Keeping an Ultraviolet Eye on the Transient Universe

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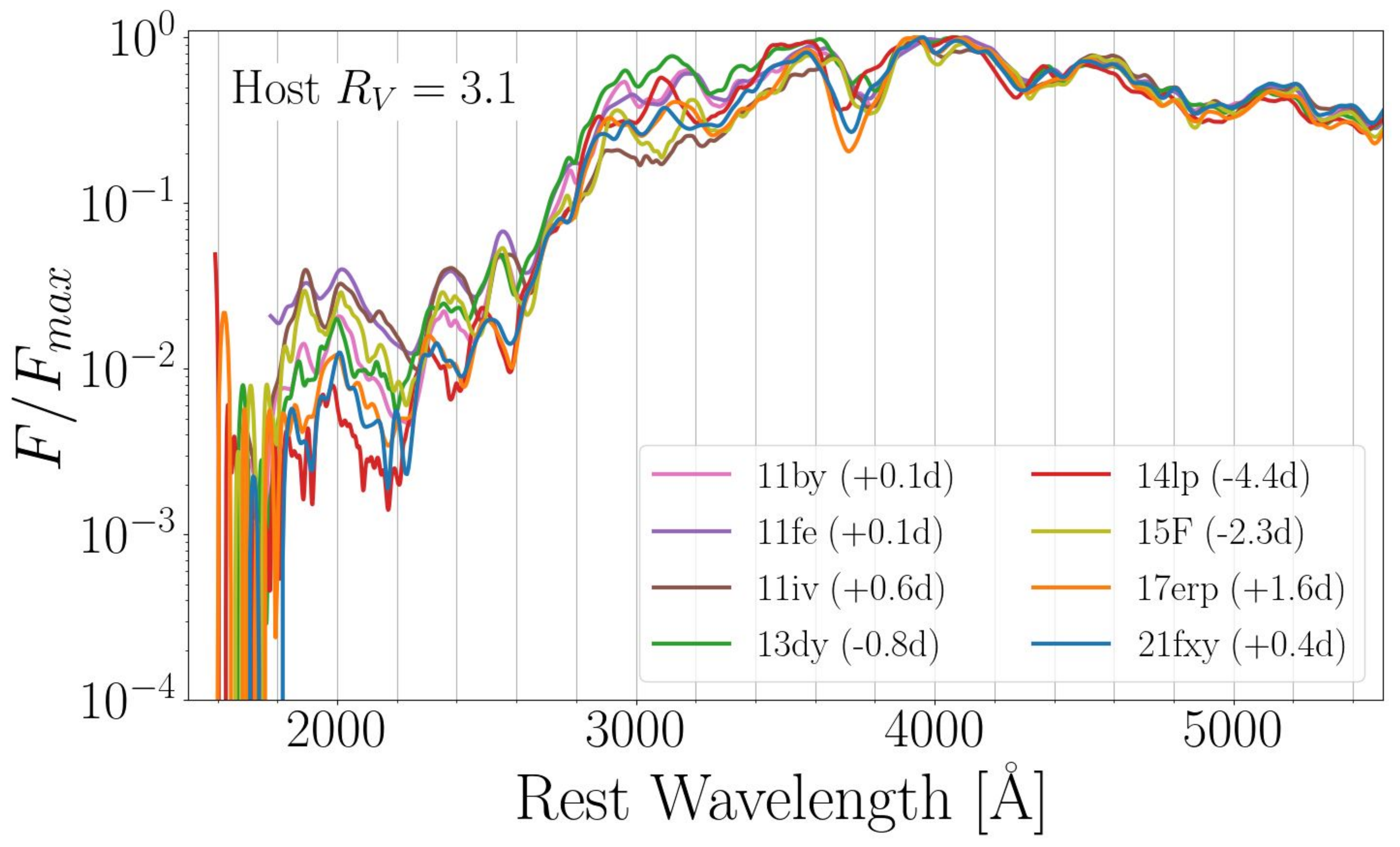


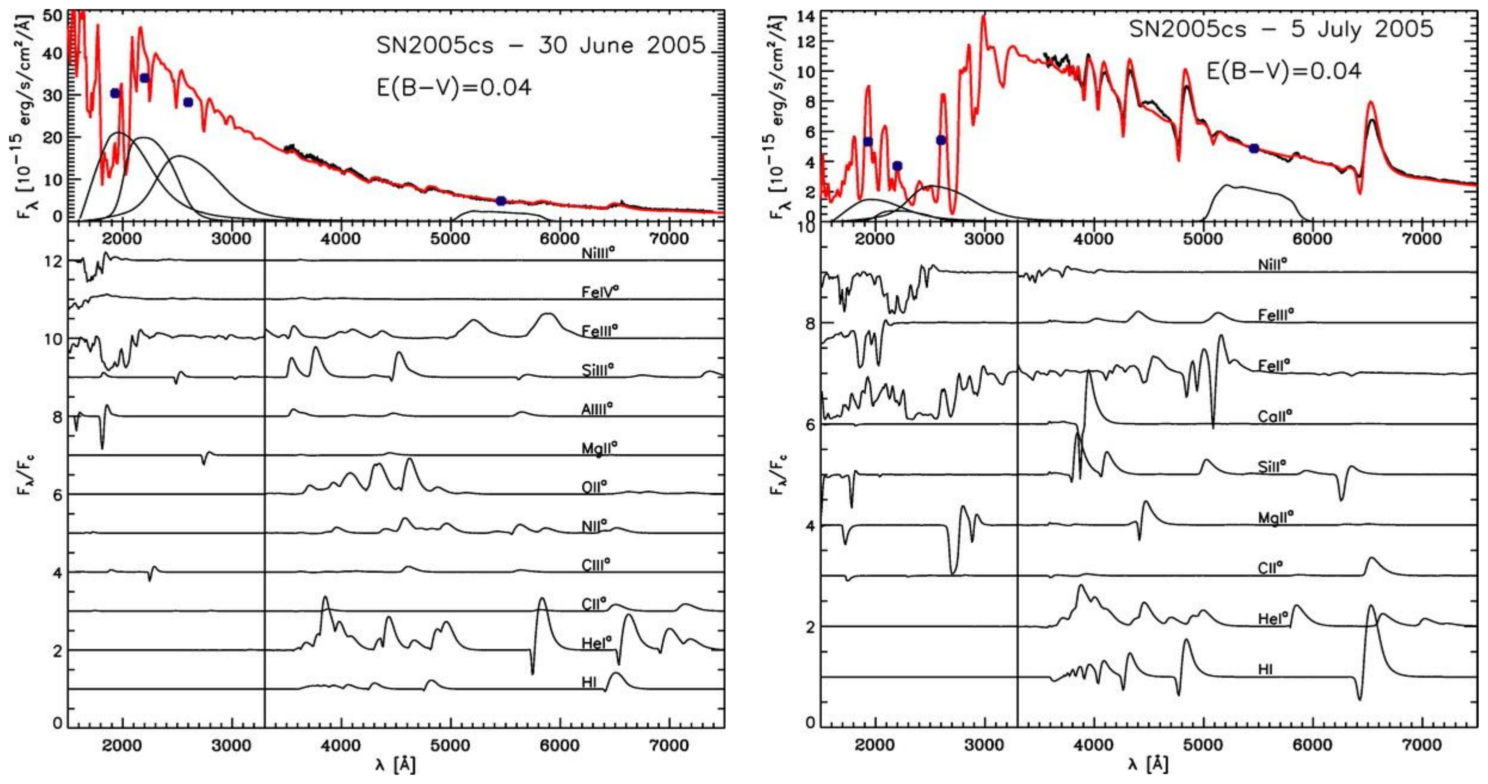
DerKacy et al. (2022)

Observing the diversity of “standard candle” Type Ia Supernovae requires

UV spectroscopy and a <10 day response time

As we look at near-term projects, the astronomical community will have incredible wide-field area and depth in the optical (thirty -meter telescopes, Rubin/LSST) and the infrared (JWST,Roman). Missing from the U.S. plans are long-term replacements to the ultraviolet capabilities of the aging Hubble Space Telescope and Neil Gehrels Swift Observatory's Ultra-Violet Optical Telescope (UVOT; Gehrels et al. 2004, Roming et al. 2005). It is imperative that we do not lose the ability to see in the ultraviolet over the same time period that time-domain astronomy makes its next leap into even larger samples of supernovae with Rubin and Roman.

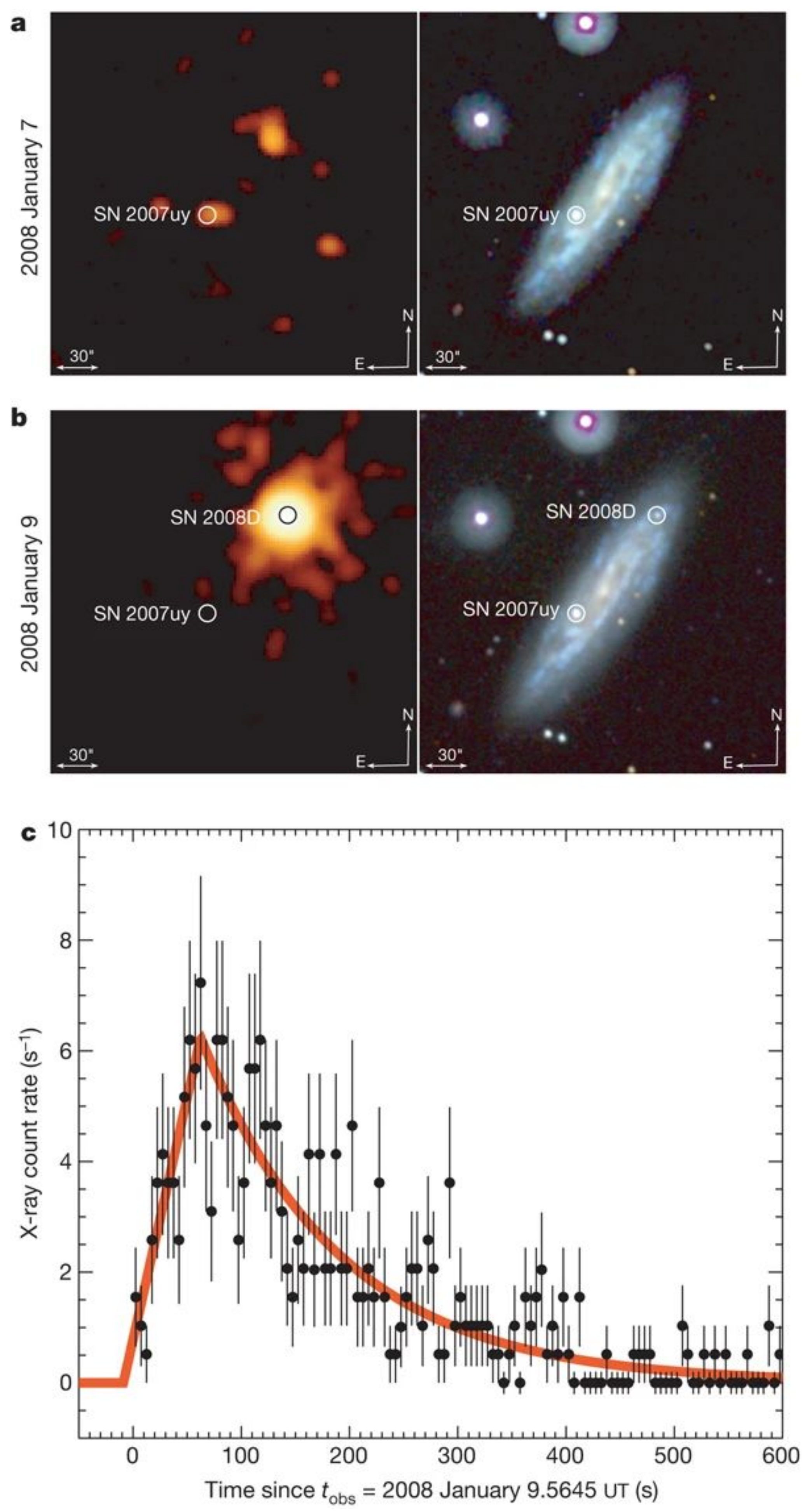
See Brown & Suntzeff (2019) Decadal Survey White Paper and references therein https://baas.aas.org/pub/2020n3i457/release/1



Brown et al. (2007)

Observing the ionization changes in Type II Supernovae requires

UV spectroscopy and a <5 day response time



The shock breakout of SN2008D (left; Soderberg et al. 2008) was observed in Swift X-ray imaging occurring during its ~20 minute outburst. SN2006aj (top right) was promptly observed after the Swift BAT detection of GRB060218 (Campana et al. 2006). SN2022oqm (bottom right) was promptly observed after the ground-based ZTF discovery by ZTF (Sollerman et al. 2022). The shock breakout flux, evolution, and temperature constrain the progenitor star and its environment.

Since one does not know which star will explode when, being in the right place at the right time with the right instrumentation requires good luck or good strategy.

Observing the shock breakout of supernovae requires:

Wide-field, high-cadence imaging in X-ray or UV

or

Rapid-response (<hours) multi-band UV photometry or spectroscopy triggered by wide-field, high-cadence transient searches (gamma ray, X-ray, UV, optical, NIR, neutrino?)