

High-redshift supernova survey with Subaru/Hyper Suprime-Cam

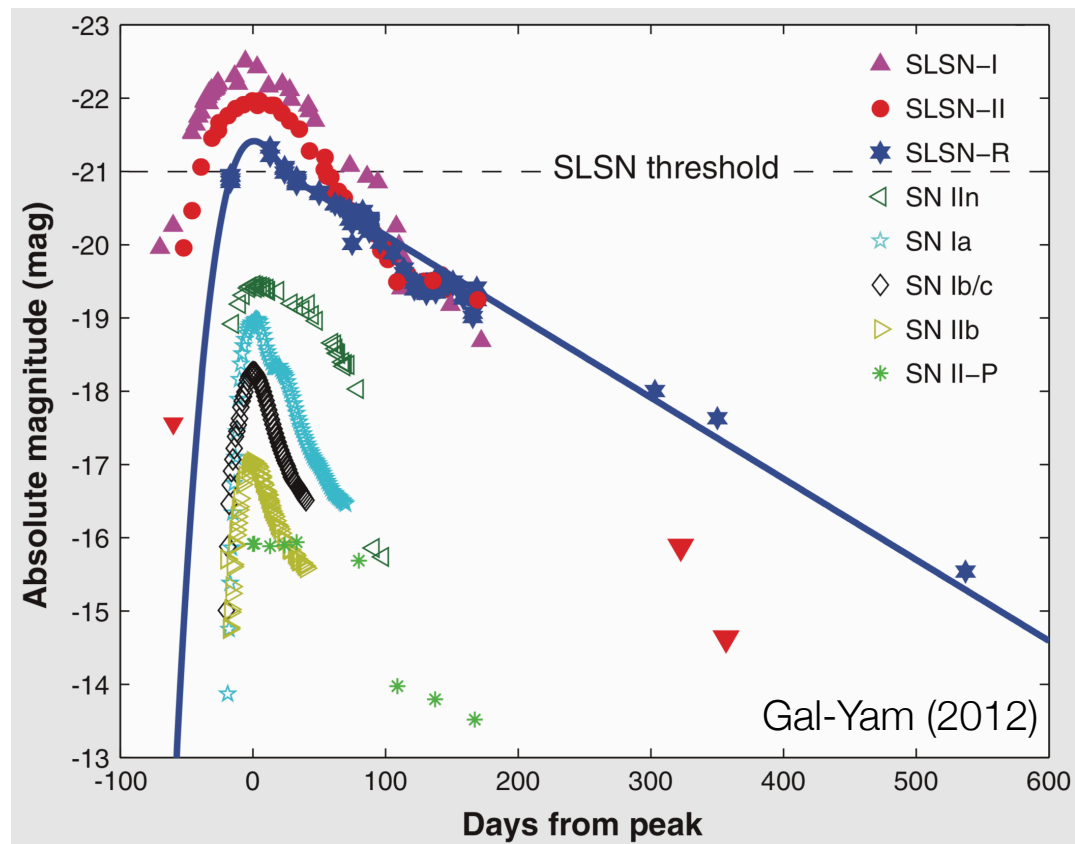
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HSC transient collaboration

Moriya et al. 2018, arXiv:1801.08240; Curtin et al. 2018, arXiv:1801.08241



Superluminous supernovae (SLSNe)

- very luminous supernovae (SNe) identified in the last decade
 - more than 10 times brighter than typical core-collapse SNe
- a recent review: Moriya, Sorokina, Chevalier (2018)
 - free access URL: <http://rdcu.be/IZVA>

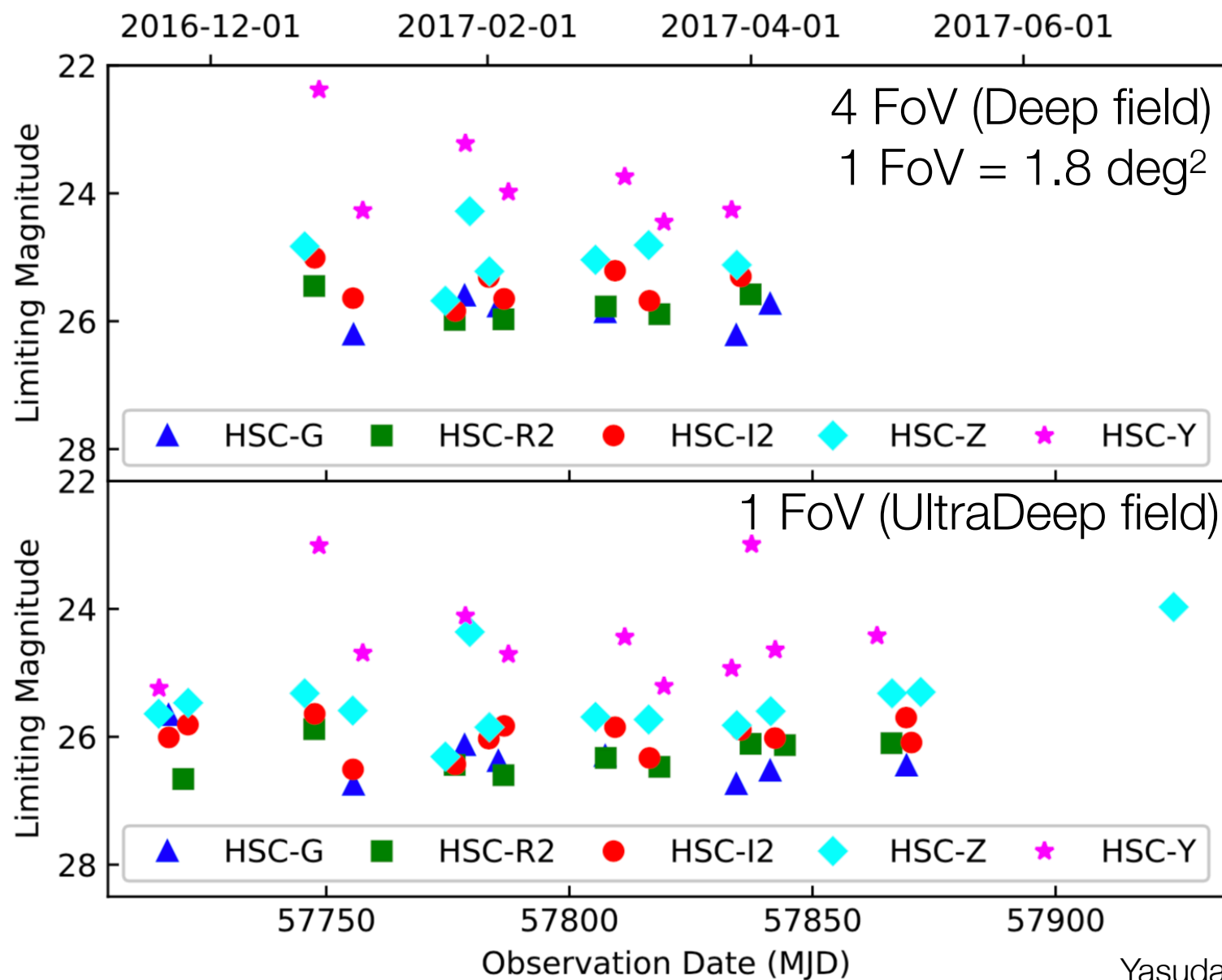


Superluminous supernovae (SLSNe)

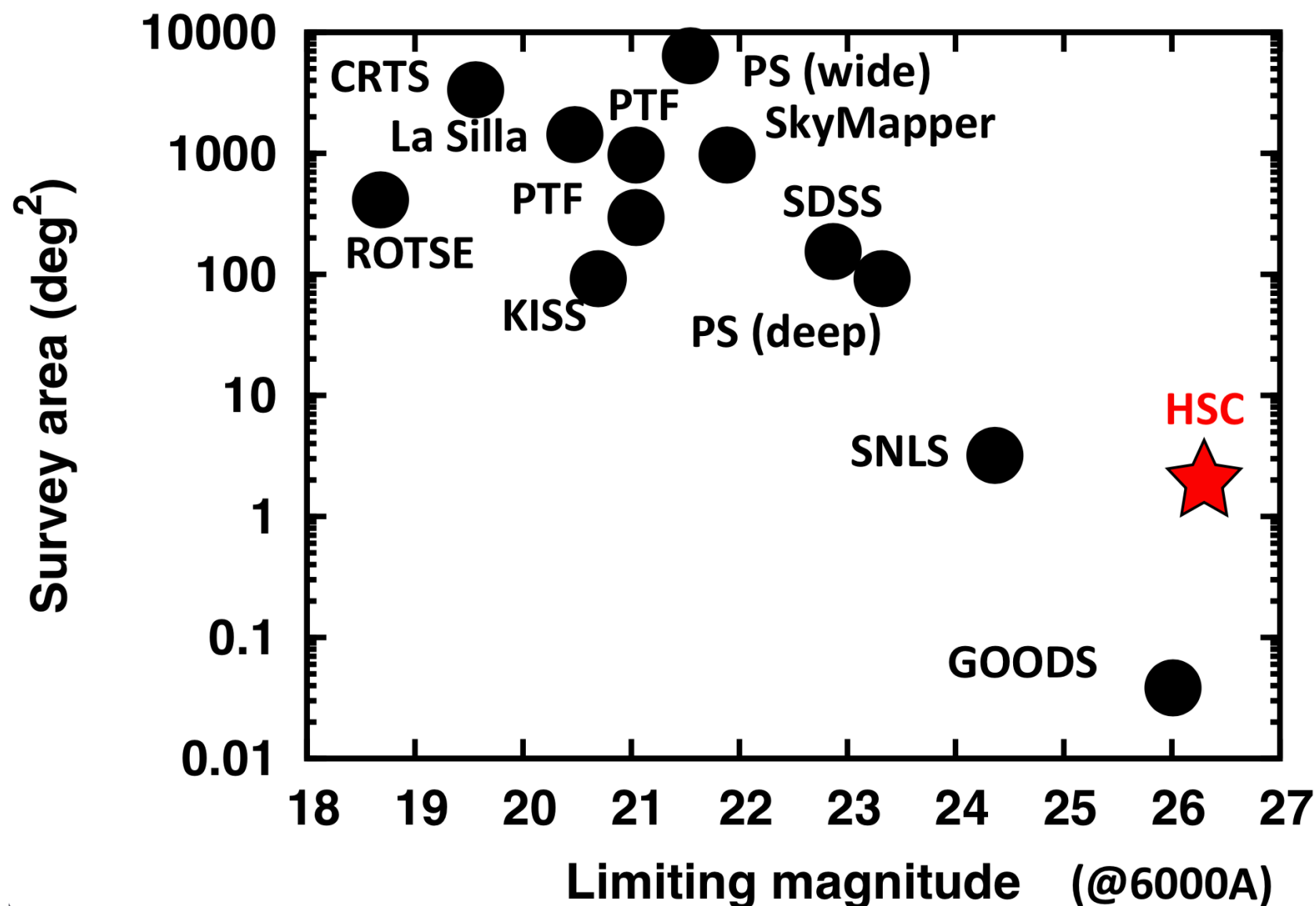
- very luminous supernovae (SNe) identified in the last decade
 - more than 10 times brighter than typical core-collapse SNe
 - luminous in UV as well
 - can be observed at high redshifts ($z > \sim 1.5$)
 - massive star origin
 - however, we don't know the exact progenitors
 - a probe of massive star formation at high redshifts
- may be applicable as a distance measure
 - Hubble diagram beyond the reach of SNe Ia may be constructed

SLSN survey with Subaru/Hyper Suprime Cam
Subaru High-Z sUpernova CAmpaign (SHIZUCA)

Subaru/Hyper Suprime-Cam transient survey



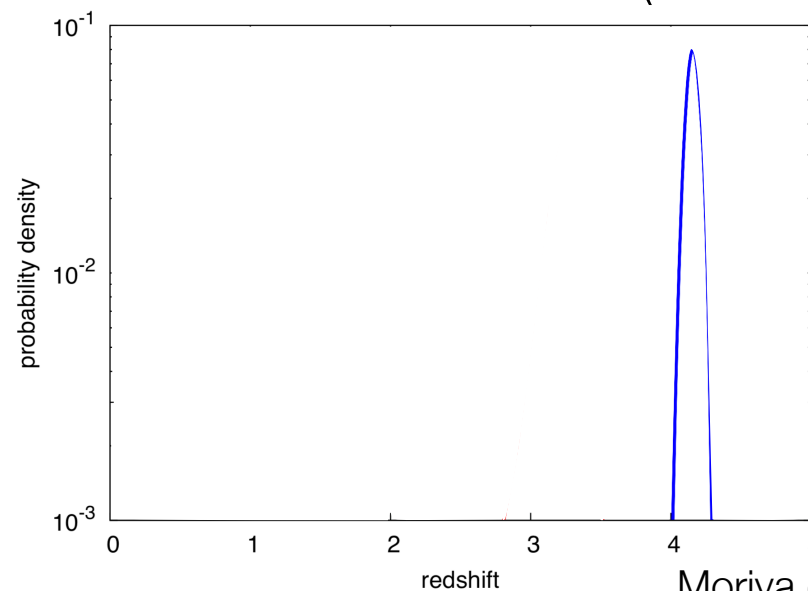
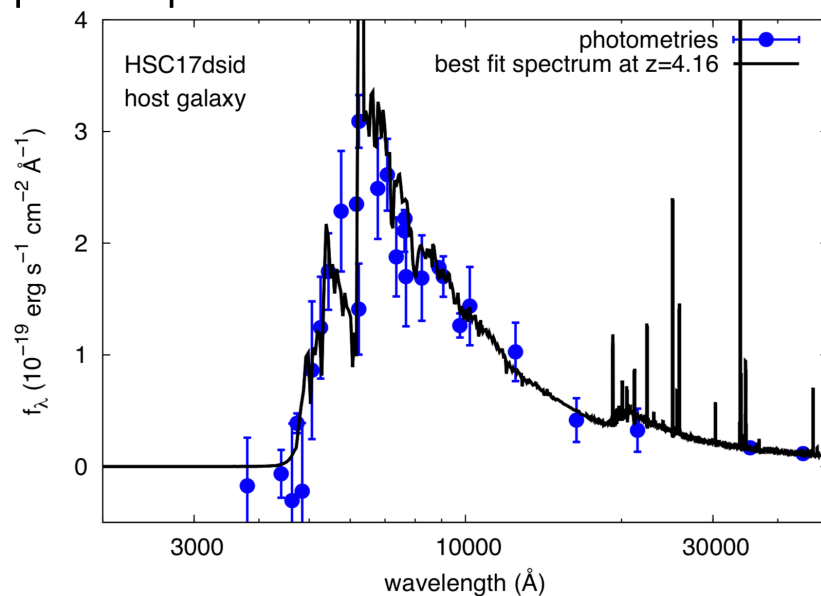
Subaru/Hyper Suprime-Cam transient survey



Selecting high-redshift SLSN candidates

- a transient survey was conducted in the COSMOS field
 - COSMOS has multi-band (~ 30 bands) photometric data from which good photometric redshift estimates can be obtained
 - we took spectra of SN candidates appeared in galaxies with large photometric redshifts to confirm the redshift and SN type

an example of photometric redshift estimated with the MIZUKI code (Tanaka 2015)

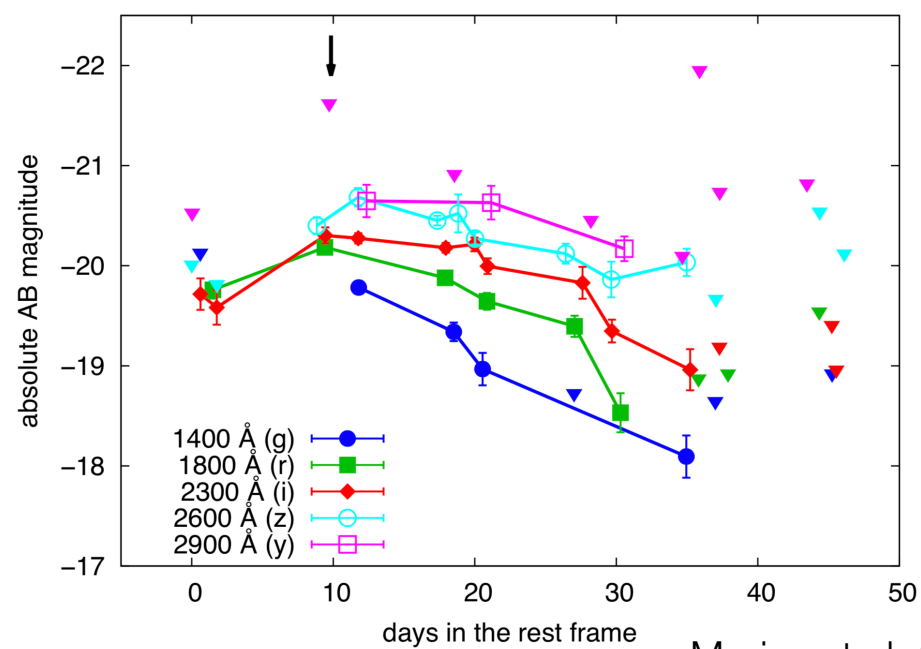
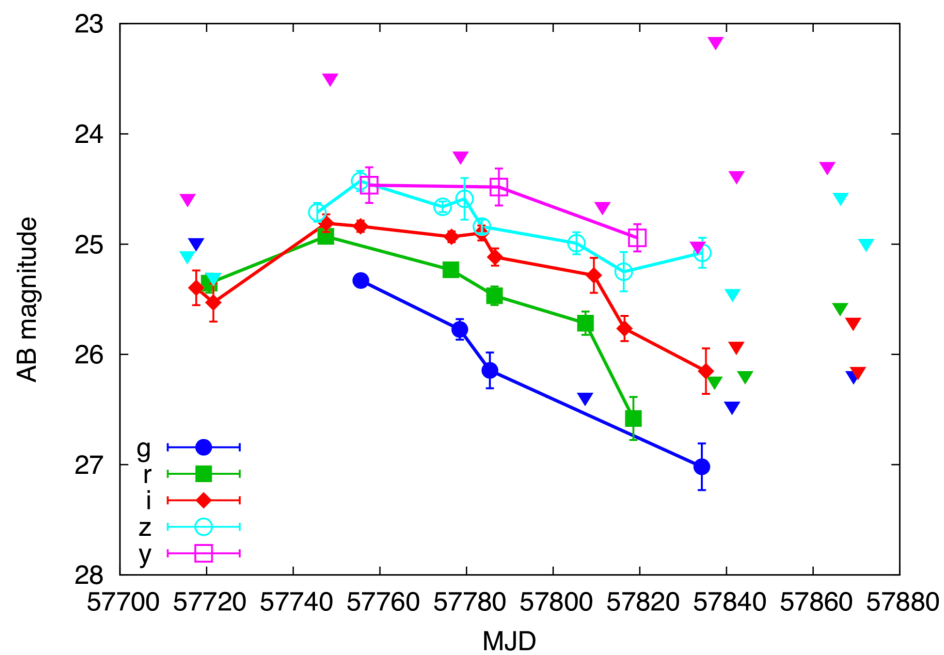
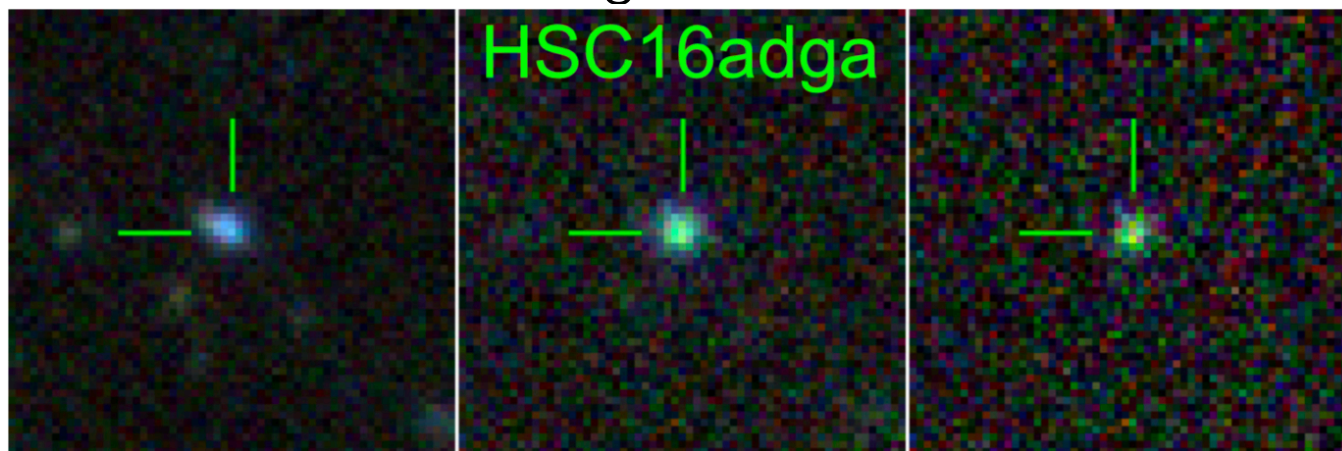


Collaborations with Chilean astronomers

- Spectroscopic follow-up for high-redshift SLSNe with VLT/FORS2
 - led by Prof. G. Pignata at Universidad Andres Bello
 - no time is allocated during the COSMOS survey in 2016-17
 - 16 hours are allocated in 2018
 - Subaru/HSC observations are canceled due to bad weather and earthquake..
- We discuss the results and the papers reporting our results include Chilean astronomers as co-authors
- Spectroscopic follow-up observations in 2016-17 were conducted with Gemini/GMOS-S and Keck/LRIS
 - GMOS time from the Subaru-Gemini time exchange program
 - LRIS time from J. Cooke and C. Curtin at Swinburne University at Australia

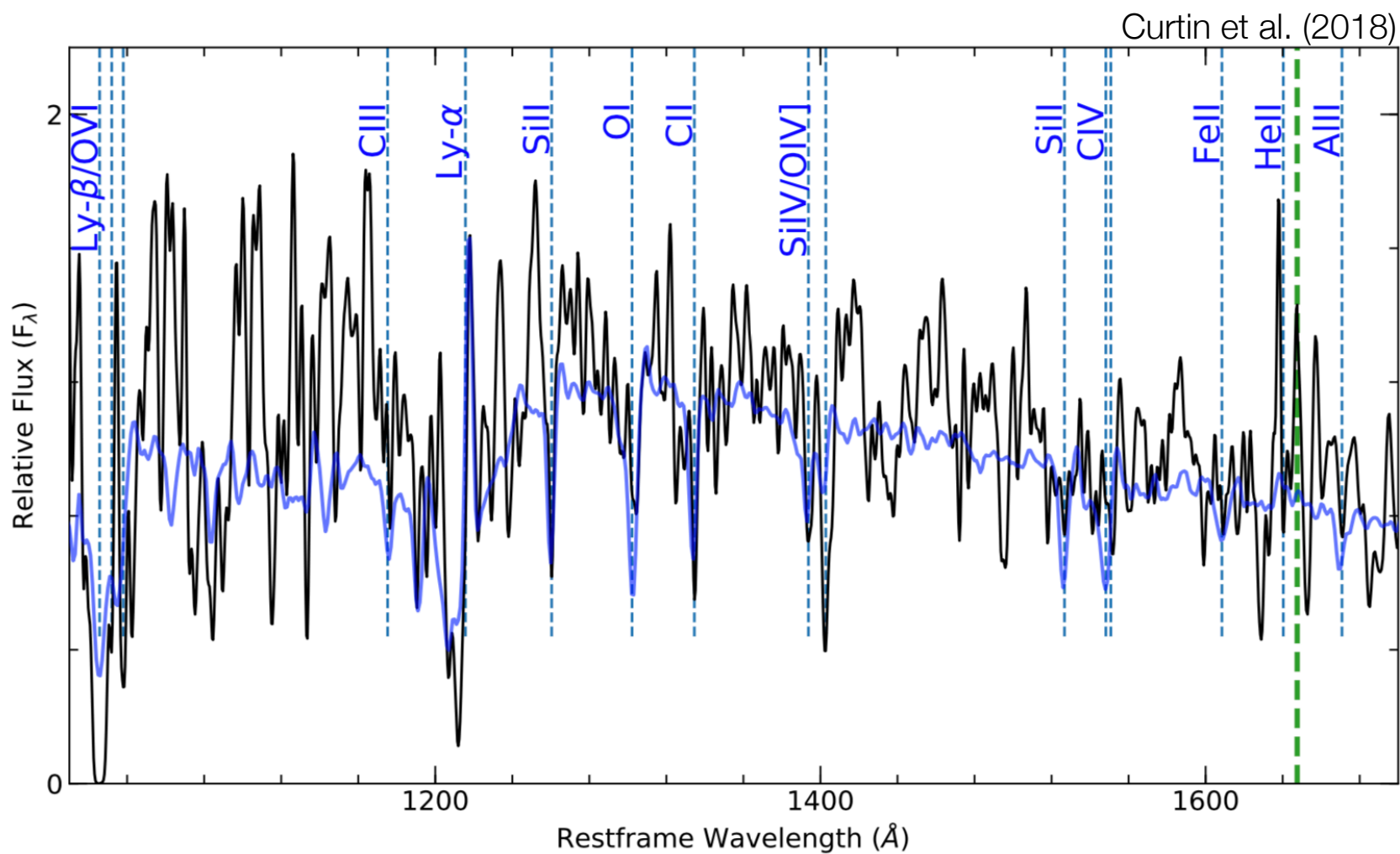
Results

HSC16adga: $z = 2.399$



Results

- a spectrum taken with Keck/LRIS
 - $z = 2.399$



Summary

- A deep wide transient survey with Subaru/HSC was conducted
 - We searched for high-redshift SLSNe
- High-redshift SLSN candidates were selected based on the photometric redshifts of the host galaxies
- We found SLSNe at $z = 2.399$, $z = 1.965$, $z = 1.851$
 - $z \sim 3$ and $z \sim 4$ candidates were also found but not confirmed
- SLSN rate at $z \sim 2$ is more than ~ 900 /Gpc³/yr
 - currently consistent with those extrapolated with the cosmic SFR history
- Candidate selections without photometric redshifts are underway
- We did a similar survey at COSMOS in last winter but the weather at Mauna Kea was extremely bad (+ earthquake)
- We plan to have a similar survey at the SXDS field from this Oct