with the IRAM GILDAS software.1 For each line, the spectra were added and an horizontal baseline was fitted and subtracted. This simple procedure ensures to avoid possible artefact due to bad baseline subtraction. The flat resulting spectra, displayed in Fig. 5, confirm the good conditions of observation but also the absence of signal. We then resample the channels in order to reach 30.7 km s$^{-1}$ per channel at 146.373 and 219.55 GHz. Last, we calibrate the spectra using the standard S/T$^2_A$ factors: 6.7 and 8.7 mJy K$^{-1}$. As displayed in Fig. 5, we do not detect any CO lines at the 3.2 and the 4.7 mJy (rms) levels, respectively.

Given the secure spectroscopic optical redshift and the large bandwidth at 2 mm, we do not expect a large velocity shift, which could explain this missing CO emission. Very few galaxies (usually at z > 3) present a CO-line width larger than 1000 km s$^{-1}$. We would have detected a non-flat baseline at 2 mm given our reduction procedure.

Following, e.g. Solomon & Vanden Bout (2005), we then compute various upper limits with different CO-line width $\Delta v$ assumptions as displayed in Table 2. (i) The velocity integrated flux $S_{\text{CO}}$ in Jy km s$^{-1}$, (ii) The CO-line luminosity $L_{\text{CO}}$ expressed in K km s$^{-1}$ pc$^2$, computed as

$$L_{\text{CO}} = 3.25 \times 10^7 S_{\text{CO}} \Delta v \frac{D_L^2}{r_{\text{obs}}(1+z)^2},$$

where $S_{\text{CO}}$ is the CO flux in Jy, $\Delta v$ is the (expected) line width in km s$^{-1}$, $r_{\text{obs}}$ is the rest frequency of the line in GHz and $D_L$ the luminosity distance in Mpc. (3) The H$_2$ mass $M(H_2) = \alpha L_{\text{IR}}$ assuming a Milky Way mass-to-CO luminosity ratio $\alpha = 4.6 M_\odot/(K \text{ km s}^{-1} \text{ pc}^2)$. (4) The infrared luminosity $L_{\text{IR}}$, expressed in $L_\odot$, relying on the relation for isolated and weakly interacting galaxies from Solomon & Sage (1988):

$$L_{\text{IR}} = 3.1 \times 10^8 \left( \frac{L_{\text{CO}}}{10^9} \right)^{0.74}.$$  

(5) The SFR in M$\odot$ yr$^{-1}$ based on Kewley et al. (2002) empirical relationship:

$$\text{SFR} = 1.7 \times 10^{-10} L_{\text{IR}}.$$  

We assume that the (expected) CO flux ($S_{\text{CO}}$) is increasing as $\sim v^2$ for the first CO lines, for a given H$_2$ mass, as derived for starbursts by Combes, Maoli & Omont (1999). The ratios $L_{\text{CO}}/(J = 2–1)$/$L_{\text{CO}}$ ($J = 1–0$) and $L_{\text{CO}}/(J = 3–2)$/$L_{\text{CO}}$ ($J = 1–0$) are thus taken to be equal.

Table 2. Upper limits computed for the two studied CO-lines (IRAM-30 m observation). We consider different assumptions for the expected line widths and provide $\sigma$ upper limits on the line integrated intensity $S_{\text{CO}}$ $\Delta v$ and the CO line luminosity $L_{\text{CO}}$. Assuming a CO-to-H$_2$ ratio appropriate for the Milky Way, we estimate an upper limit on the molecular mass $M(H_2)$. Relying on the relation for isolated or weakly interacting galaxies from Solomon & Sage (1988), we provide upper limits on the infrared luminosity $L_{\text{IR}}$. Last, using the relation of Kewley et al. (2002), we derive upper limits on the SFR.

| Lines     | 100  | 250  | 500  | 750  |
|-----------|------|------|------|------|
| CO(2–1)   | 0.532| 0.841| 1.19 | 1.46 |
| CO(3–2)   | 0.782| 1.24 | 1.75 | 2.14 |
| CO(2–1)   | 2.31 | 3.65 | 5.17 | 6.33 |
| CO(3–2)   | 1.51 | 2.39 | 3.37 | 4.13 |
| CO(2–1)   | 1.06 | 1.68 | 2.38 | 2.91 |
| CO(3–2)   | 0.69 | 1.10 | 1.55 | 1.9  |
| CO(2–1)   | 1.07 | 1.55 | 2.05 | 2.41 |
| CO(3–2)   | 0.76 | 1.10 | 1.45 | 1.71 |

1 http://www.iram.fr/IRAMFR/GILDAS.
to 1. This assumes that the lines are thermalized at high temperature and optically thick. This might not be the case for our host galaxy, in which case if one relies on studies of nearby galaxies our upper values should be multiplied by a factor of the order of 1.1 (Braine & Combes 1992) and 1.6 (Devereux et al. 1994).

Fig. 6 displays the upper limits derived from our observations on $L'_{\text{CO}}$, compared to previous detections of submillimetre galaxies detected in CO (Sanders, Scoville & Soifer 1991; Solomon et al. 1997; Yao et al. 2003; Greve et al. 2005). We also add for comparison the upper limits obtained by Endo et al. (2007b) and Le Floc’h et al. (in preparation) for long Gamma-Ray Burst (GRB) hosts. We assumed for all GRB hosts upper limits based on $\Delta v = 250$ km s$^{-1}$. This figure shows that our measurements are competitive with the current state of the art.

4 DISCUSSION

On the basis of the optical spectrum (SFR, $[\text{O} \ \text{II}] \sim 0.2 \ M_\odot \text{yr}^{-1}$), the $B$ luminosity ($0.7 \ L_B$) and the CO lines upper limits, we can securely exclude that this host galaxy is a strong starburst galaxy. We can derive a star formation rate per unit luminosity of $0.3 \ M_\odot \text{yr}^{-1}/L_B$.

We can derive a star formation rate of $780 \ M_\odot$ and take into account the atmospheric windows at IRAM. The specific SFR is obviously low with $3 \ M_\odot/\text{yr}$ and optically thick. This might not be the case for our host galaxy, in which case if one relies on studies of nearby galaxies our upper values should be multiplied by a factor of the order of 1.1 (Braine & Combes 1992) and 1.6 (Devereux et al. 1994).

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We consider two possible explanations. (1) The heating source of the large gas mass is hidden in the nucleus and escapes detection. This would require a background object.

The host galaxy cannot heat the dust up to temperatures close to 20 K (Bethell et al. 2004). However, nothing suggests an AGN component in the optical spectrum nor in the ROSAT All-Sky Survey (RASS), while the 1.4 GHz upper limit is compatible with a quiescent or moderate starburst galaxy. Alternatively, Clements et al. (2005) discussed that this strong submillimetre flux could correspond to cirrus, which could explain the absence of starburst, and derived a (cold-) dust mass of $1.3 \times 10^4 \ M_\odot$ ($T_{\text{dust}} \sim 20$ K). This is nevertheless quite far-fetched as this would correspond to a very large mass of gas: $2 \times 10^4 \ M_\odot$, assuming a canonical Galactic (cold) dust-to-gas ratios of 1/150, and excluded given our non-detection of the CO(2–1) line and the excitation temperature of CO(2–1) ($T_{\text{ex}} \sim 15$ K).

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is well associated with the HDF galaxy 2-264.1 (Cohen et al. 1996; Williams et al. 1996), which also has near-infrared, mid-infrared and radio counter-parts. This supernova belongs to the SN1a sample observed with Spitzer by Chary et al. (2005) and is peculiar in the sense that it has the sole host detected in the submillimetre. This supernova lies at 0.84 arcsec from the centre of the spiral galaxy, which corresponds to a projected distance of 4.9 kpc. Even though this host is in a starburst phase, it is most probable that the SN exploded in the outskirts of the starburst zone. Various values of its SFR have been estimated in the literature and tend to converge towards 25 M⊙ yr⁻¹ (Chary et al. 2005; Pope et al. 2006), while it is a relatively small mass system with L∗ ~ 3L⊙. It does not display clear Ca II H and K absorption lines, but exhibits strong [O II] and Hβ emission lines. It is thus a starbursting galaxy, with a star formation rate per unit luminosity of 84 M⊙ yr⁻¹ L⊙/L⊙. For this galaxy, all the observational facts point towards a moderate starburst of 25 M⊙ yr⁻¹ and 0.3L⊙.

5 CONCLUSIONS
We discussed the properties of SN1997ey host. This SN1a occurred in a late-type system (0.7L⊙). According to the optical data, this disc galaxy exhibits a residual star formation activity but no obvious sign of AGN activity. In parallel, a 6σ and 7σ submillimetre flux is detected at 450 and 850 μm but no heating source explaining this strong continuum submillimetre flux is detected. We search for CO lines at z = 0.575 in this initially promising galaxy but we have only been able to derive upper limits. We suggest that either the AGN/starburst activity is hidden by dust in the nucleus or this host galaxy is anemic or passive and this strong submillimetre source associated with a background galaxy.

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See the spectrum in the Hawaii HDF active catalogue http://www.ifa.hawaii.edu/~cowie/cts/hdf17.html.
APPENDIX A: PROBABILITY OF ASSOCIATION WITH GRB971221

Bosnjak et al. (2006) performed a statistical analysis to determine the association rate of GRB and SN. They consider both short and long duration bursts as well as core-collapse and SNeIa. Surprisingly, the short burst GRB971221 has thus been associated with SN1997ey. The burst was detected 1997 December 21, while the supernova was discovered on December 29 (expected to be the maximum of the light curve $±6$ d). As the maximum of SNIa light curves is expected $19.1 \times (1 + z)$ days after the explosion (Conley et al. 2006), the association is plausible. However, the error box of 6:3 affecting GRB050709 position is so large that the probability of a chance alignment is huge. If one integrates up to $z = 2$, a Schechter function (with $\alpha = -1.12$, $\phi_* = 0.0128 \text{ Mpc}^{-3}$, $M_* = -19.43$, Marzke et al. 1998) with a uniform galaxy distribution, one expects $7 \times 10^4 \text{ galaxies}$ up to $z = 0.5$ and $2 \times 10^5 \text{ galaxies}$ up to $z = 2$ in the GRB error box. Given the SNeIa rate published by Sullivan et al. (2006) and assuming an average stellar mass of the galaxies of $10^{10} \text{ M}_\odot$, $5.3 \times 10^{-4}$ SNeIa are expected per year and per galaxy. Given the number of galaxies present in the GRB error box and assuming a temporal window of 14 d, one can expect about 140 (2000) SNeIa, while 0.007 short GRB would be expected. We thus consider the association as highly improbable.

Only a few short GRB (Levan et al. 2007, and references therein) were intensively monitored to exclude definitively some association with SN. From a theoretical point of view, short GRB are usually thought to be generated by the merger of two neutrons stars or one neutron star with a black hole (e.g. Paczynski 1991; Narayan, Paczynski & Piran 1992), so no association with SNeIa is expected. However, King, Pringle & Wickramasinghe (2001) suggested that the merger of two white dwarves could lead to the formation of a magnetar, which could produce short GRB as studied by Levan et al. (2006). Interestingly, coalescing white dwarf binary is one of the channel considered for the production of SNeIa (Iben & Tutukov 1984; Webbink 1984; King et al. 2001; Ivanova et al. 2006), compatible with observations of the population of double white dwarfs in the Galaxy (Nelemans et al. 2001). The result of this coalescence depends on the locus of the carbon ignition, and Saio & Nomoto (2004) argue that it probably occurs in the envelope preventing the explosion of an SNIa.