Searching for supernovae at the reionization era with WFIRST and Subaru/HSC

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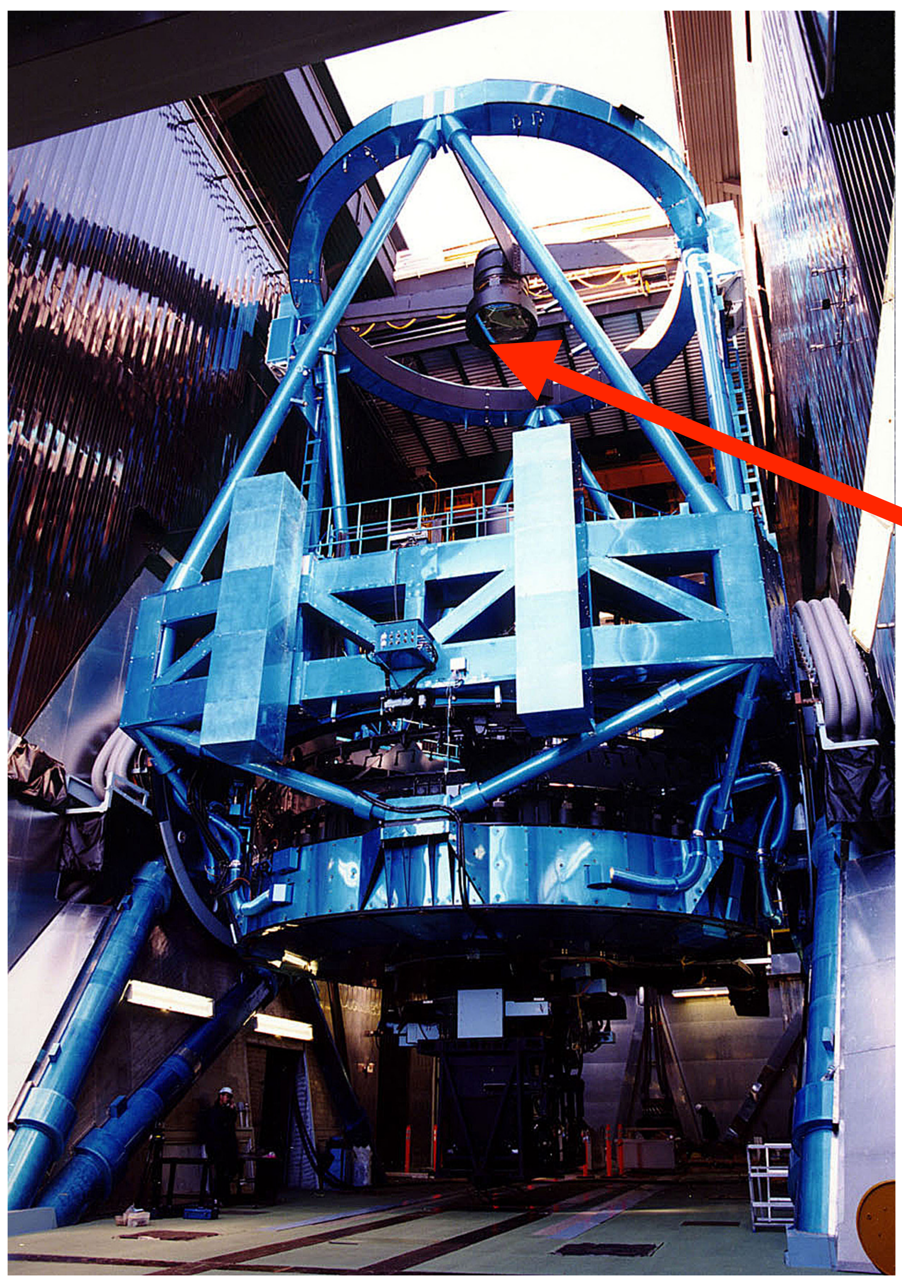
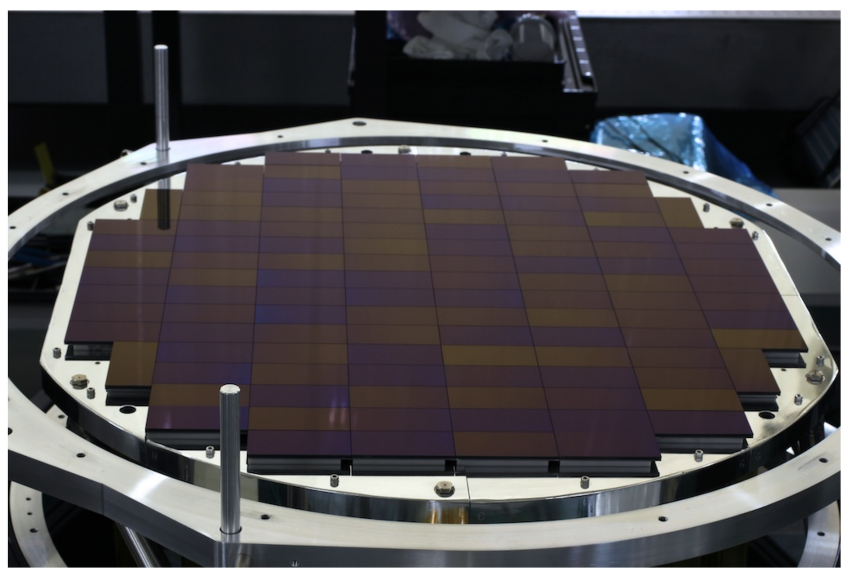
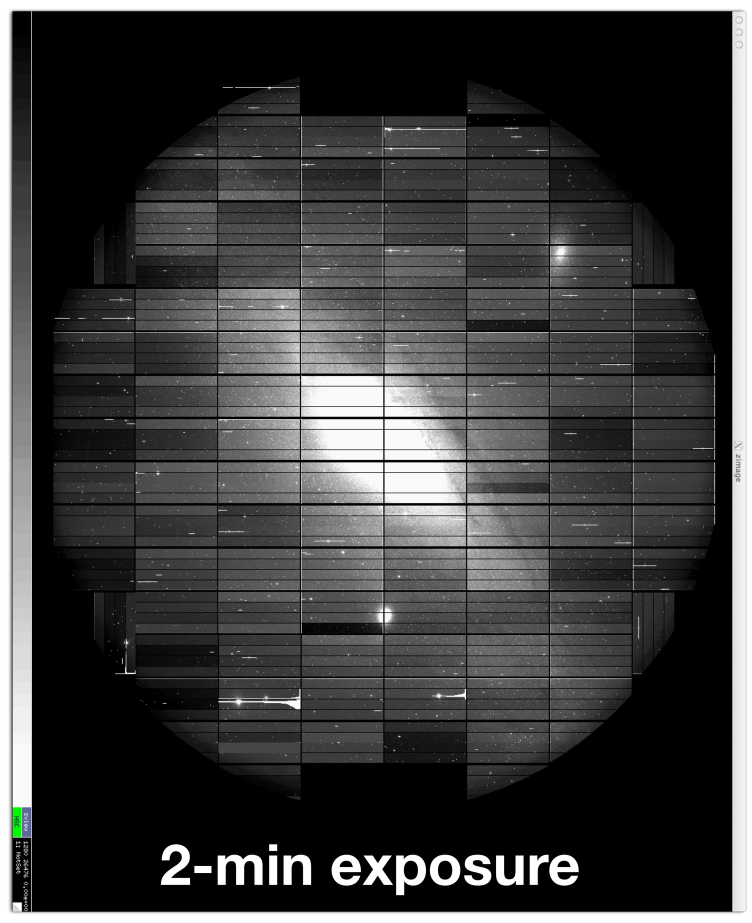
Subaru/HSC



Hyper Suprime-Cam (HSC) is a wide-field imaging instrument on the prime focus of the 8.2-m Subaru telescope. The field of view is 1.8 deg^2 and it can take the whole image of the Andromeda galaxy with one shot. The wide field and deep imaging capability of Subaru/HSC make it an ideal instrument to investigate high-redshift supernovae (SNe).

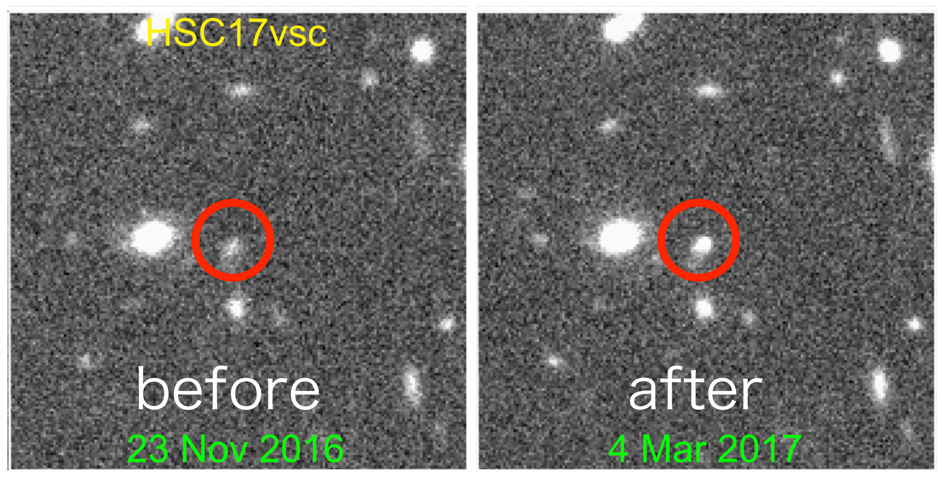
116 chips

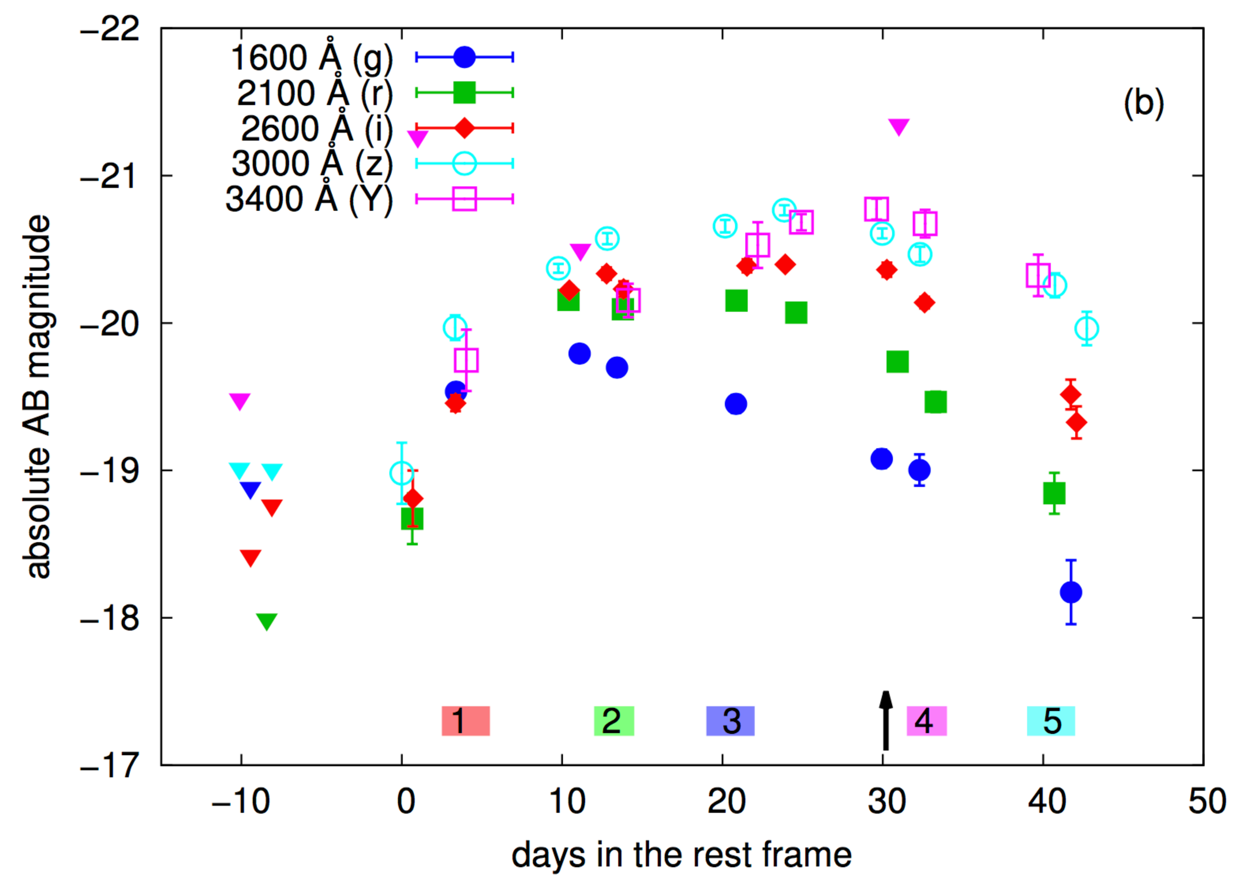




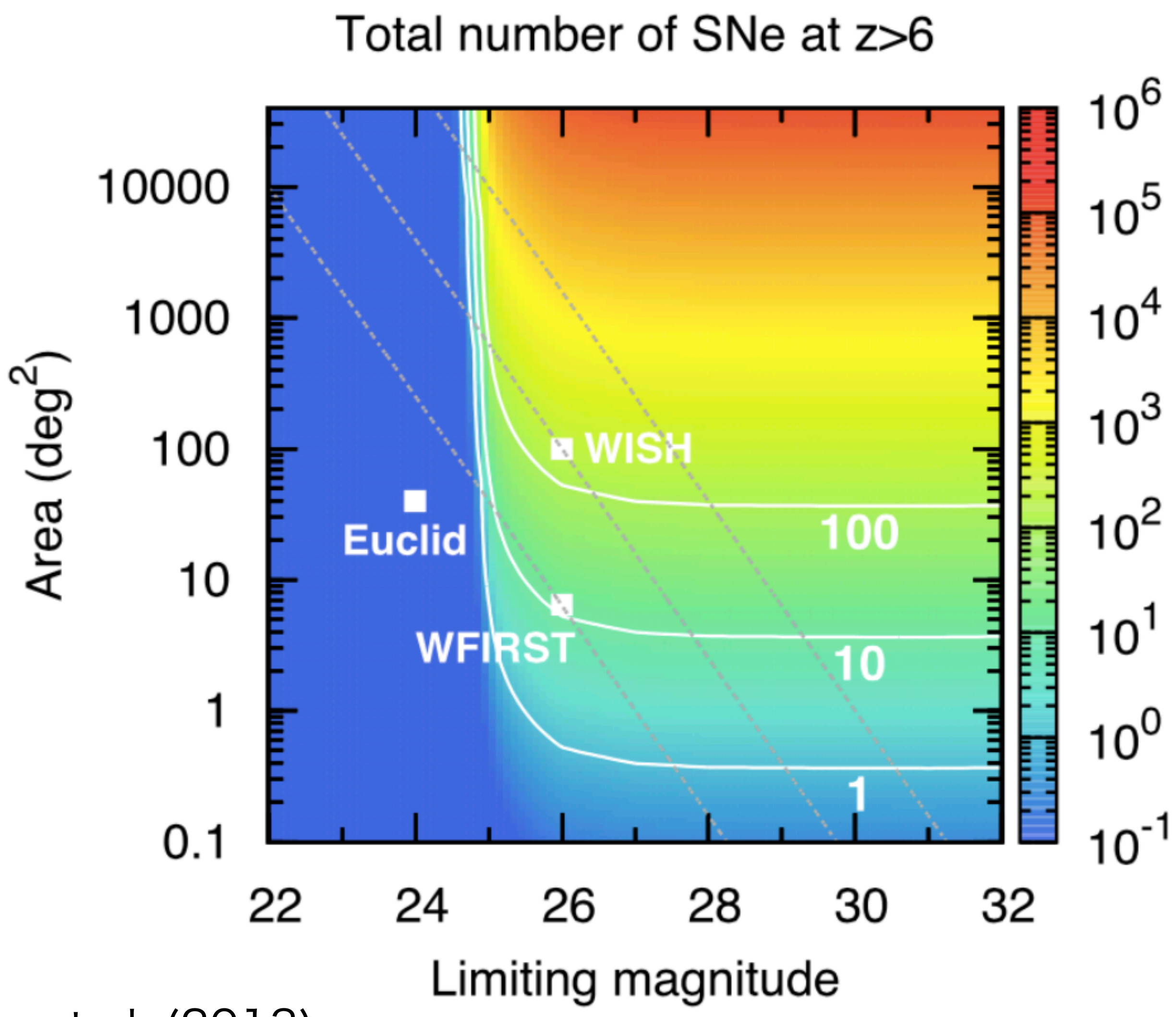
high-redshift supernova survey with HSC

We have performed a half-year deep transient survey with HSC from Nov. 2016 to Apr. 2017. We have found several z~2 SNe whose redshifts are confirmed by spectroscopic observations. We also found SN candidates up to z~4 whose redshifts are estimated by their host galaxy photometric redshifts. HSC17vsc in the figures is a SN at z=1.97.

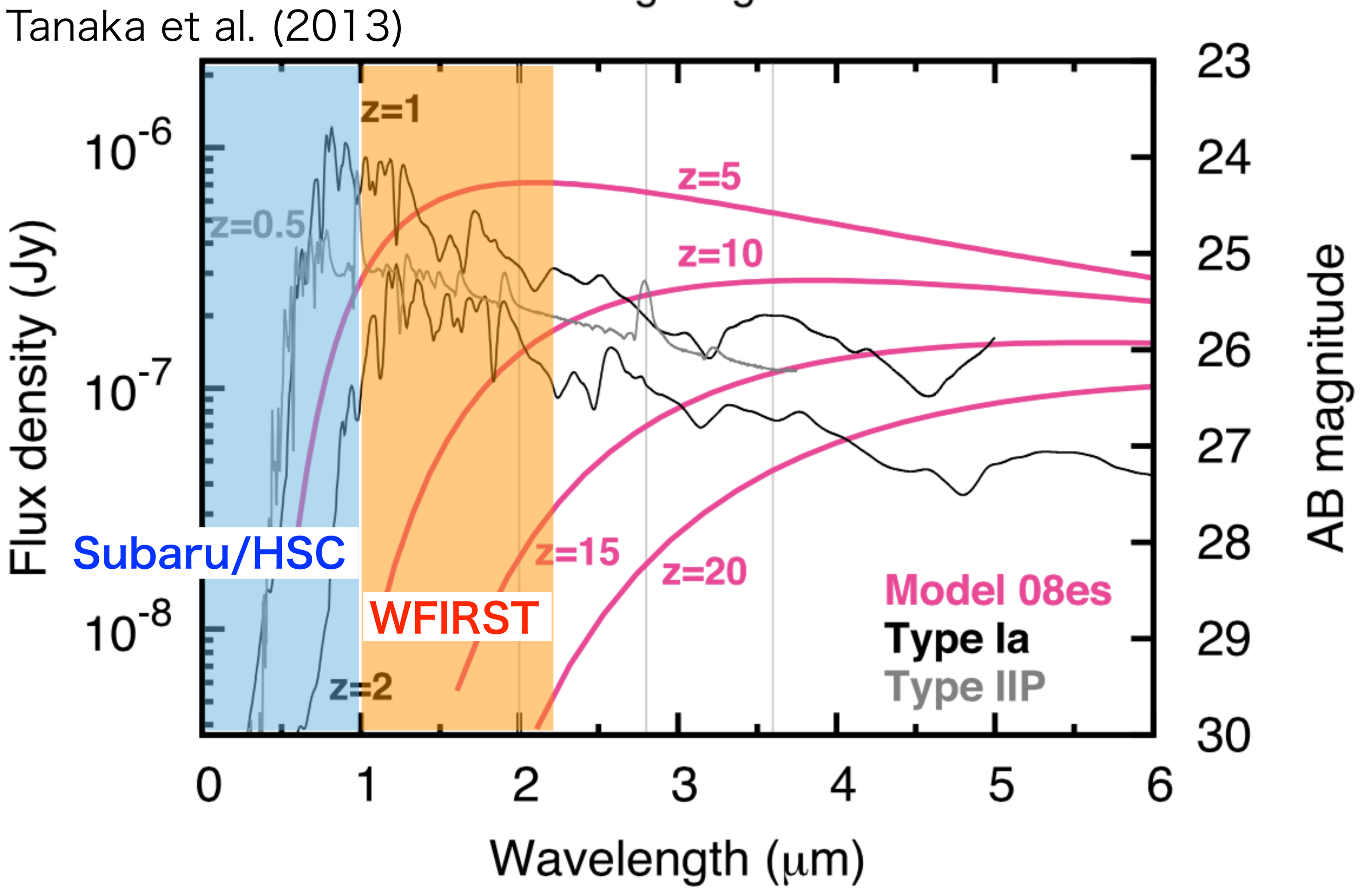




beyond z=6: WFIRST + HSC

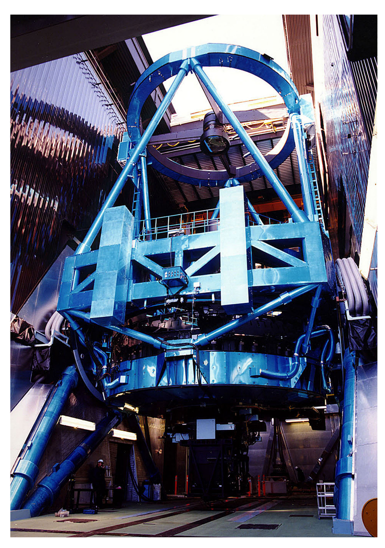


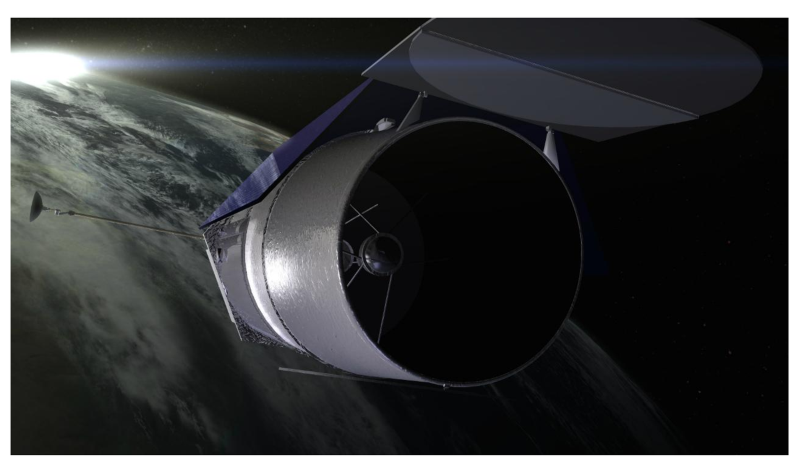
Tanaka et al. (2013)



SNe at the reionization era can directly tell us about the contribution of massive stars to the reionization. In addition, there may remain the first generation of stars and we expect bright pair-instability SNe to exist commonly in these epochs. However, finding SNe at z>6 require deep and wide transient surveys in infrared. WFIRST is the best instrument for this purpose. We expect more than 10 SNe at z>6 with the WFIRST transient survey (left top figure).

However, there are many transients that can be bright in infrared. Simultaneous transient survey in optical and infrared can efficiently pick up high-redshift SNe. Left bottom figure shows SEDs of superluminous SNe that can be detected at z>6 with WFIRST. If we can make optical observations with the limiting magnitudes of ~ 27 mag in the z band with Subaru/HSC with WFIRST transient survey for example, we can efficiently select high-redshift SNe by choosing transients that are only detected with WFIRST. High-redshift SNe would be observed as z-drop transients.





Efficient discoveries of SNe at z>6, enabling us to directly investigate massive stars in the reionization era and beyond!