

Time Domain ISDT

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Other Participants: Paula Szkody, Brad Cenko, Ori Fox, Albert Stebbins, Katy Roth, Alak Ray

Time Domain

- Target of Opportunity - transient phenomenon [SNe, GRBs, GW sources, stellar flares, AGN, unknown transients, etc]
- Monitoring - Known variables
- Time critical – orbital phase variations, transiting exo-planets, solar system objects, etc

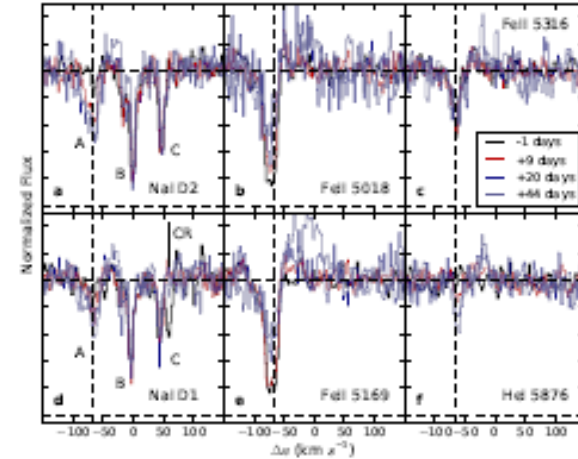
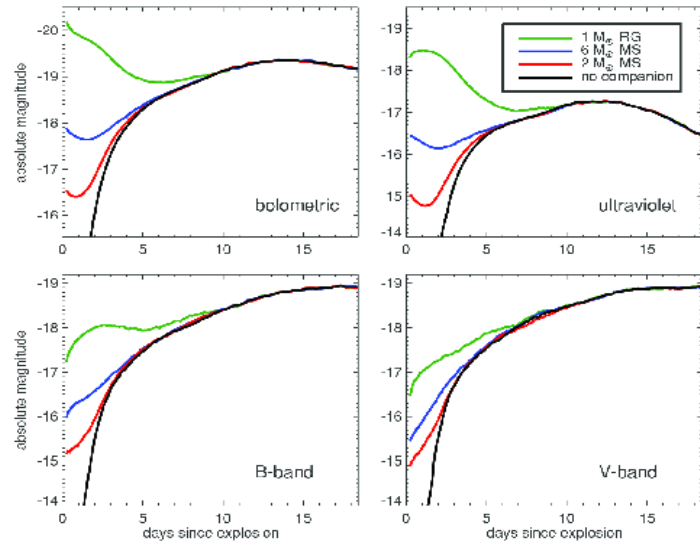
Key Programmes – a few thoughts

- Discussions within ISDT
- Discussions during the Time Domain sessions on 24 June 2015
- **Inter-partner ToO** - key programme is needed because ToO must be triggered beyond separated time allocation for each partner
- **Campaign Programmes** - key programme is needed because (a) multi-epoch observations; (b) required time largely exceeds available time for 1 partner

Inter-Partner ToO

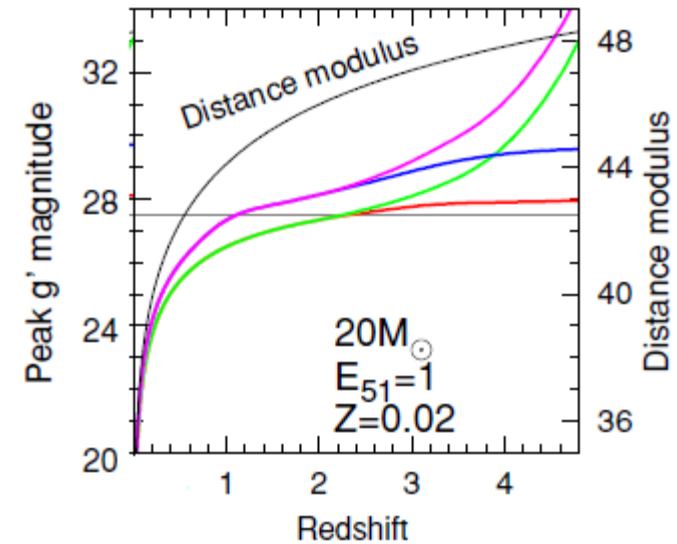
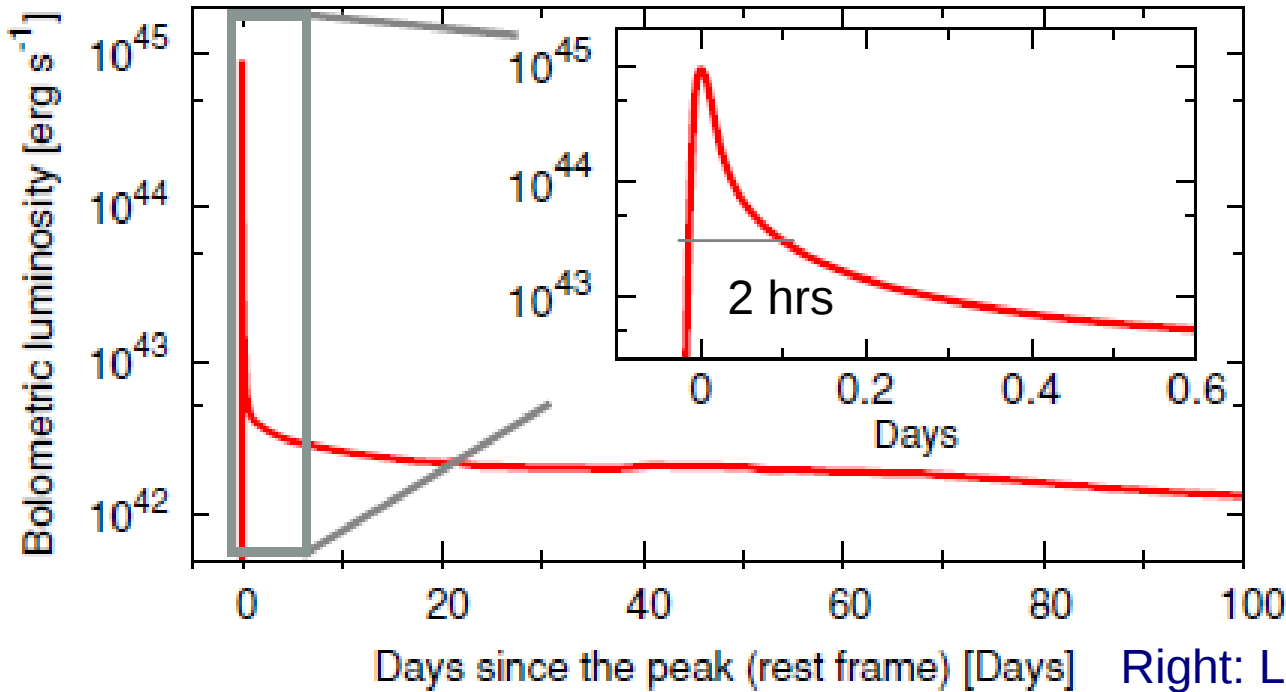
- Prompt Observations (<24hrs) – Synergy with various other facilities [LSST, HSC, gamma-ray, X-ray, Radio, GW]
 - Spectroscopy of GRBs and SNe (high-Z, faint)
 - [GRB – kilonova, chemistry of early universe]
 - Spectroscopic identification of GW sources
 - Optical follow-up of fast radio bursts
 - Unknown transients
 - Galactic transients – e.g. optical follow-up of thermonuclear X-ray bursts from accreting compact objects

Prompt Observations – SNe Ia



- Distinguish between single degenerate, double degenerate or sub-Chandra progenitors
 - Spectroscopy – signatures of CSM in the very early phases (Narrow absorption features)
 - Unburned carbon features

Prompt Observations - CCSNe



Right: Light curve of shock breakout
 Left: Expected peak magnitude as a
 Function of redshift for different extinction

Shock breakout most effectively detected by optical facilities, such as Subaru/Hyper Suprime-Cam (HSC) and LSST, with deep and wide-field capability (Tominaga et al. 2011).

The redshift range of the detection extends to $z \geq 2.5$ with the limiting magnitude in g'band of 27.5 mag (Tominaga et al. 2011).

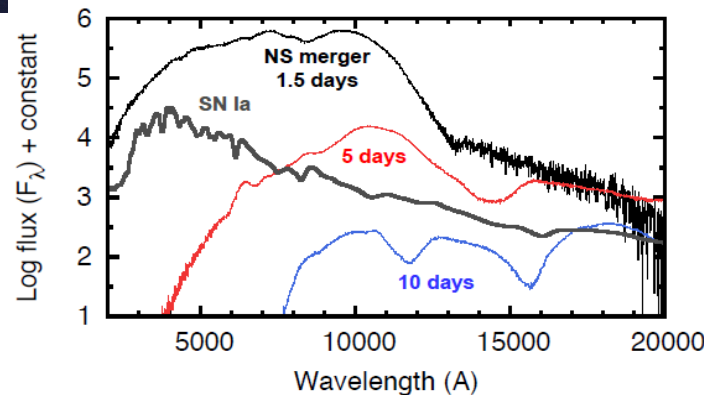
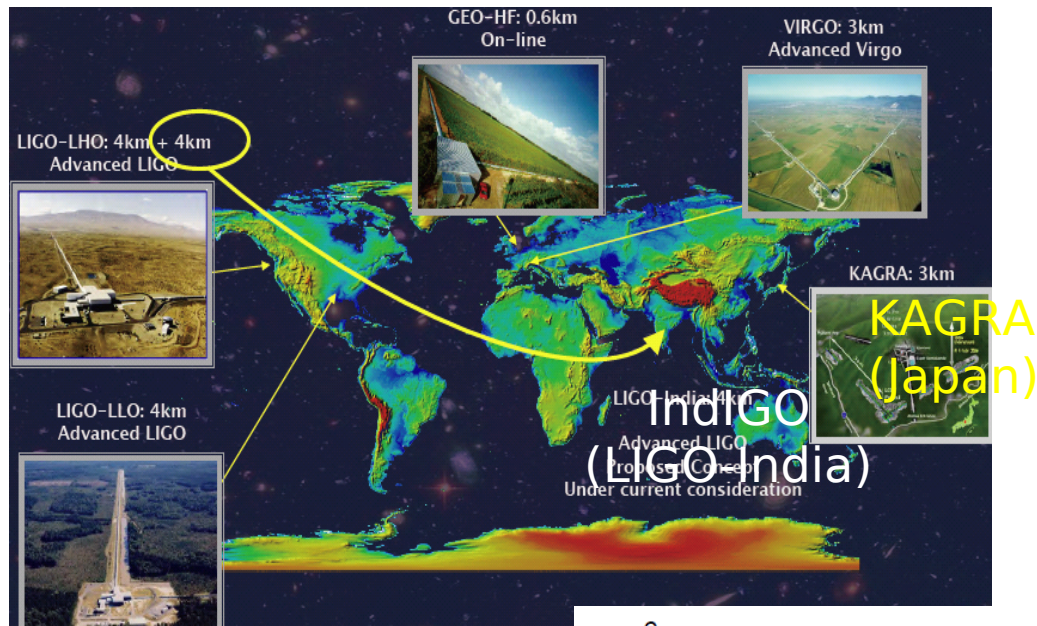
According to theoretical predictions, the typical decline rate of the shock breakout is 0.1 mag/hr at $z = 2$

Follow-up of Gravitational Wave Sources

Accelerating Massive Objects in Asymmetric System Generates GW. Possible Sources -

NS-NS(BH) collision (candidate of short GRBs); Core-collapse of Massive stars

Light Curves and spectroscopy - identification



GW detection
~ 100 deg²
Localization

Search with
Subaru/LSST/ZTF

Spectroscopy
with TMT

Identification of
GW sources

Campaign Programmes

- Late phase ($> 2\text{yr}$)
 - Spatially resolved (AO+IFU) observations of nearby supernovae
 - Dust formation
- Accreting compact objects
 - Neutron star / Black hole binaries
 - Companions of Binary radio pulsars
 - Cataclysmic variables – Novae, Dwarf Novae, Nova-likes

Requirements

- Scheduling and Operations
 - A common ToO policy for the TMT Observatory
 - Queue / flexible scheduling to enable “prompt observations” and monitoring programmes
- Instrument requirements (beyond first generation)
 - Fast readout detectors (WFOS??)
 - High resolution spectroscopy
 - Spectropolarimetry
 - Mid-IR

Looking Forward

Key science cases

- Expected science with first generation instruments
 - Simulations, narrow down on the objects, etc
- Instrument requirements
- Schedule and operations requirements

Other Time Domain Science cases

- Develop the science cases
- Instrument requirements
- Schedule and operations requirements
- Contact non-ISDT TD experts; other ISDTs