# International Science Development Teams (ISDT)

# Time-domain Science

Masaomi Tanaka
(National Astronomical Observatory of Japan)

# ISDT members

- **Initial member (2013 May) <= From each partner**
  - **G. C. Anupama (India) Convener (will join later via skype)**
  - **Lucas Macri (US)**
  - **Enrico Ramirez-Luiz (UC)**
  - **Masaomi Tanaka (Japan) Convener**
  - **Xiaofeng Wang (China)**
- **New members (2014 Feb) <= Call for application (2014 Jan)**
  - **Manjari Bagchi (India)**
  - **Varun Bhalerao (India)**
  - **U. S. Kamath (India)**
  - **Keiichi Maeda (Japan)**
  - **Shashi Pandey (India)**
  - **Warren Skidmore (US) Chapter editor**
  - **Nozomu Tominaga (Japan)**
  - **Lingzhi Wang (China)**
  - **Chao Wu (China)**
  - **Xufeng Wu (China)**

# Update of Detailed Science Case (2014 July)

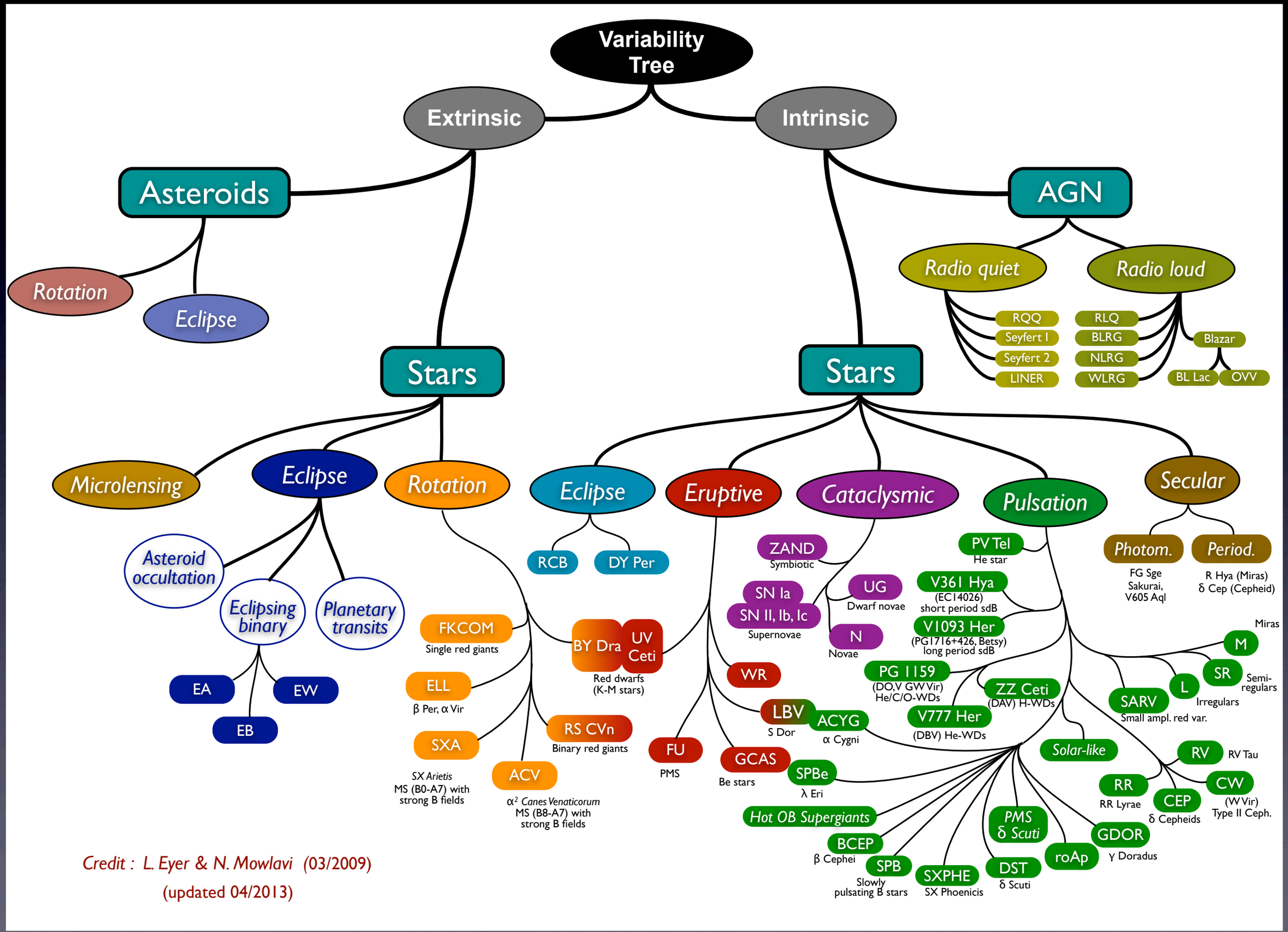
1. Introduction
2. Overview
3. Fundamental physics and cosmology
4. The early Universe
5. Galaxy formation and the intergalactic medium
6. Extragalactic supermassive black holes
7. Exploration of nearby galaxies
8. The formation of stars and planets
9. Exoplanets
10. Our solar system

Thirty Meter Telescope
Detailed Science Case: 2007

TMT Science Advisory Committee


**No section for time-domain science**

# Time-domain science??




*Credit : L. Eyer & N. Mowlavi (03/2009)*

(updated 04/2013)

# DSC 2014 draft

**Type Ia SN**

**Core-collapse SN**

**SN progenitor**

**GW sources**

**GRBs**

**Tidal disruption**

**CVs**

**Radio pulsars**

**Cepheids**

# Time-domain science??

**Target of opportunity observations**

Type Ia SN
Core-collapse SN
GW sources
GRBs
Tidal disruption
Classical novae

**Rapid response (telescope, operation)**

**Time-resolved observations**

CVs, X-ray binary (accretion disk)
Pulsars

**Rapid sampling (instruments)**

**Monitoring observations**

Cepheids
Binaries
RR Lyrae
AGNs

**Flexible time allocation**

# ToO observations => “transient” objects

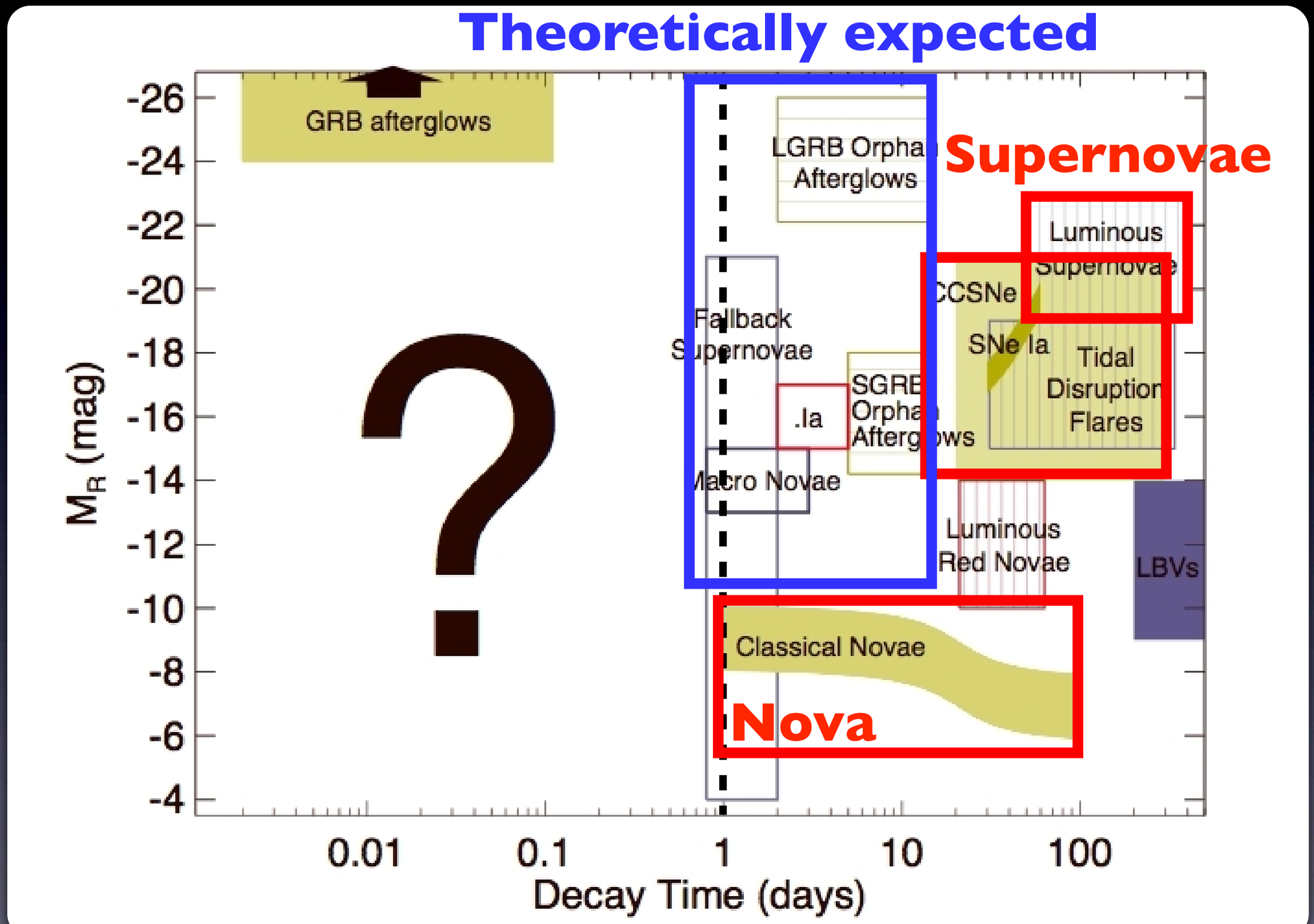
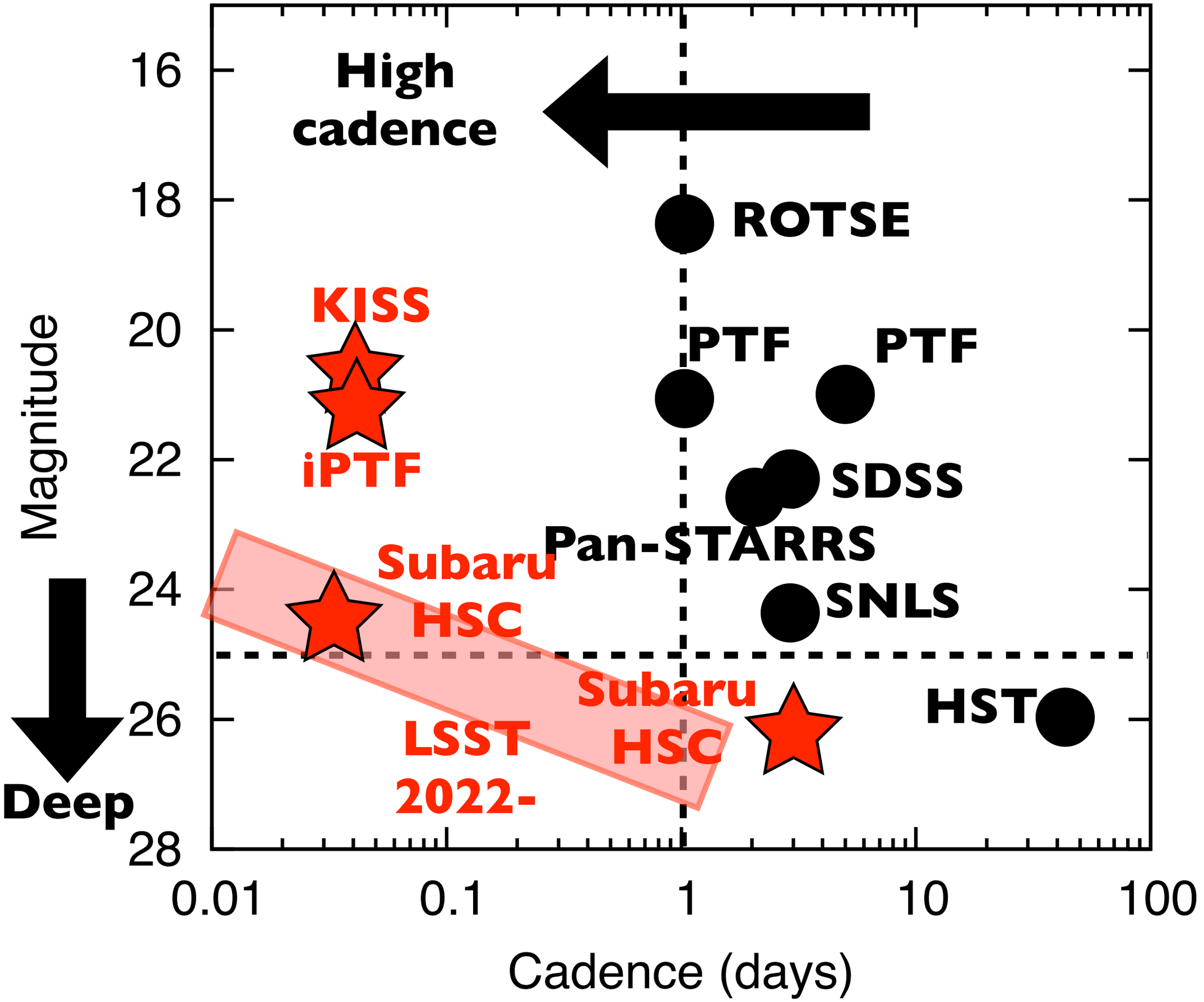
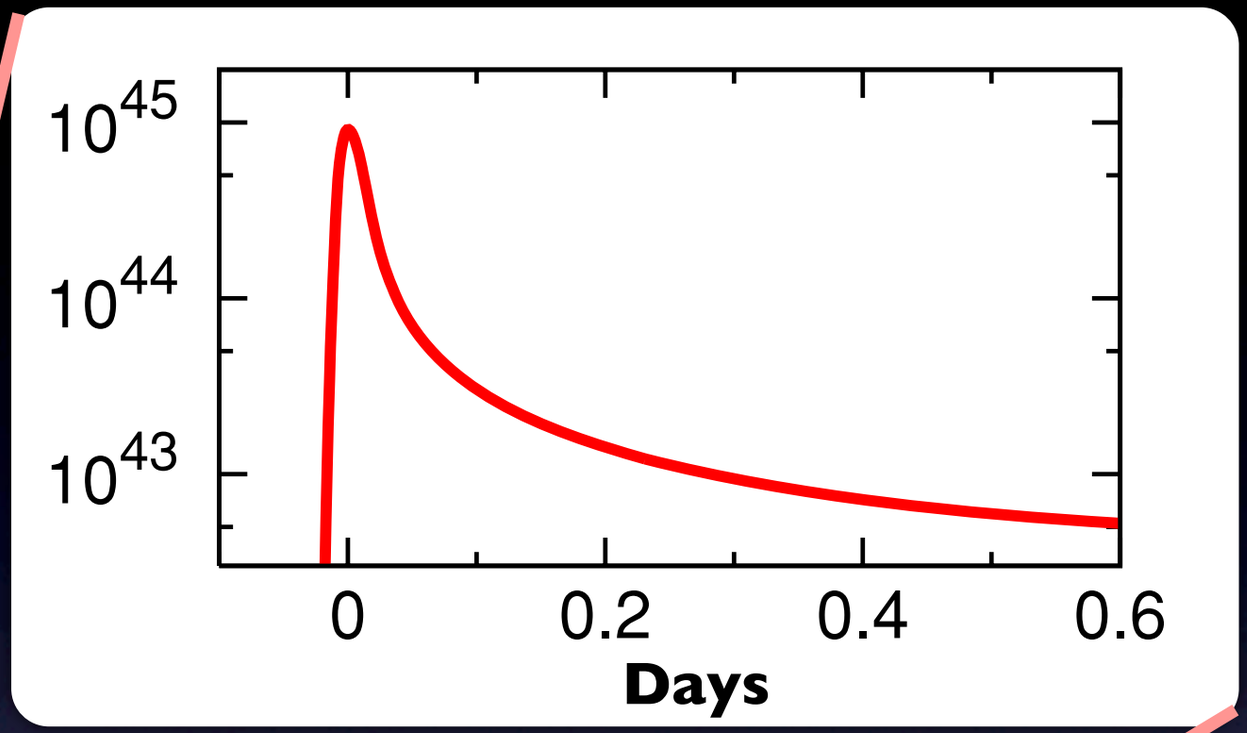


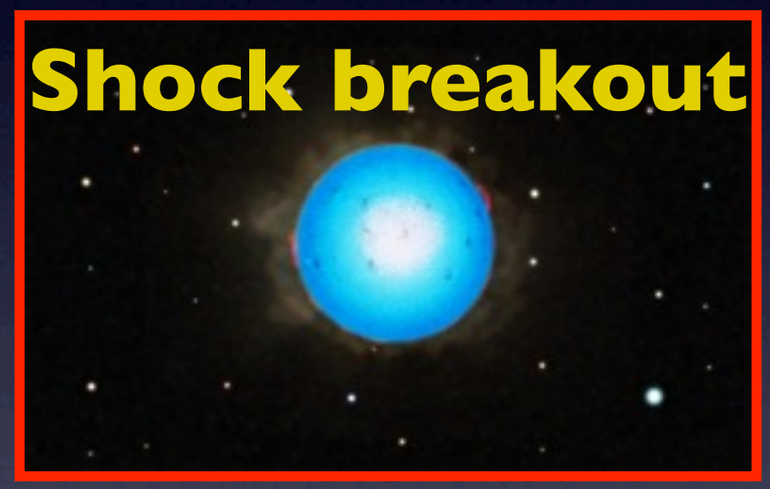

**Figure from LSST Science Book**
**(after PTF collaboration, Rau+09, Kasliwal+,Kulkarni+)**

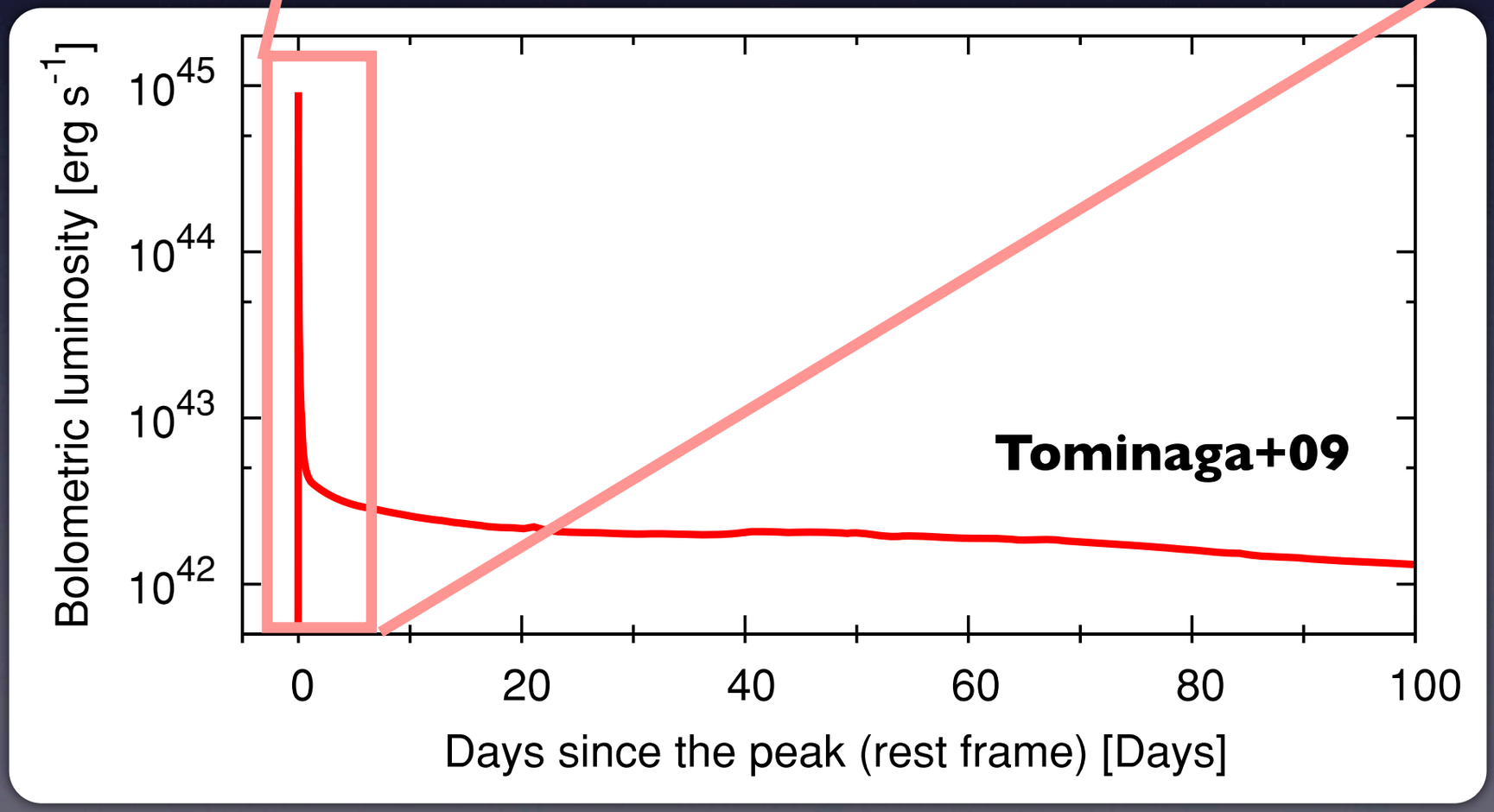

High cadence
ROTSE
KISS
PTF
PTF
iPTF
SDSS
Pan-STARRS
Subaru HSC
SNLS
HST
Subaru HSC
LSST 2022-
Deep
Magnitude
16
18
20
22
24
26
28
0.01
0.1
1
10
100
Cadence (days)

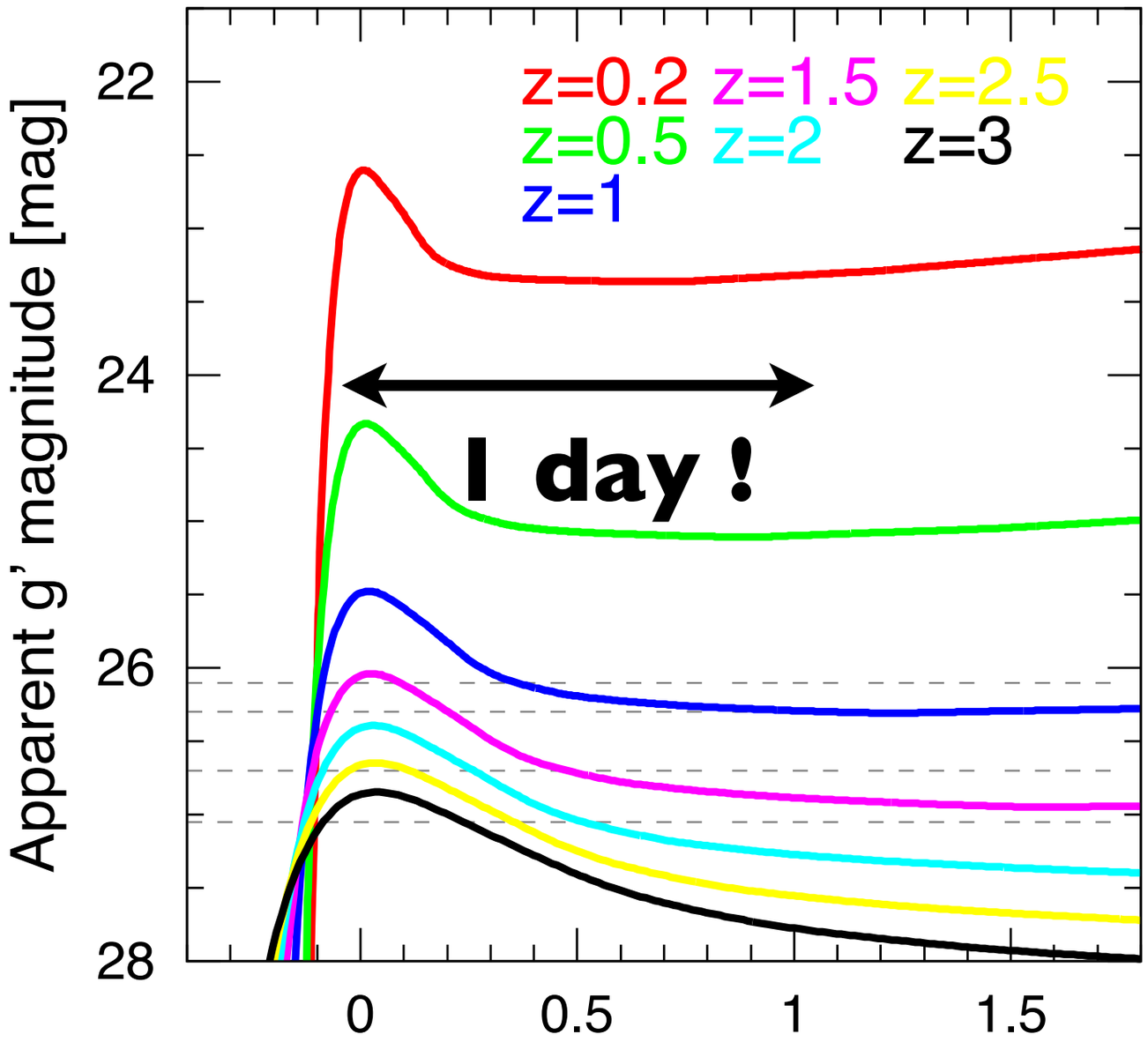
# The moment of supernova explosion








**Tominaga+11**

**High-cadence 10 deg² survey with 27 mag (g)**

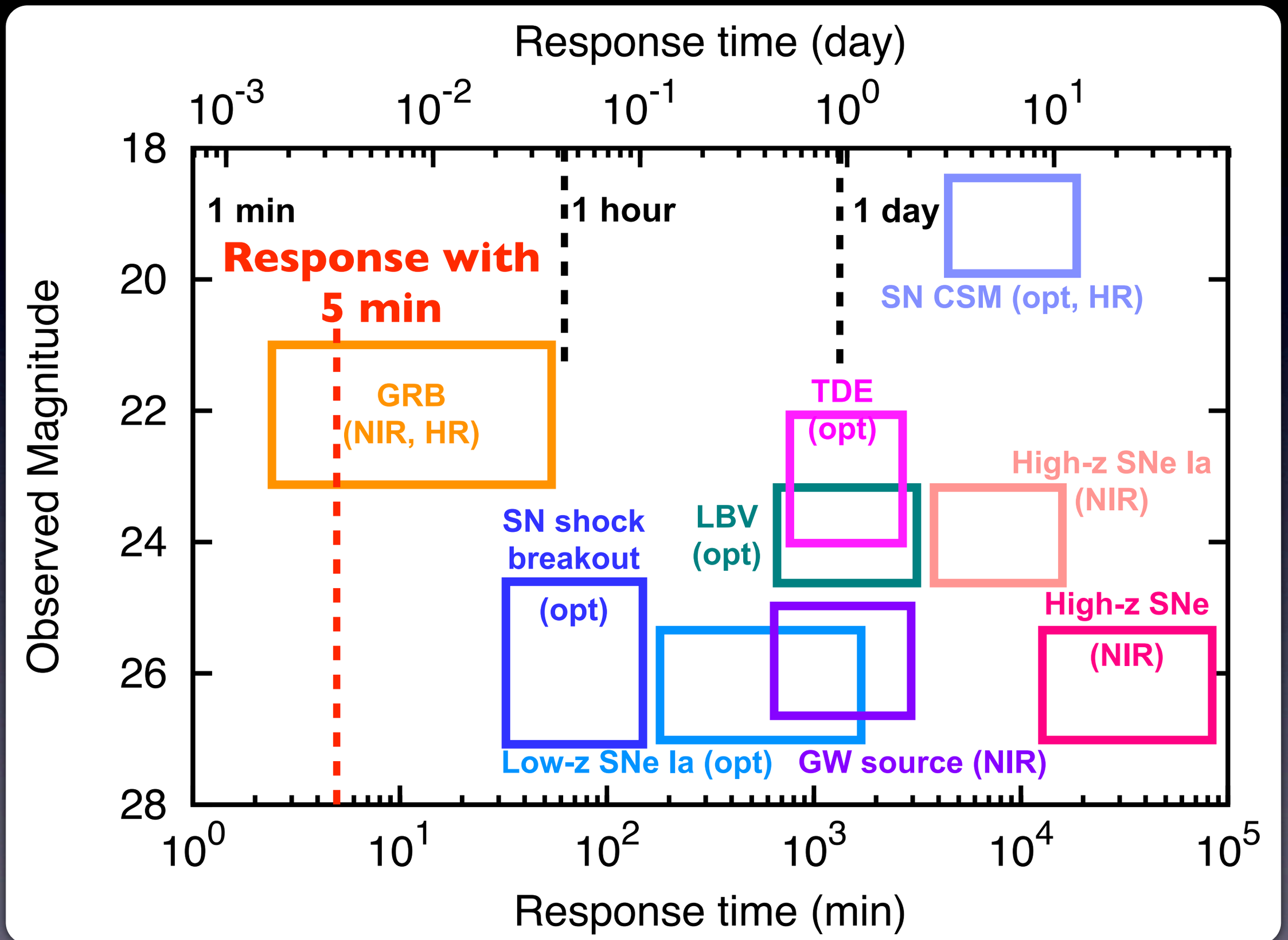
**Typical supernovae at z~2**

**R ~ 500-1000**
**Opt (g): ~27 AB mag**

**Prompt (< 30 min) Optical spectroscopy with TMT**

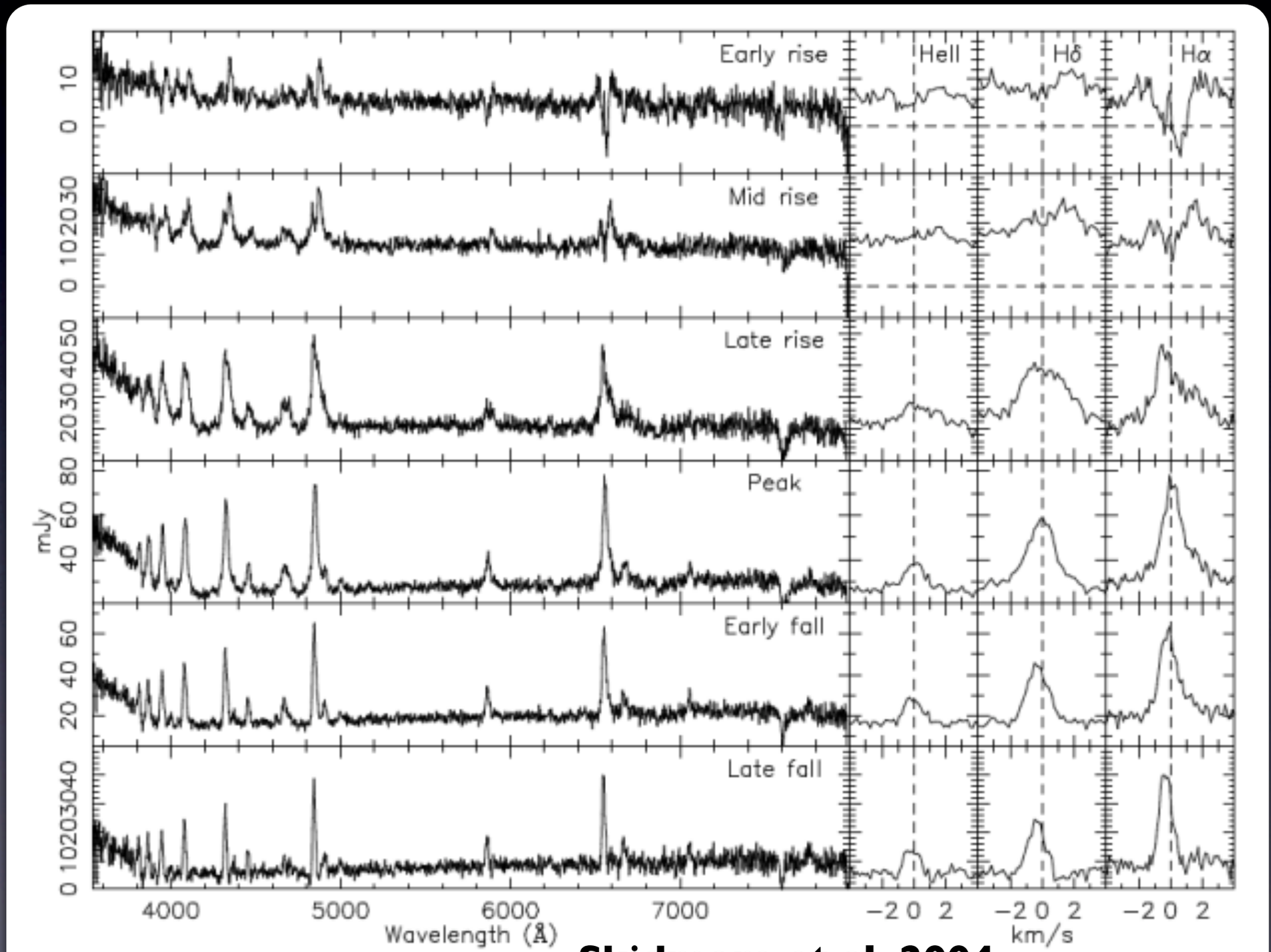
**New window to study supernovae (progenitor mass/radius, kinetic energy)**

# Required response time



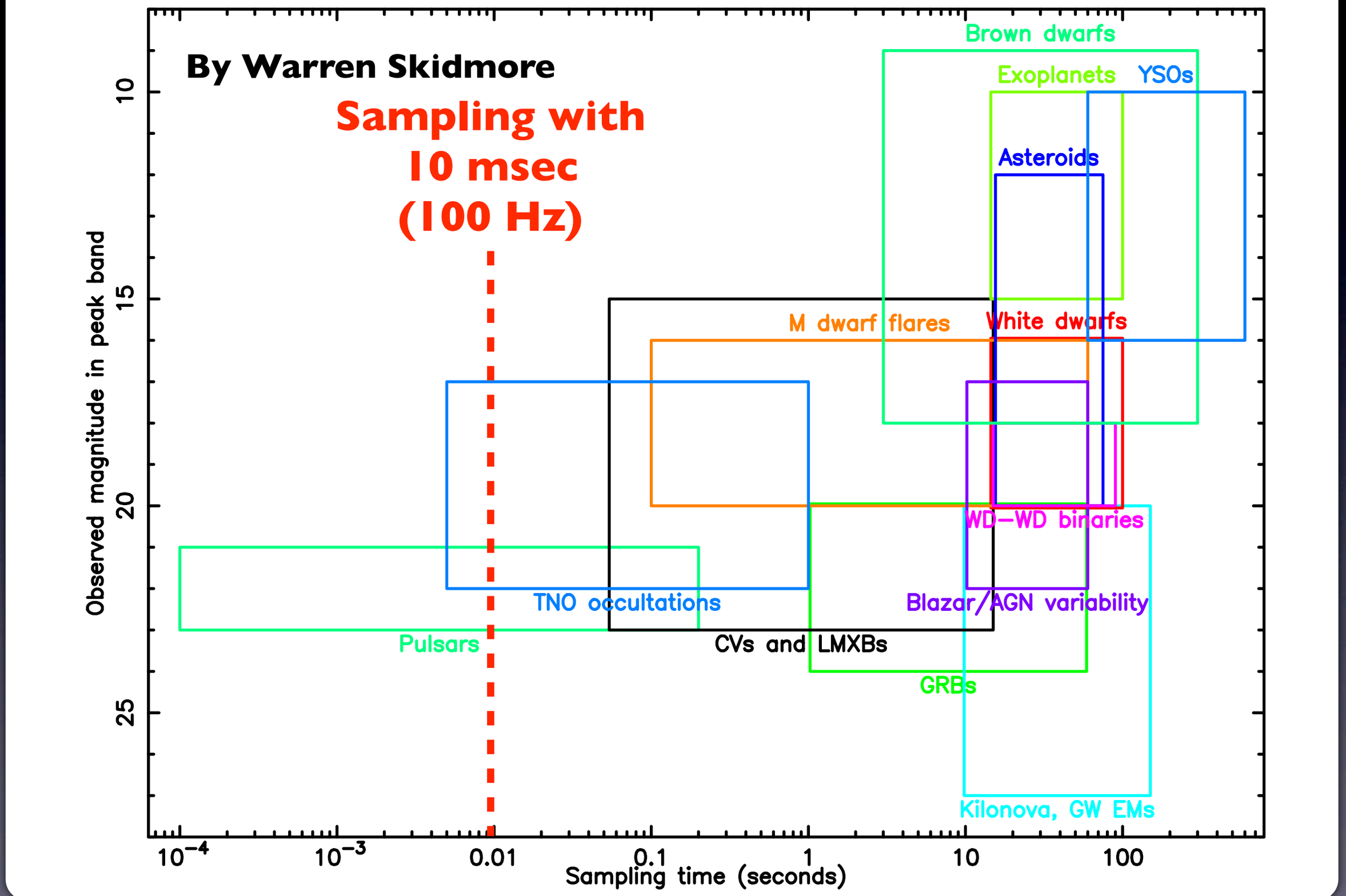
# Time-resolved observations

## 75 ms spectroscopic sampling for cataclysmic variables




Skidmore et al. 2004

# Required sampling time



# TODAY

- **Antonino Cucchiara**
  - The Swift mission as high-z explorer: the GRBs legacy for TMT
- **Jennifer Hoffman**
  - The Supernova Spectropolarimetry Project: Probing the Evolution of Asymmetries in Supernovae

- (Coffee break)

- **Warren Skidmore**
  - Summary of time-resolved/polarimetric science
- **Discussion**

# Agenda for discussion

1. Feedback to TMT instrument/telescope teams
    1. Response time (telescope/operation) 5 min?
    2. Time-resolving capability (instrument) 50 msec?
    3. Polarimetric capability (instrument/telescope)
2. Inter-patner programs for ToO observations
3. TMT Key/Legacy programs