

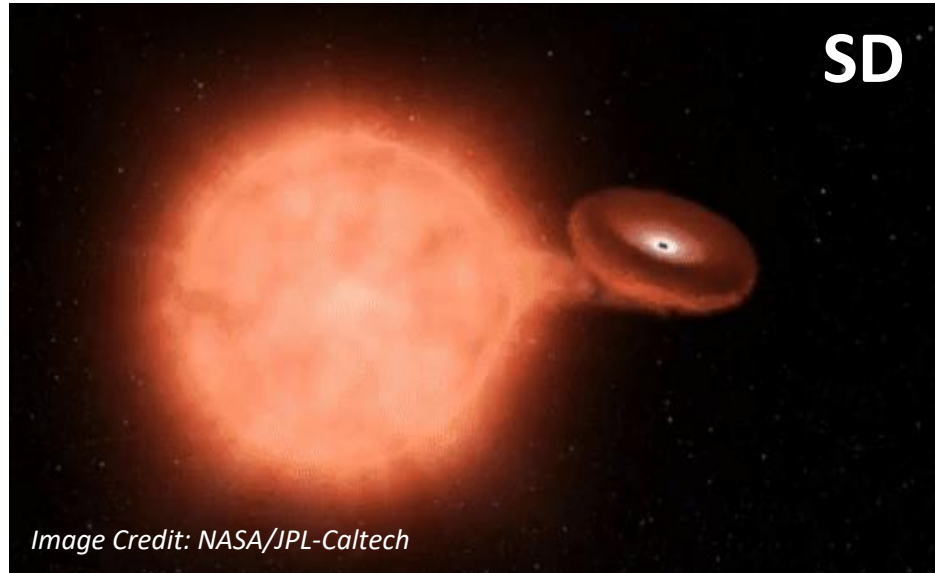


Intensive Monitoring Survey of Nearby Galaxies (IMSNG) : Constraints on the Progenitor System of a Type Ia Supernova SN 2019ein from its Early Light Curve

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Type Ia SN

- The explosive end in the binary system
- Diverse progenitor models

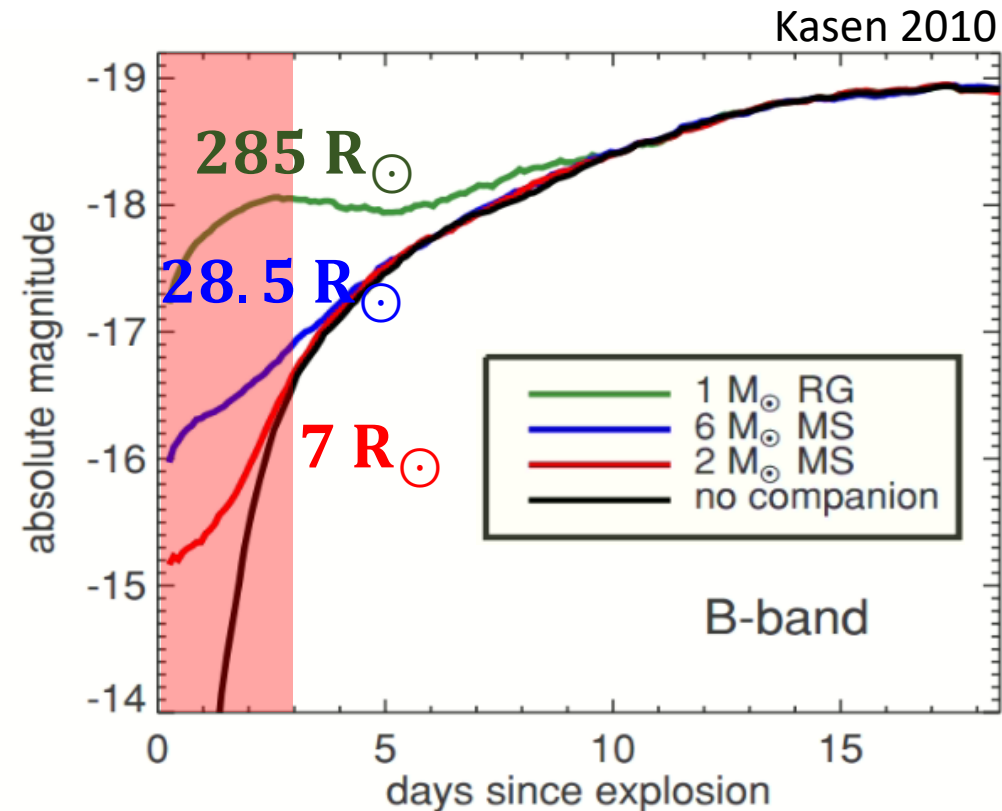
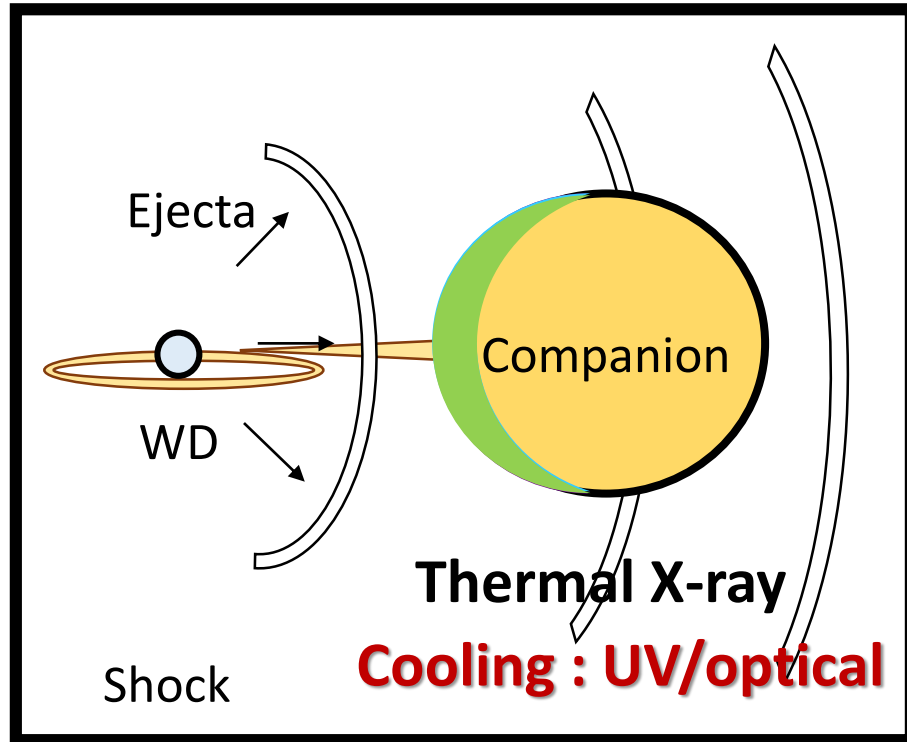


✓ **Observational evidences of the progenitor system are lacking**

The very early light curve

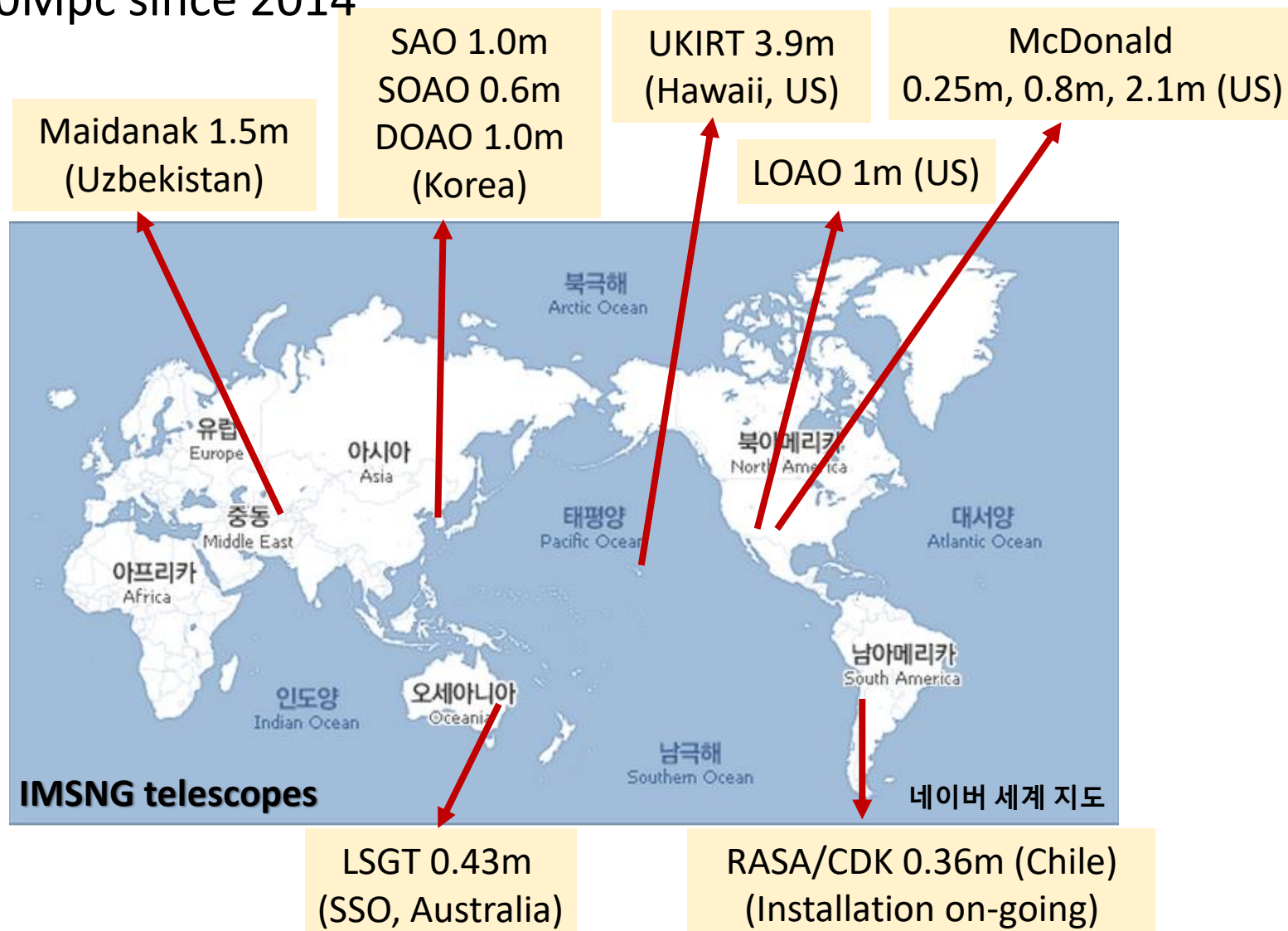
➤ **Shock-heated cooling emission** can constrain the size of the progenitor system.

(Kasen+10, Rabinak & Waxman 2011)



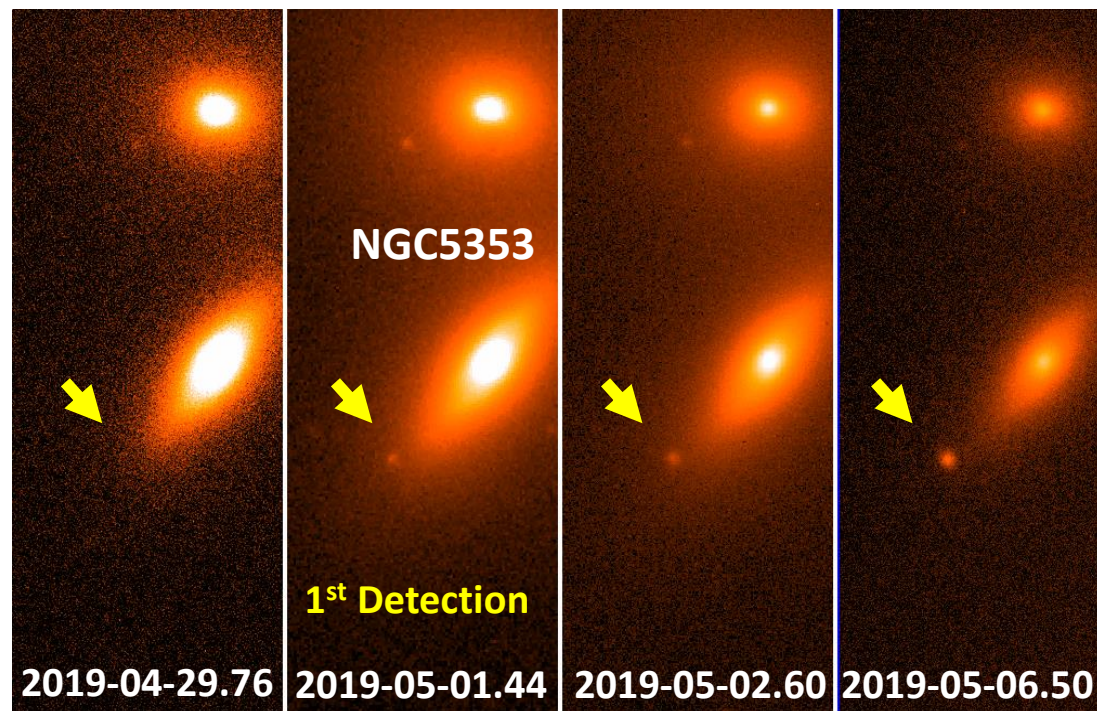
IMSNG : Intensive Monitoring Survey of Nearby Galaxies

➤ 60 UV bright galaxies within $d < 50\text{Mpc}$ since 2014



Data

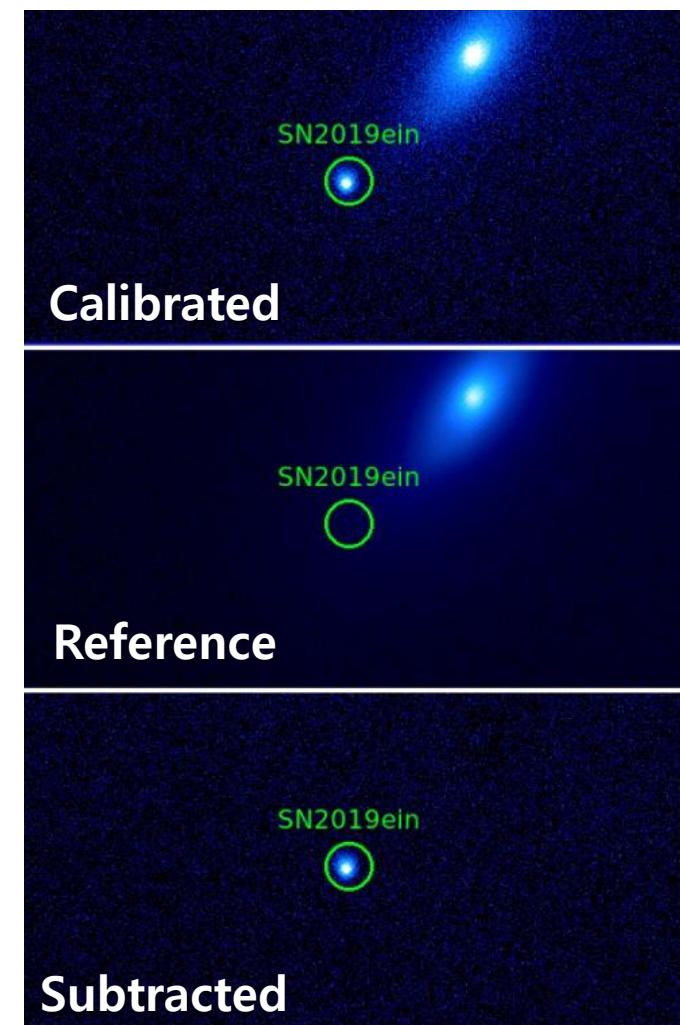
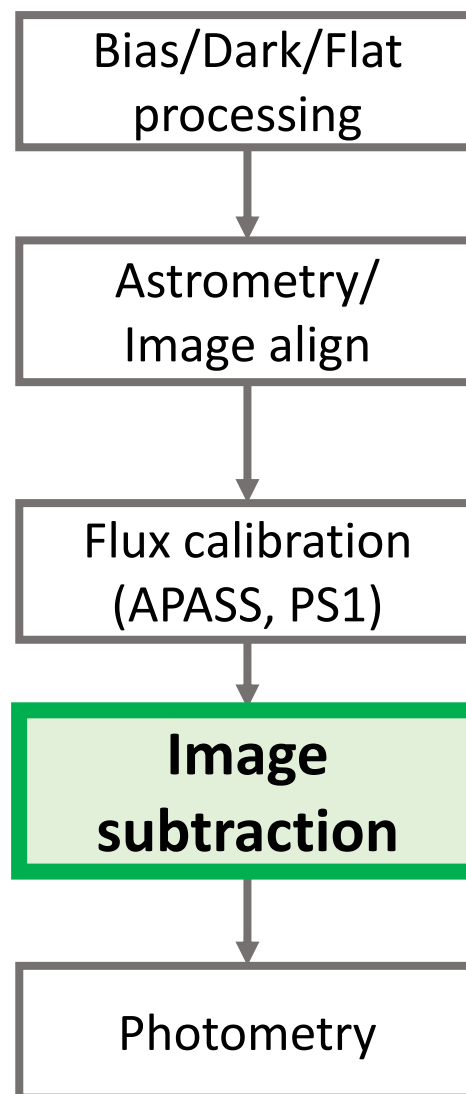
SN 2019ein appeared!



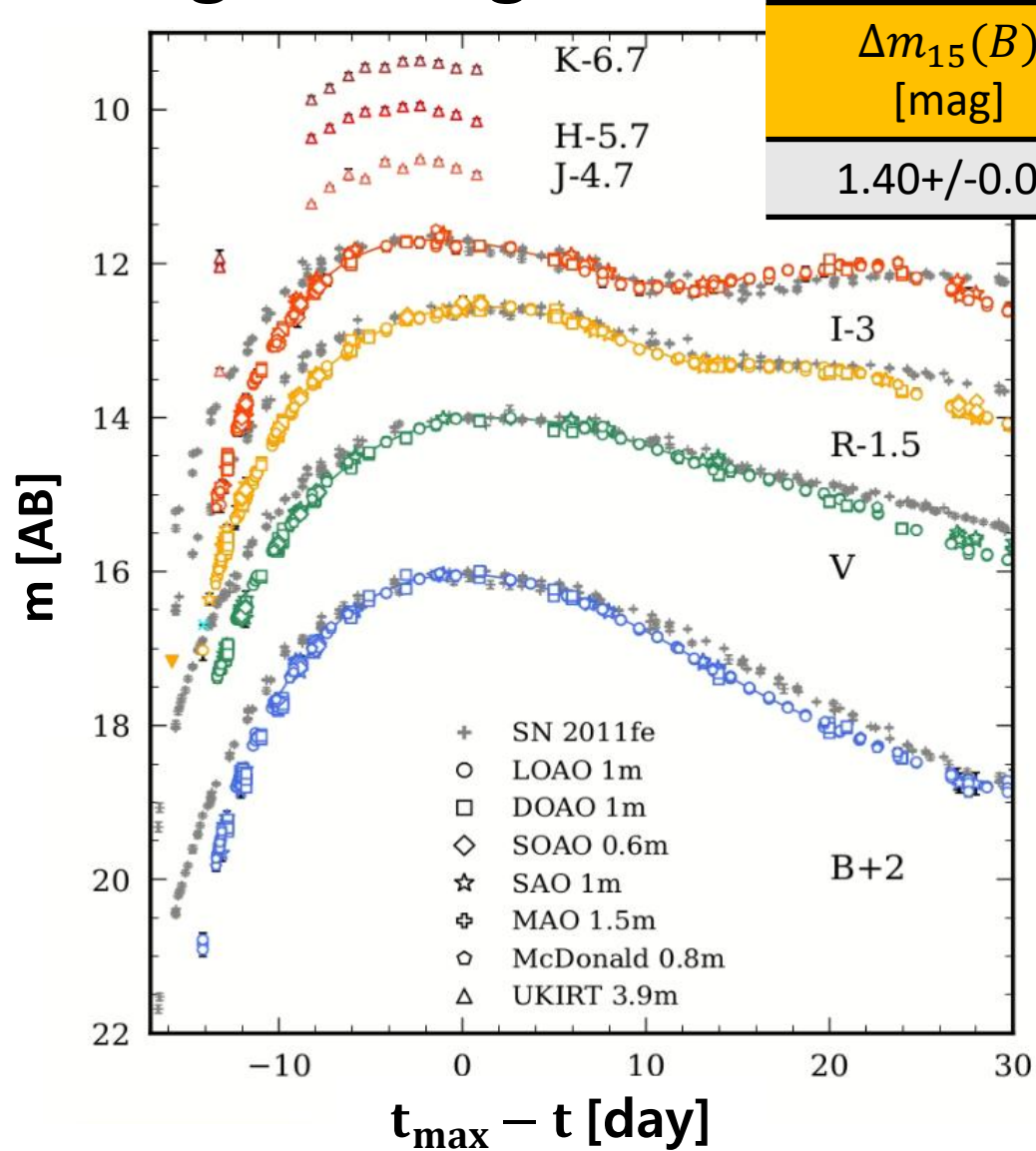
✓ The early light curve was obtained!

- *BVRI* + *JHK* Imaging

Reduction



Long-term light curve

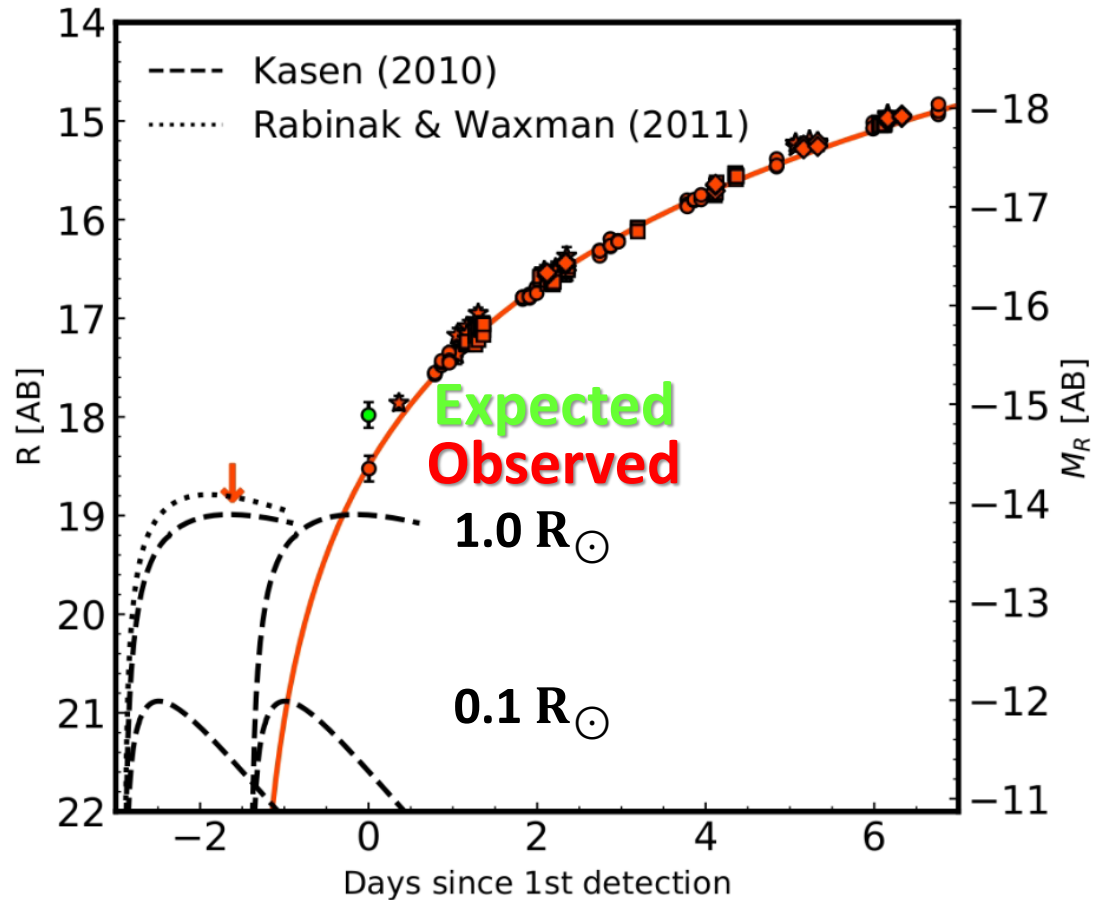


$\Delta m_{15}(B)$ [mag]	B_{\max} [mag]	$M_{B,\max}$ [mag]	μ [mag]	$E(B - V)_{\text{host}}$
1.40+/-0.01	14.04+/-0.01	-18.74+/-0.1	32.78+/- 0.09	0.056+/-0.04

$$E(B - V)_{\text{gal}} = 0.011 \text{ (S \& F 2011)}$$

**A typical SN Ia
but slightly faint**

The very early light curve



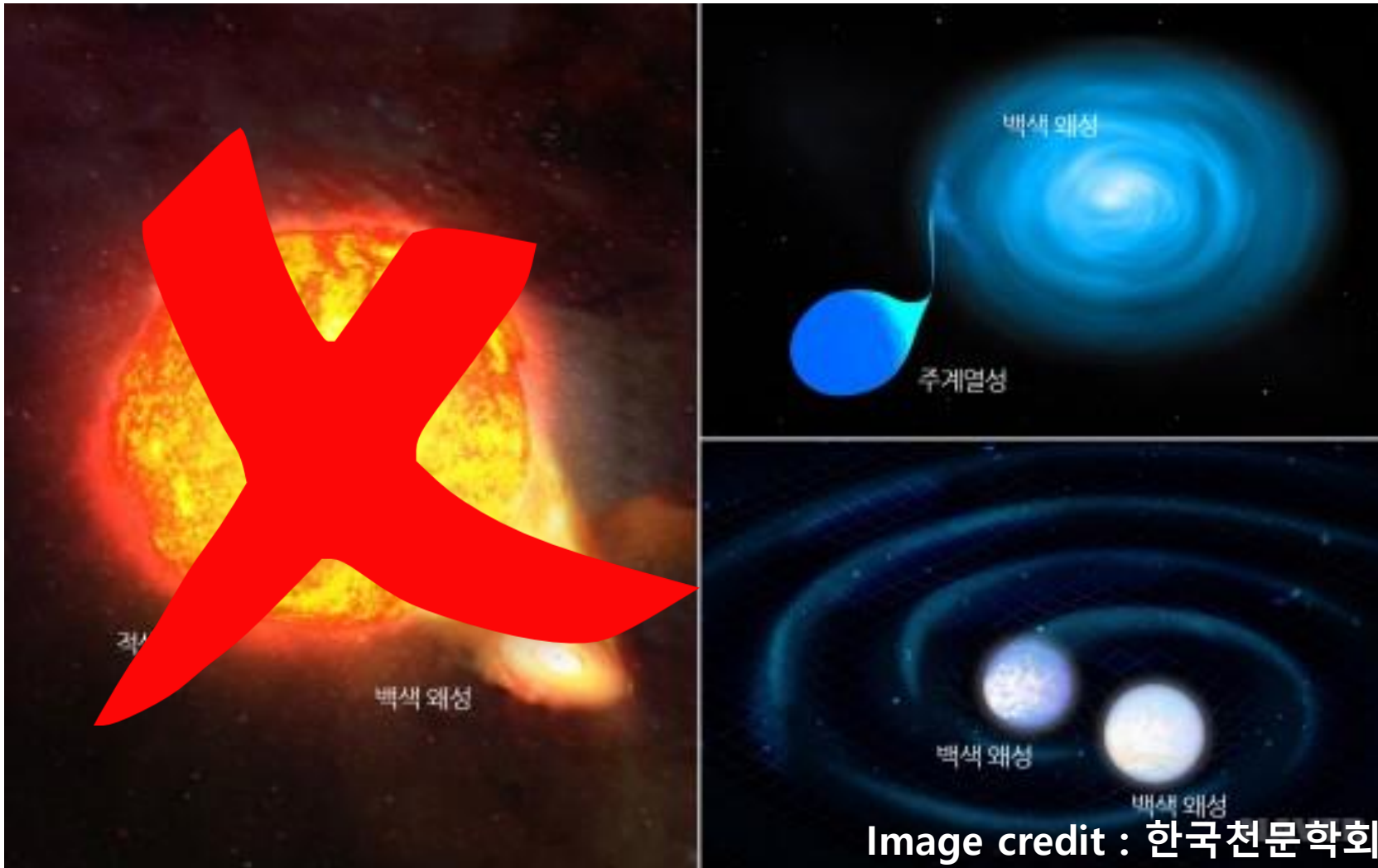
Data points : *Cooling + ^{56}Ni decay emission*

Red line : *Expected ^{56}Ni decay*

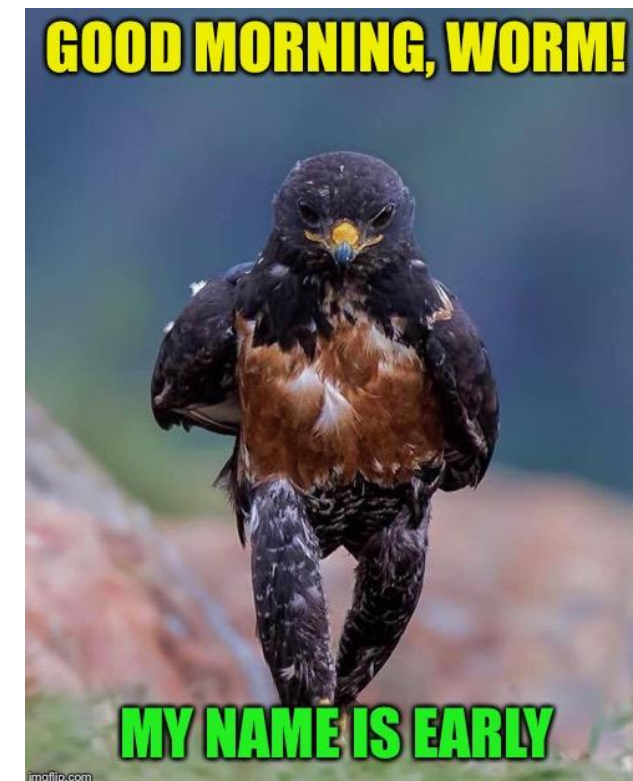
Black line : *Expected cooling*

✓ **The size of the system of SN 2019ein $< 1.0 R_{\odot}$**

For SN 2019ein,



- **IMSNG : Early observation of Type Ia SN 2019ein**
- **A typical SN Ia but slightly faint**
 - Shape of light curve
- **Weak cooling emission on the early phase**
 - The size of Progenitor $< 1.0 R_{\odot}$



✓ The progenitor system can be **WD-WD** or **WD-MS**