

# Studying fast-brightening transients with the HSC-Tomo-e synergetic survey

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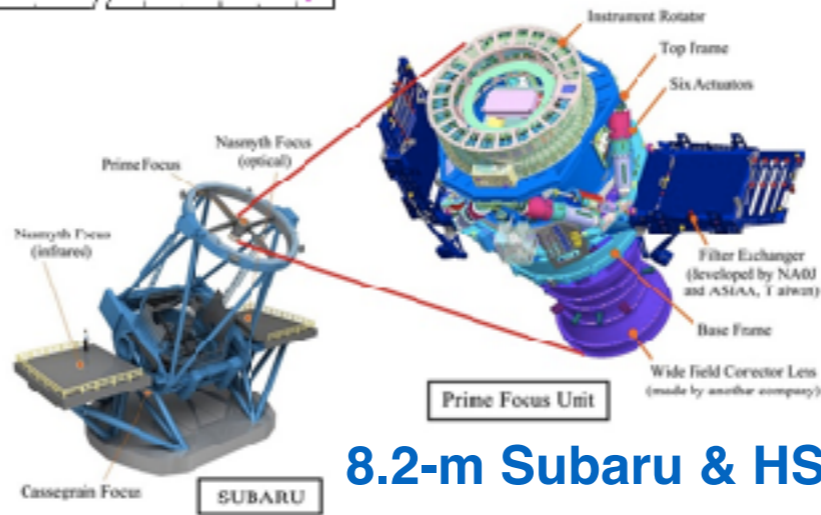
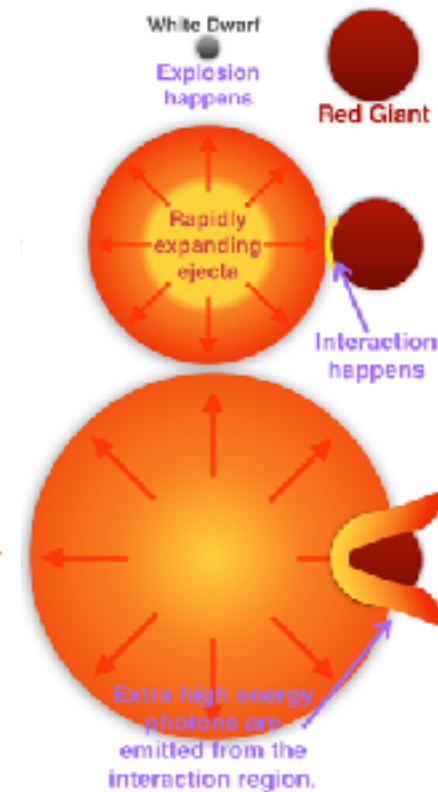
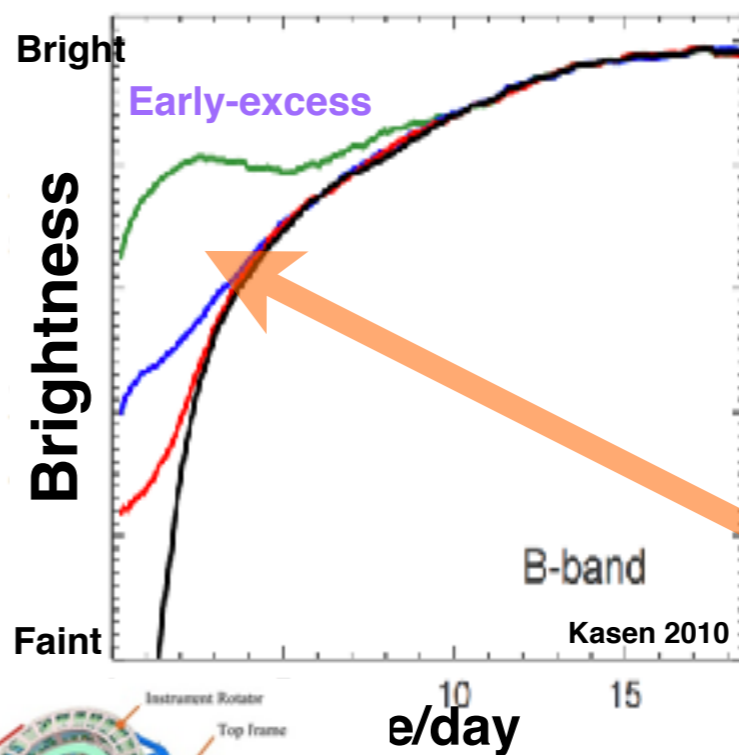
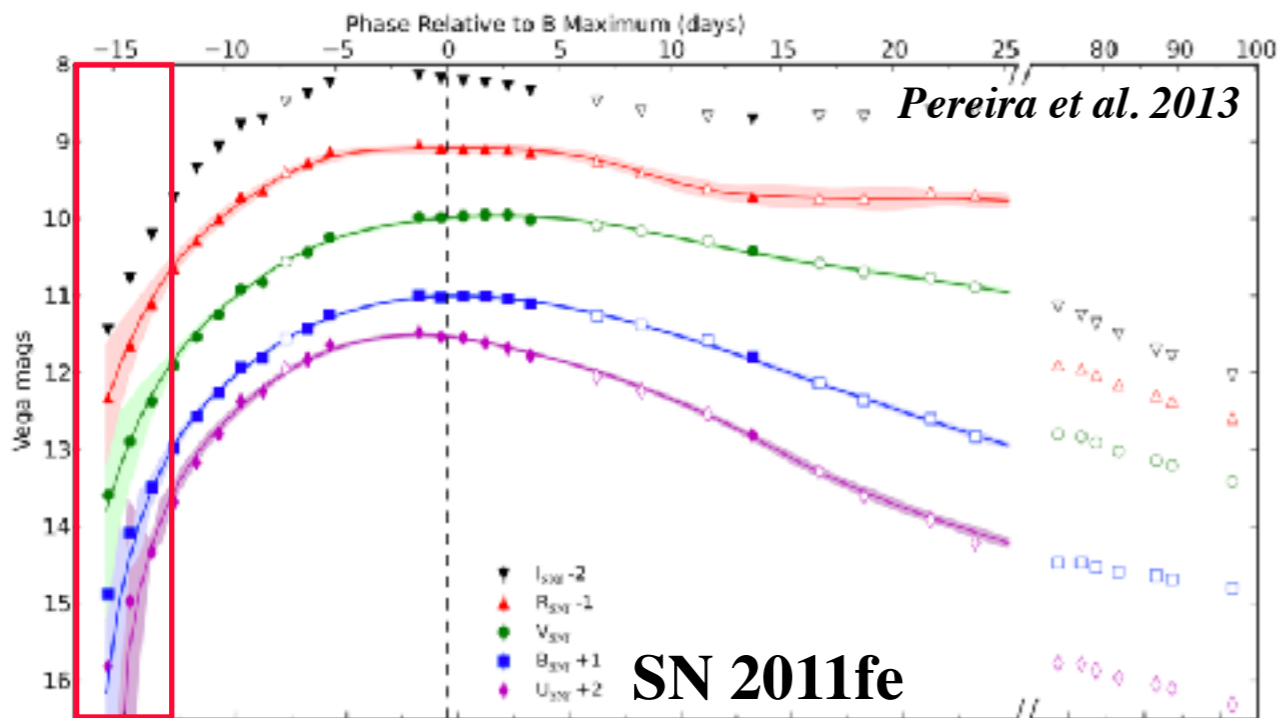
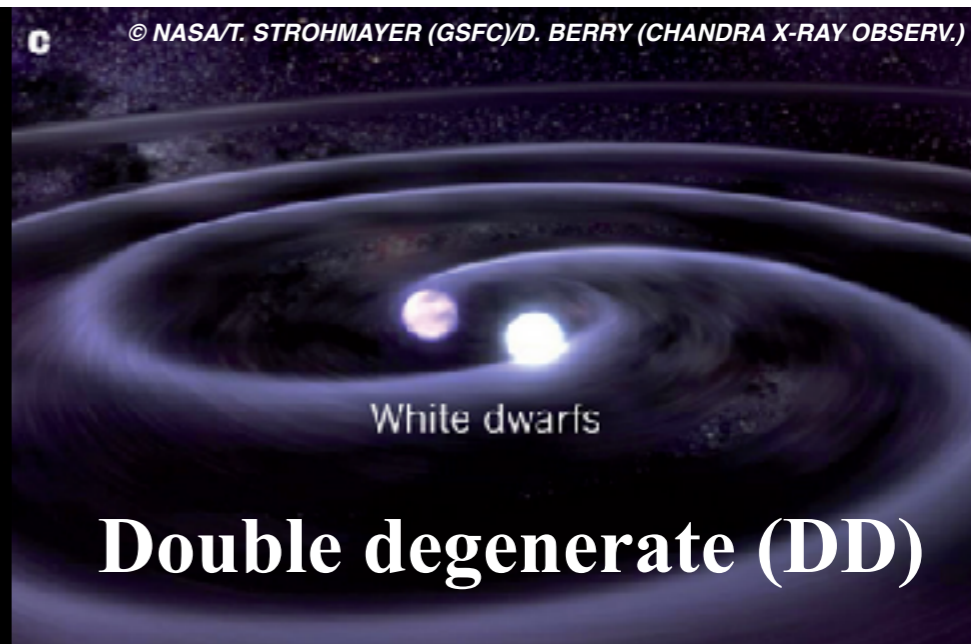
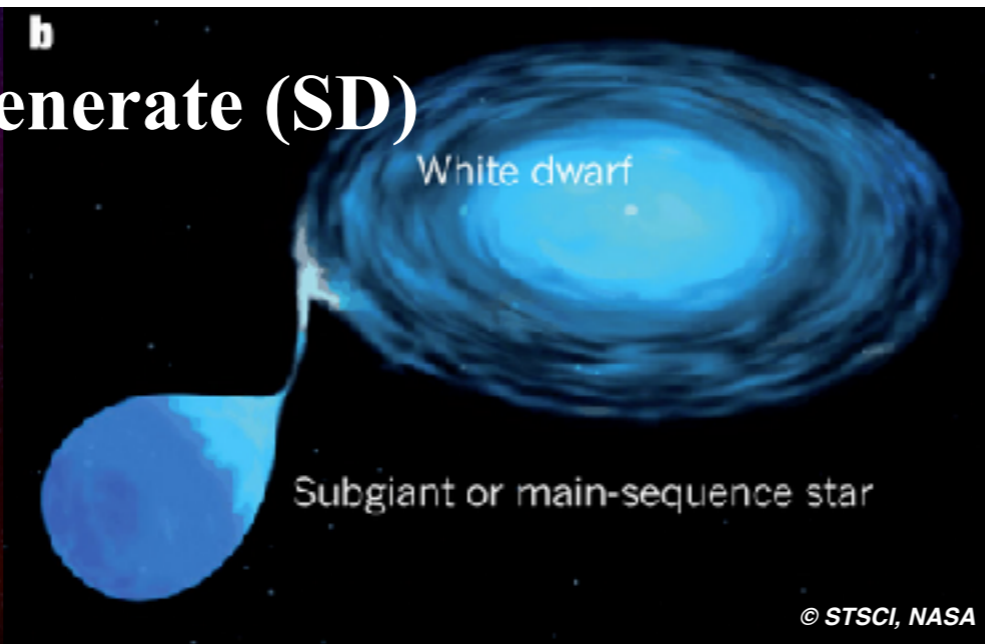
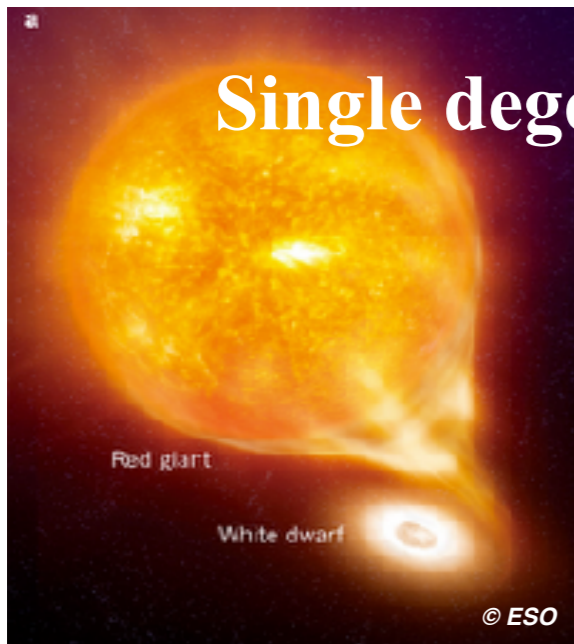
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# Type Ia Supernovae and Early-phase Photometric Behavior



## Japanese Wide-Field Survey Facilities

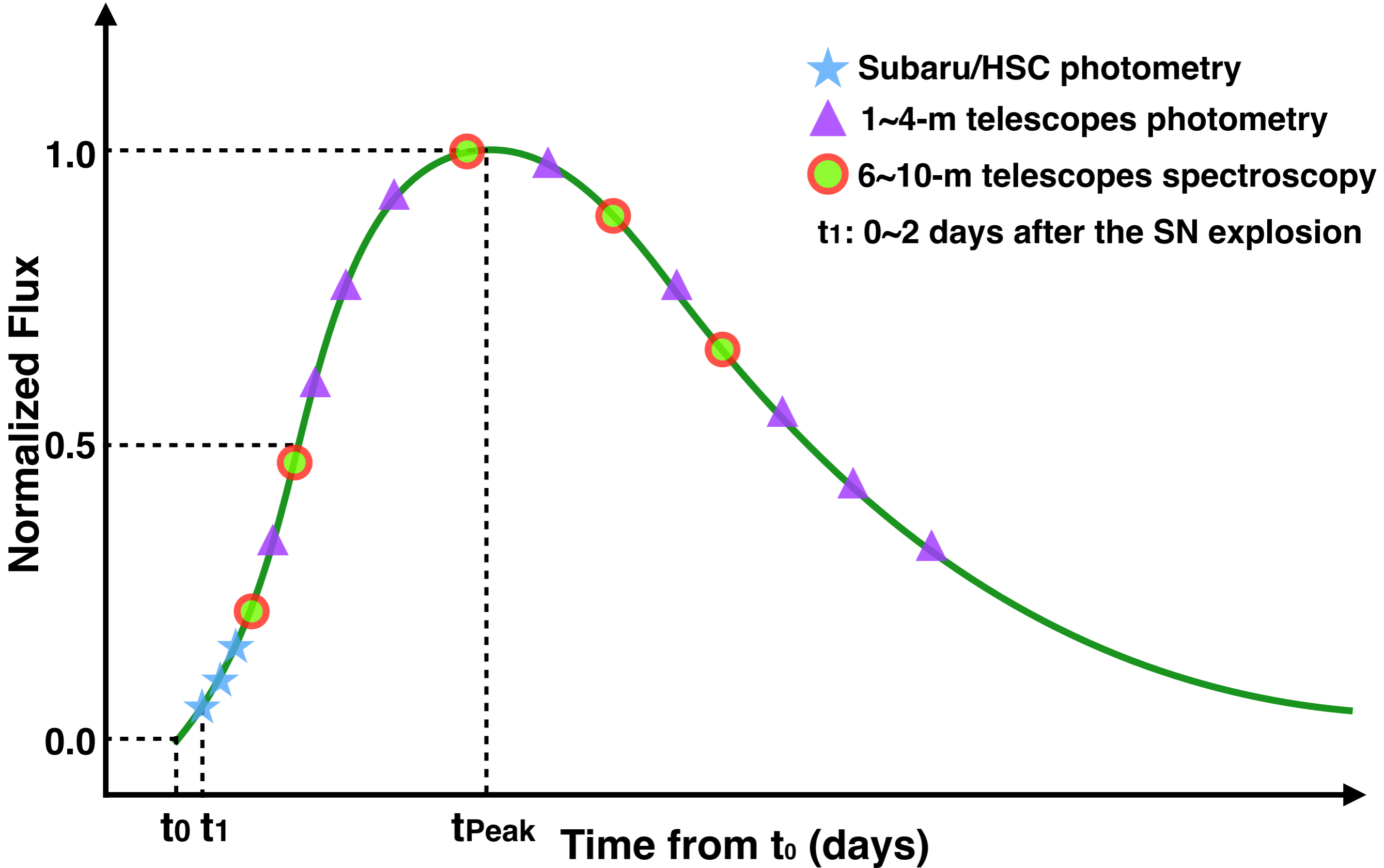
Searching for SNe Ia soon after the explosion (early-phase SNe Ia) with the most powerful survey facilities in the world!

# The **MU**lti-band **S**ubaru **S**urvey for **E**arly-phase **SNe Ia** (**MUSSES**)

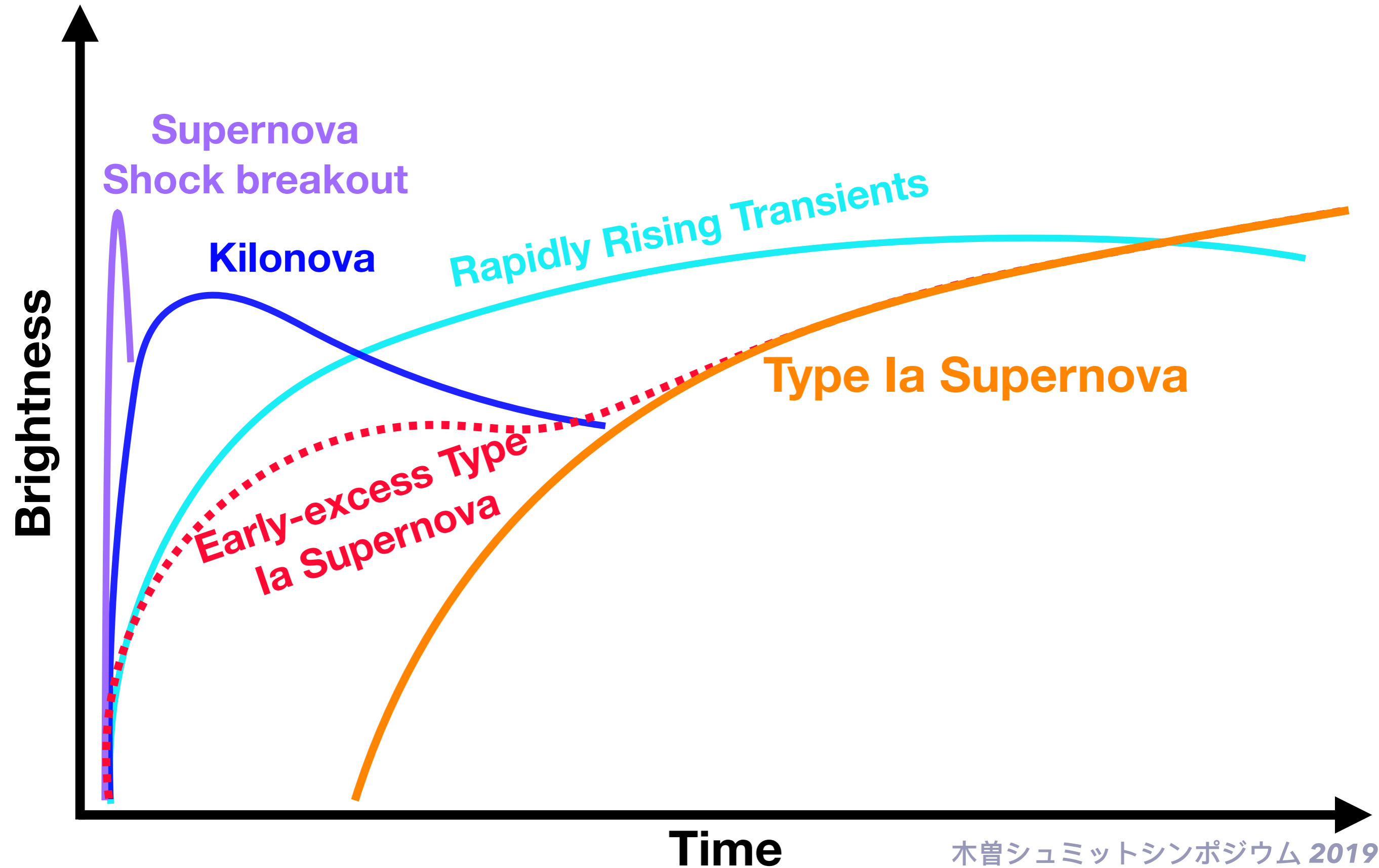
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- ❖ **Period:** Started from April 04, 2016
- ❖ **Objectives:** Investigating the photometric/spectroscopic behavior of ESNe Ia
- ❖ **Observing Mode:** Subaru/HSC survey+ follow-up observations
- ❖ **Time Allocation:** 2-2.5 nights Subaru/HSC observation for each observing run
- ❖ **Filters:** g- and r-band for the Subaru/HSC observation
- ❖ **Limiting Magnitude: 26 mag ( $5\sigma$ ) in g-band**
- ❖ **Cadence: 1 day** **"Deep"+"Wide"**
- ❖ **Survey Area:  $\sim 100$  deg<sup>2</sup> for each observing run**
- ❖ **Expected Number of ESNe Ia: 10+ per observing run**
- ❖ **Follow-up Network:** 10.4-m GTC, 9.2-m SALT, 8.2-m VLT, 8.1-m Gemini, 3.5-m ARC, 2.5-m NOT, 2.5-m INT, 2-m LT, 1.05-m Kiso, etc.

# 🌸 Observing Strategy of MUSSES



# Early-phase light curves of typical extragalactic transients





# ❁ 1909 MUSSES Observing Run

## ❖ SSP + Open-use HSC observation

Multi-bands, long-term, deep survey (optimized for studying SNe Ia);

## ❖ Tomo-e monitoring observation

20 min (2 min\*10) for each Tomo-e field (~ 6 fields); 3 runs per night;

Rest of time will be used for other projects, e.g. Tomo-e Gozen Transient Survey;

## ❖ More intensive follow-up observations

## **Take-home message**

- \* Early-phase photometric information (usually show fast-brightening behavior) plays a unique role in understanding the physics and progenitors of transients;
- \* The special locations of HSC and Tomo-e make the possibility of using two top-class survey facilities to study the early-phase transients synergistically.
- \* We would like to carry out 4-nights (~6 hours/night) Tomo-e observations during the Sep MUSSES observing run.
- \* Lots of early-phase transients will be discovered in the next MUSSES observing run. However, we note that such a joint observation is high risk - high reward for Tomo-e as most of the objects are too faint for Tomo-e.

**Thank you!**