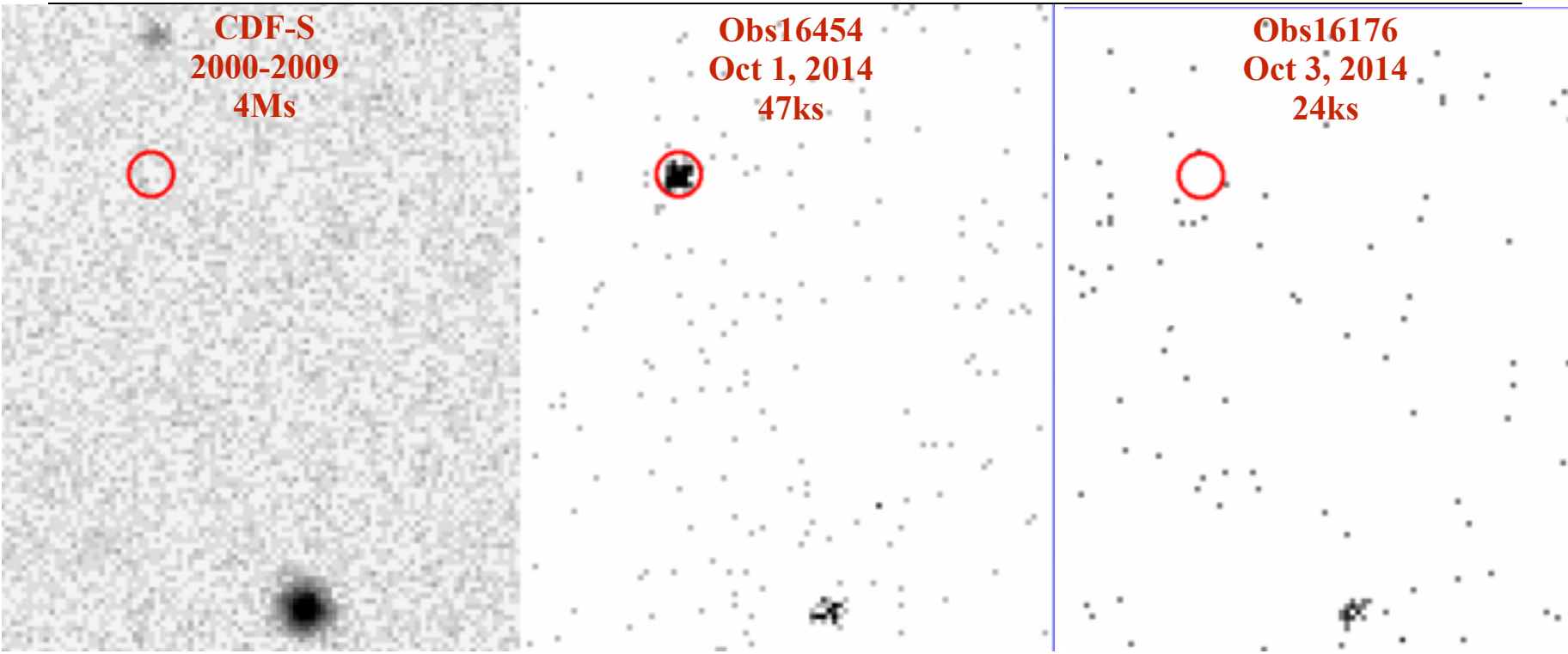
An X-ray Transient Goes Bump in the Night



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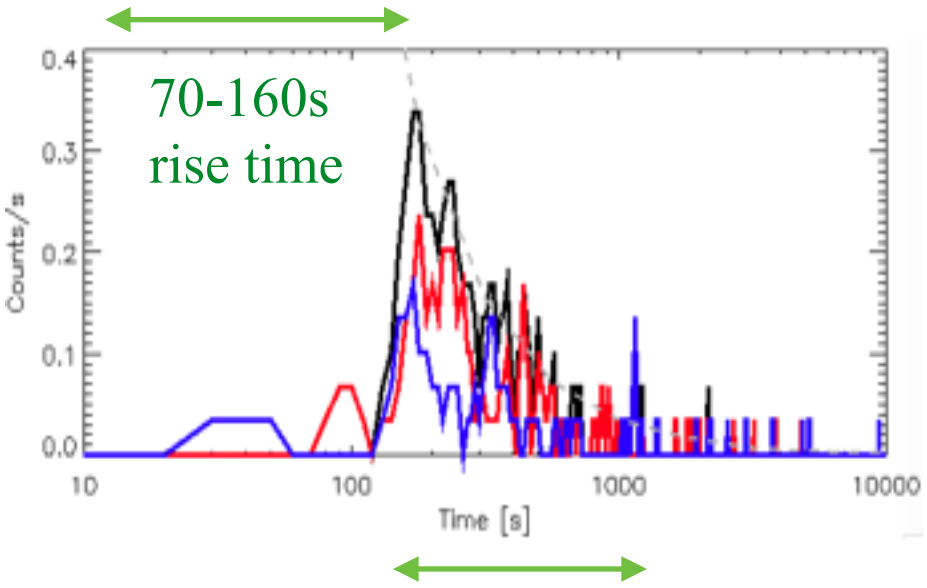
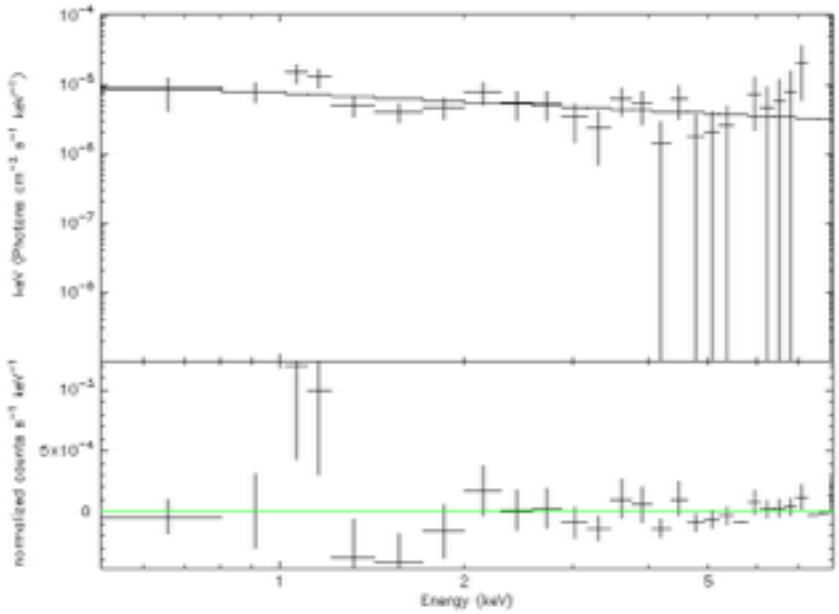
High Energy Properties

- Detected 2014 October 01 07:04:37 UT
- 110 counts in 0.5-8 keV band in ~1ks
- Event fell outside of both Swift/BAT and Fermi FOVs (not sampled above >10 keV).
- Not detected by GRB Network/MAXI.

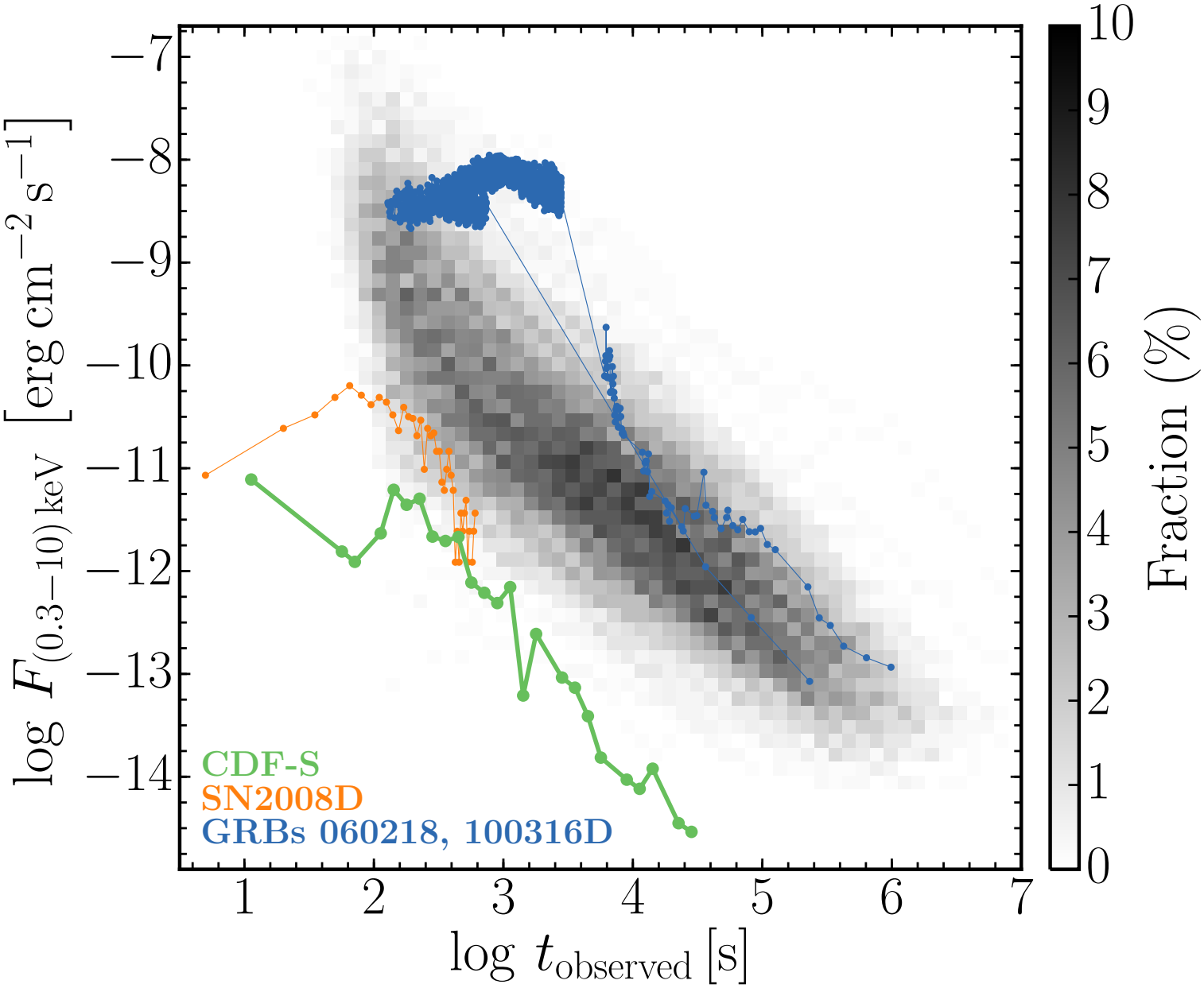


~1000s decline as
$F_{(2-10keV)} \propto (t / 75s)^{-1.5}$

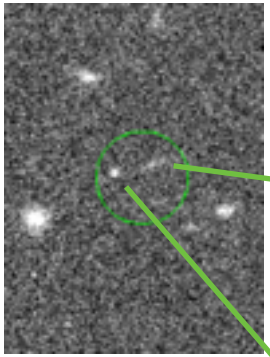


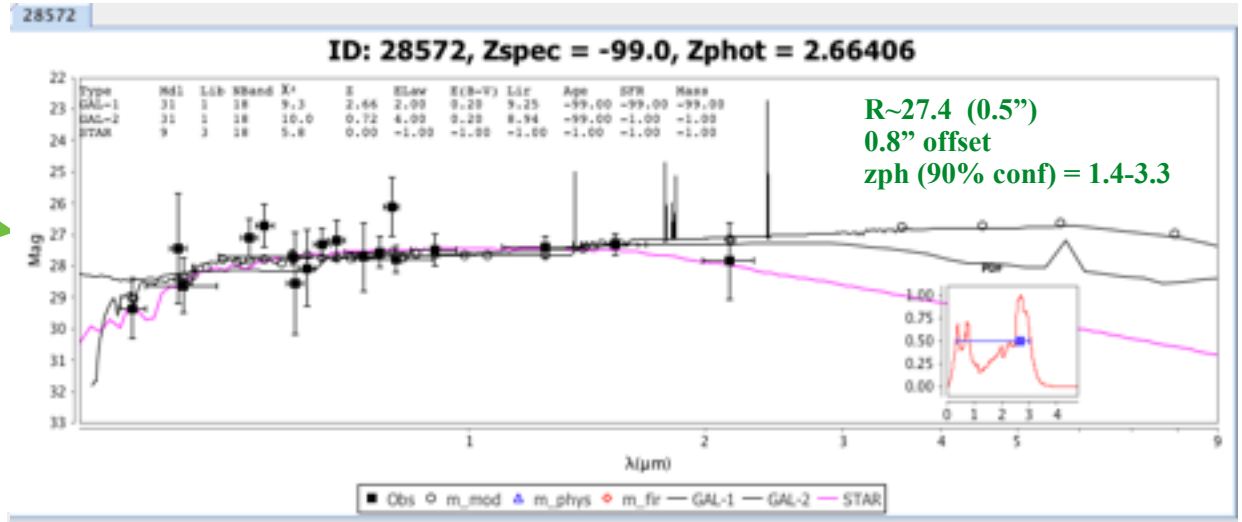
Γ=1.40+/-0.3 (90% conf.) power law
kT=12 thermal (unconstrained)
N_H => Galactic (3e20 cm^{-2})

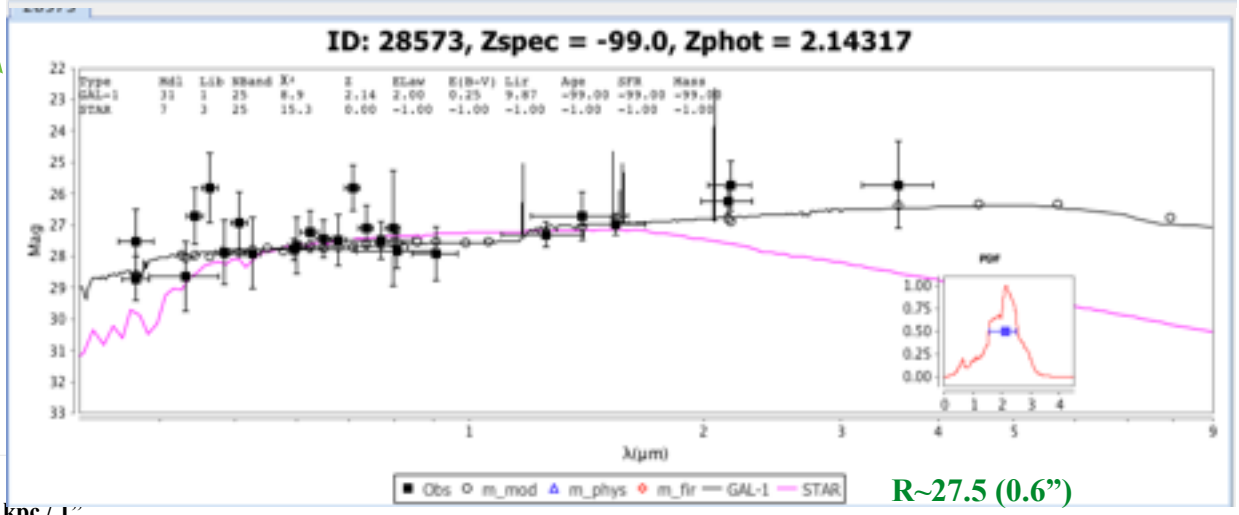
Faint/off-axis GRB? Shock Breakout from CCSNe?!?!?!



Potential Host?







R~27.5 (0.6")
0.4" offset
zph (90% conf) = 0.2-3.1

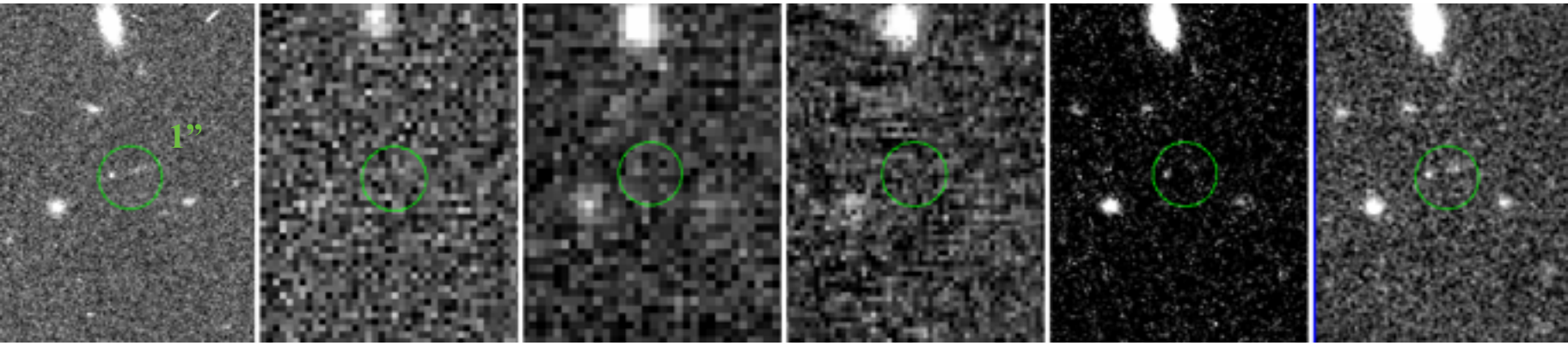
X-ray position should be good to ~0.5"

(10^{45} erg/s)

Redshift	$L_{2-10keV}$	$M_{R,Host}$	
0.30	0.3	-12.5	<= 4.5 kpc / 1"
0.50	1.1	-14.5	
1.00	6.0	-16.5	<= 8.0 kpc / 1"
2.00	32.9	-17.5	
5.00	297.0	-20.5	<= 6.3 kpc / 1"
8.00	884.0	-21.5	

Optical Imaging

reference	(80 min) Oct 01, 2014	(18 day) Oct 19, 2014	(28 day) Oct 29, 2014	(113 day) Jan 22, 2015	reference

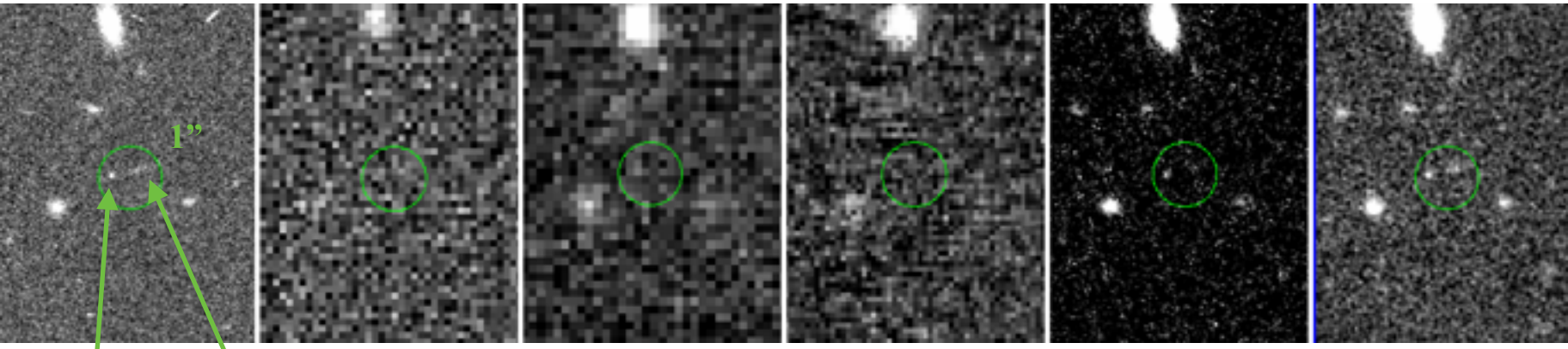


CANDELS F814W	VIMOS R	FORS2 $R_{special}$	GMOS $R_{special}$	CANDELS F110W	CANDELS F125W
	R<~25.5	R<~26.5	R<~26.0	J<~27.5	

X-ray position should be good to ~0.5”

Nothing obvious, still need to finalize difference imaging for better constraints.

Optical Imaging



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	R<~25.5	R<~26.5	R<~26.0	J<~27.5	

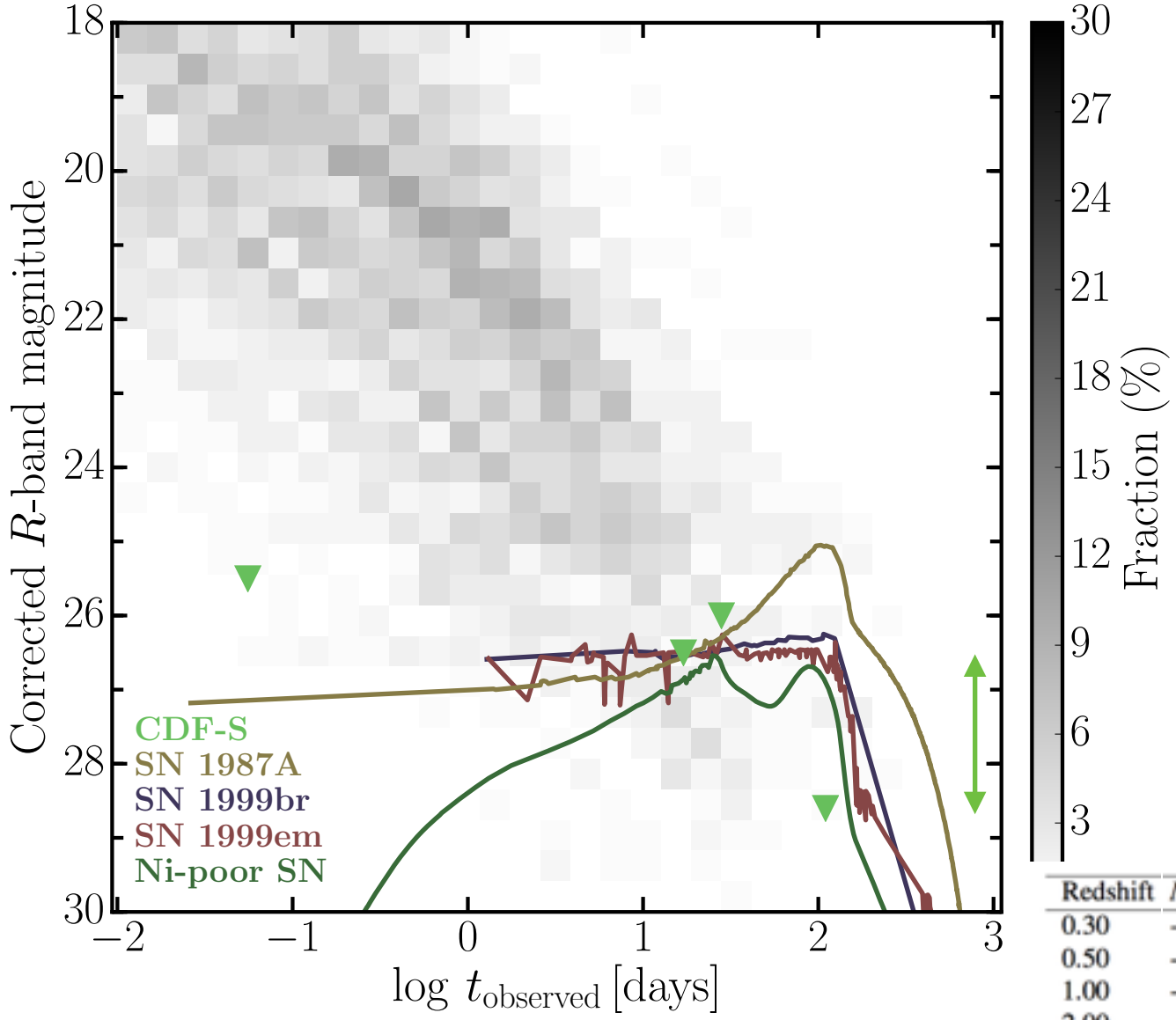
R=27.4
0.8” offset

R=27.5
0.4” offset

X-ray position should be good to ~0.5”

Nothing obvious, still need to finalize difference imaging for better constraints.

Optical Transient Constraints



E (10^{48} erg)
0.3
1.1
6.0
32.9
297.0
884.0

Redshift	$M_{R,E1}$	$M_{R,E2}$	$M_{R,E3}$	$M_{J,E4}$
0.30	-14.5	-13.5	-14.0	-12.5
0.50	-16.5	-15.5	-16.0	-14.5
1.00	-18.5	-17.5	-18.0	-16.5
2.00	-19.5	-18.5	-19.0	-17.5
5.00	-22.5	-21.5	-22.0	-20.5
8.00	-23.5	-22.5	-23.0	-21.5

Radio Constraints

[Previous | Next | ADS]

Radio observations of a fast X-ray transient in the Chandra Deep Field-South survey

ATel #6583; *Davide Burlon (USyd/CAASTRO), Keith Bannister (CSIRO/CAASTRO), Paul Hancock (Curtin/CAASTRO), Martin Bell (CSIRO/CAASTRO), Tara Murphy (USyd/CAASTRO), Minh Huynh (UWA), Bryan Gaensler (USyd/CAASTRO)*
on 16 Oct 2014; 10:30 UT
Credential Certification: Davide Burlon (davide.burlon@sydney.edu.au)

Related
6650 Optical Gemini-S/GMOS observations of a fast X-ray Transient in the CDF-S
6603 Optical VLT/FORS Observations of a Fast X-ray Transient in the CDF-S
6583 Radio observations of a fast X-ray transient in the Chandra Deep Field-South survey
6541 Discovery of a fast X-ray transient in the Chandra Deep Field-South survey

Subjects: Radio, X-ray, Transient, Variables

Referred to by ATel #: 6603

Tweet 4 Recommend 17

We observed at the coordinates of the X-ray transient source reported in ATel #6541 at the coordinates (J2000)

RA= 03:32:38.80
DEC= -27:51:34.1

On 8 October 2014 we used the Australian Telescope Compact Array (ATCA) in 1.5km configuration and conducted observations at 2.1, 5, 9, 17, and 19 GHz respectively.
Bandpass calibration was done using 1921-293 and absolute flux calibration with was 1934-638 at all frequencies. For the 16cm receiver (2.1 GHz) we used 0346-279 as the phase calibrator. For the 4cm and 15mm receivers (5/9 and 17/19 GHz) we used 0327-241 as the phase calibrator.

Preliminary analysis gives non-detections with 3 sigma rms noise measurements of:

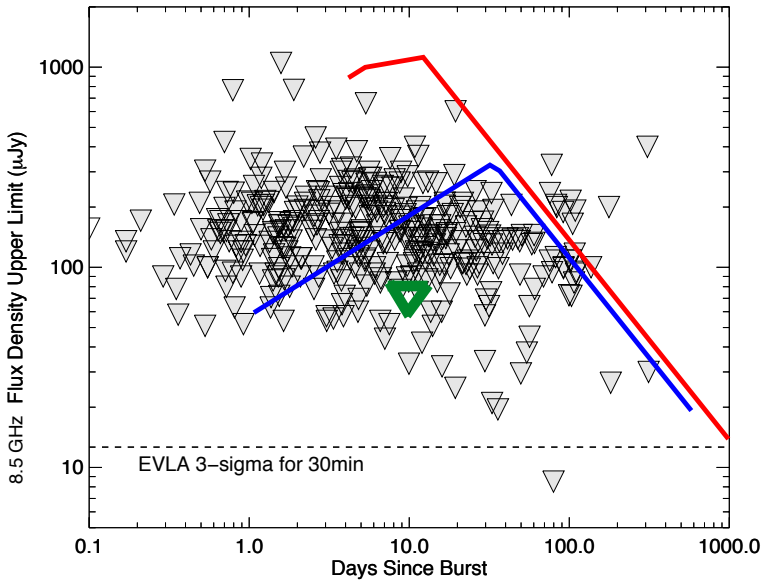
174 microJy at 2.1 GHz
81 microJy at 5 GHz
75 microJy at 9 GHz
105 microJy at 17 GHz
99 microJy at 19 GHz

Observations of the eCDFS by Miller et al. (2013) at 1.4 GHz with the VLA show no 1.4 GHz radio source is detected within the positional errors of the X-ray transient, giving an upper limit of S(1.4 GHz) ~ 24 microJy (3 sigma). Observations of the eCDFS by Minh et al. (2012) were conducted at 5.5 GHz between 2009 August 12 and 2010 January 16. Two further epochs of the CDFS field were obtained at 5.5 GHz by Bell et al. (in prep) in August 2012 and June 2012. No radio transient source was detected in those data either. Using the combined data from Huynh et al. (2012) and Bell et al. (in prep.) between 2009 and 2012 we place an upper limit to S(5.5 GHz) of 27 microJy (3 sigma).

The nature of this transient remains unclear given the absence of other published detections at other wavelengths. Should this be a tidal disruption event similar to the well-known Sw 1644+57 source, its radio light curve should peak in early 2015, provided that the redshifts were similar. We note that if this transient is indeed associated with the close 3D-HST counterpart with a photometric redshift of ~0.53 (Skelton et al. 2014), it would place this source to a similar distance to that of Sw 1644+57, albeit dimmer by more than a factor 100x in the X-ray band. We plan further observations in the next months.

We acknowledge the rapid response of the ATCA personnel in granting this ToO and supporting the observation, in particular Phil Edwards, Jamie Stevens, and Baerbel Koribalski.

Chandra + Frail 2012



- radio observations point to a faint afterglow but some GRBs had even deeper limits.
- consistent with optical and X-rays, but radio limits nowhere near as deep.

Some Conclusions....

- ★ Tidal Disruption? X-rays “hard”, no optical or radio?
- ★ 100x fainter than Swift GRBs => Off-axis / faint long duration GRB?

  => Early optical constraint probably rules out normal afterglow (at z>5-6?). HST F110W constraint may rule out hi-z afterglows too?
- ★ Short duration GRB?
- ★ SBO from CCSNE?

  => Optical constraints seem to rule out all known SNe LCs to z ~ 0.5, and most even to z ~ 1-2 (+ energetics get difficult here as well?). Full fallback?
- ★ M dwarf flare? typically have M_R ~ 8-14

  => beyond 5-79 kpc (halo?) but L_X~(3.4-850)x10^{35} erg/s (>10^{3-5} x typical?)
- ★ XRB flare? But what companion? would push outside MW?
- ★ Something else?

Prospects for More…Prospects for Gemini…

- ★ Crude estimates of space densities suggest these transients could be ~10-1000x more common than currently detectable GRBs.
- ★ Future wide-field X-ray surveys could potentially find MANY.
- ★ Extremely fortunate “luck” for VIMOS constraint 80min after.
- ★ Unfortunate “luck” to wait 14-20 days to get next non-detection confirmations.
- ★ Multi-band opt/NIR constraints would have been quite helpful

- ★ Gemini Fast ToO well suited to constrain these.
- ★ Sensitive Multiband Imager or IFU (e.g., OCTOCAM) would provide much stronger constraints.