Gap transients: constraining their progenitors and evolution

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ABSTRACT: Modern all-sky surveys have started to populate the poorly known luminosity gap separating novae and supernovae. However, the number of well-followed transients sitting in this region is still small, and the connection between their observed parameters with the progenitor type and the physical mechanisms triggering of these outbursts is still ambiguous. During this talk, I will review some of the observations efforts to characterise these transients and the conclusions extracted from their analysis.

Context of the research

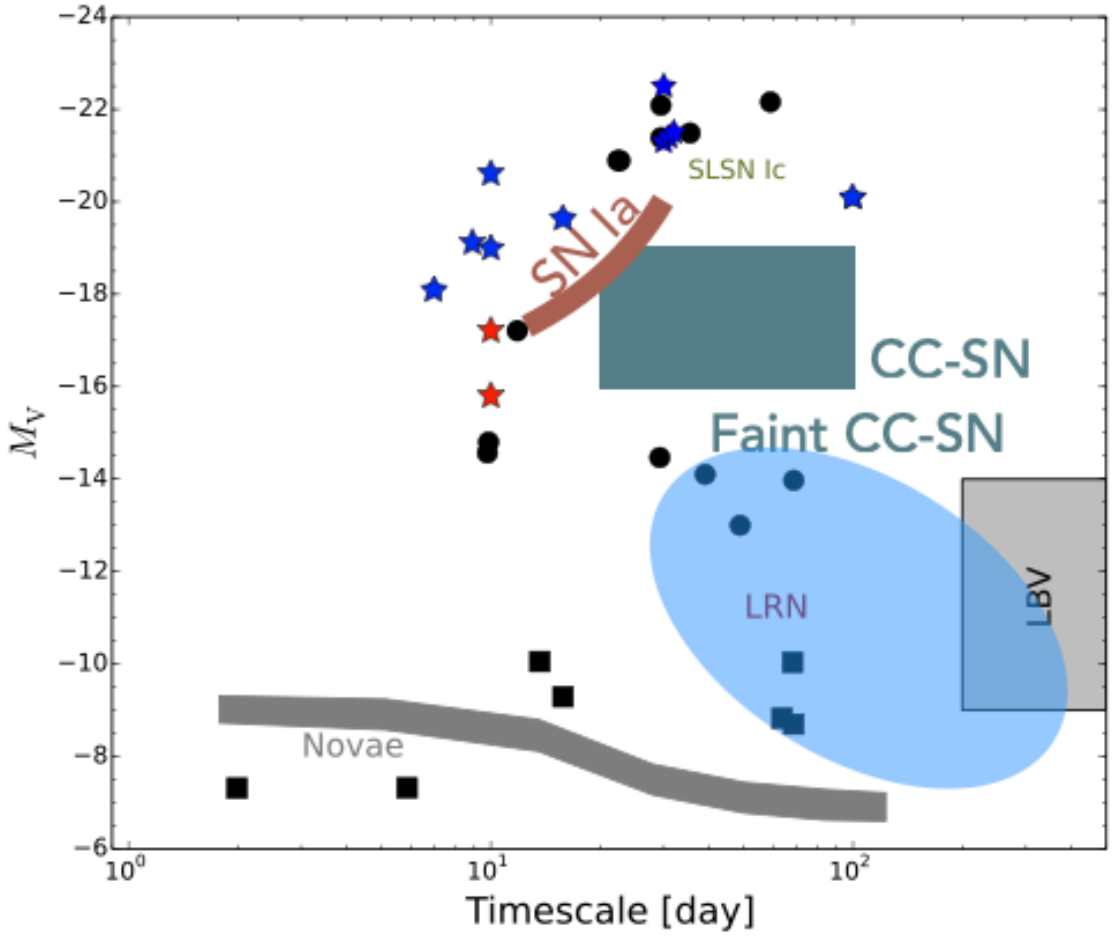


diagram of the phase space of explosive and eruptive transients

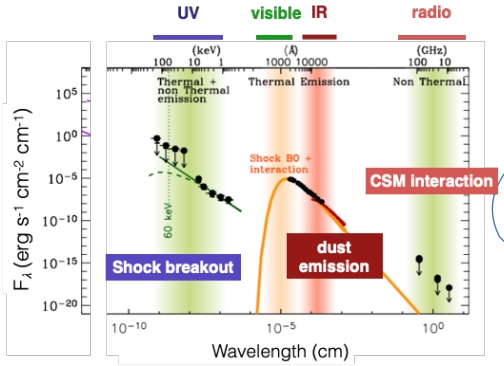
adaptation of Kasliwal 2011; Smartt et al. 2015

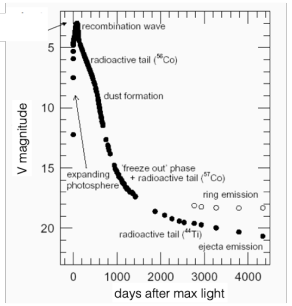
Gap transients
(Intermediate-Luminosity Optical Transients -- ILOTs)

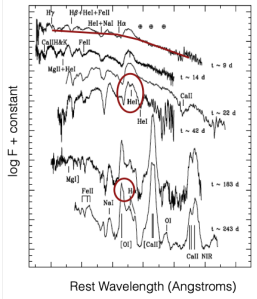
- Intermediate-Luminosity Red Transients (ILRTs)
- Luminous Red Novae (LRN)
- Giant outbursts and eruptions of very massive stars

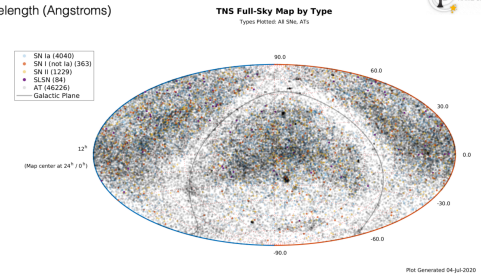
- How the heterogeneity of these transients is connected to stellar parameters?
- Are they a new physical class of transient phenomena or just known nuclear burning instabilities in massive stars?
- Can very massive star explode?

Description of the work







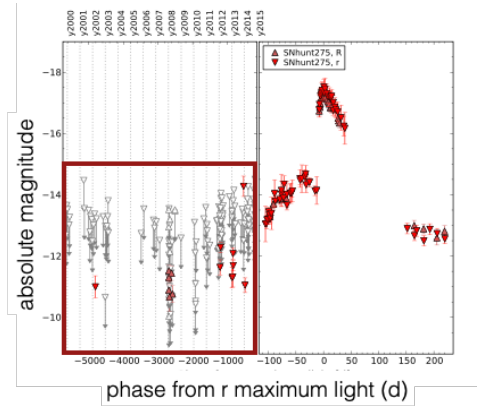


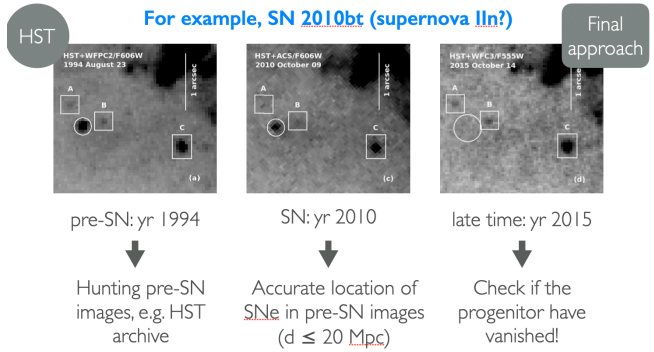
detailed multi-wavelength follow up

data analysis of observables

constrain of progenitor
- over time
- direct iden.

classification



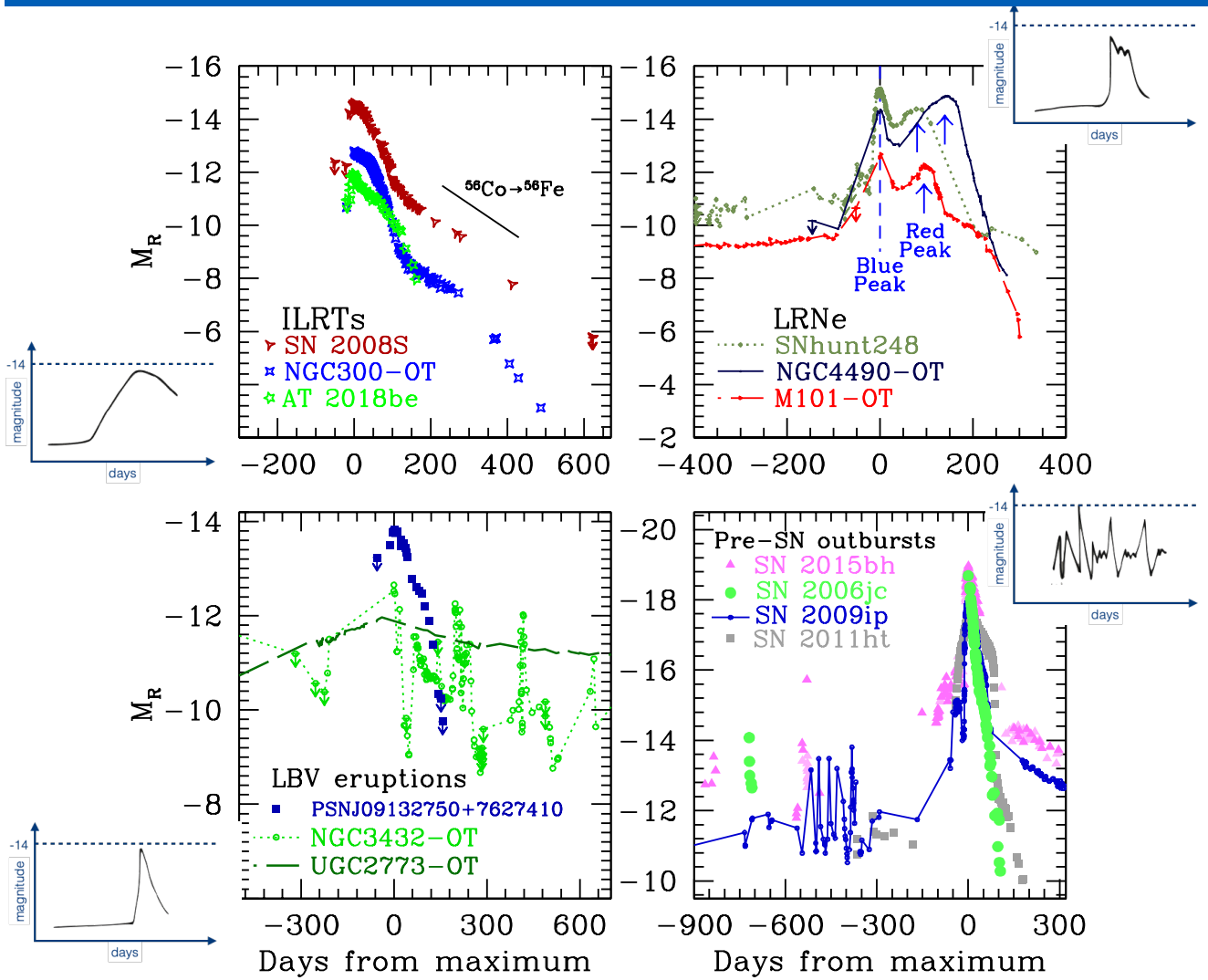


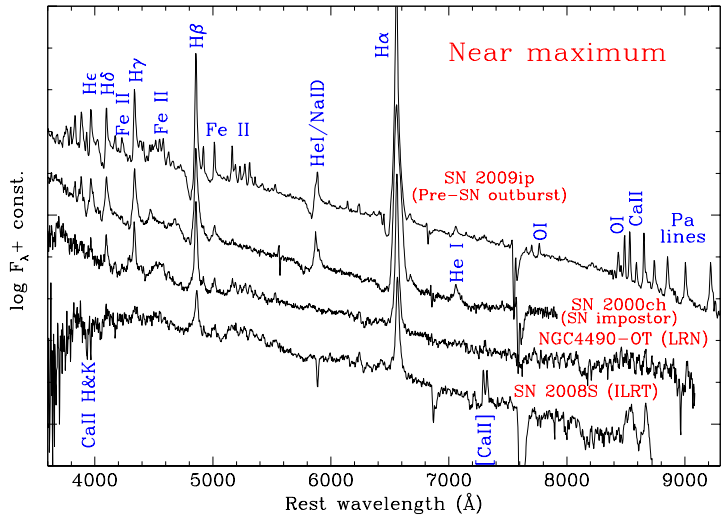
To understand the relevance of these transients and to use them as probes of stellar evolution, it is necessary to determine their origins

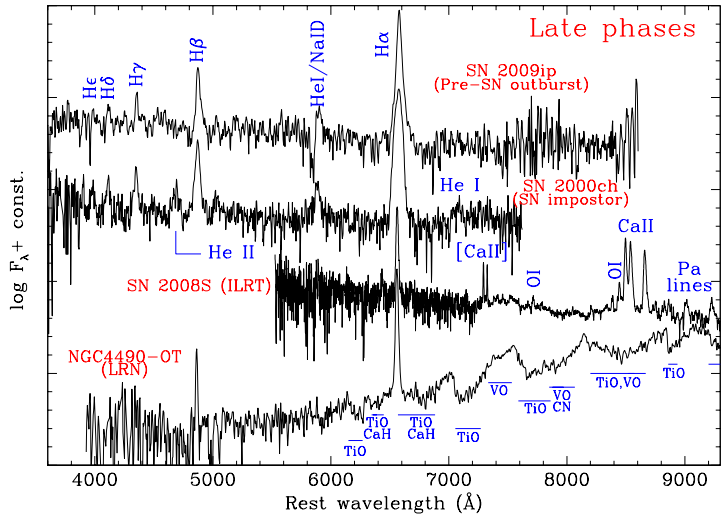
Margutti et al. 2014; Leibundgut & Suntzeff 1991; Morales-Garoffolo, Elias-Rosa et al. 2013; TNS

Elias-Rosa et al. 2016; Elias-Rosa et al. 2018

Results

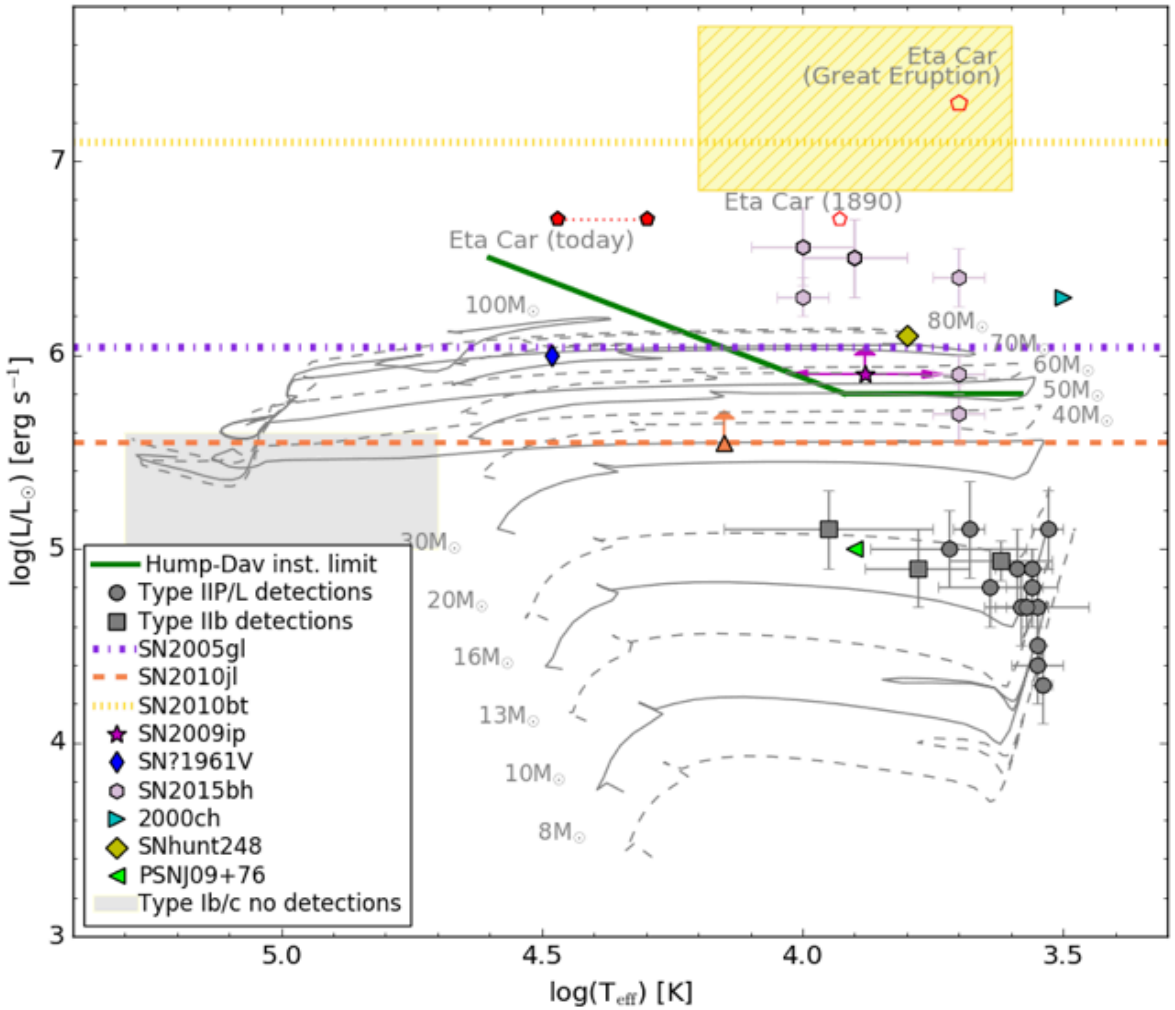






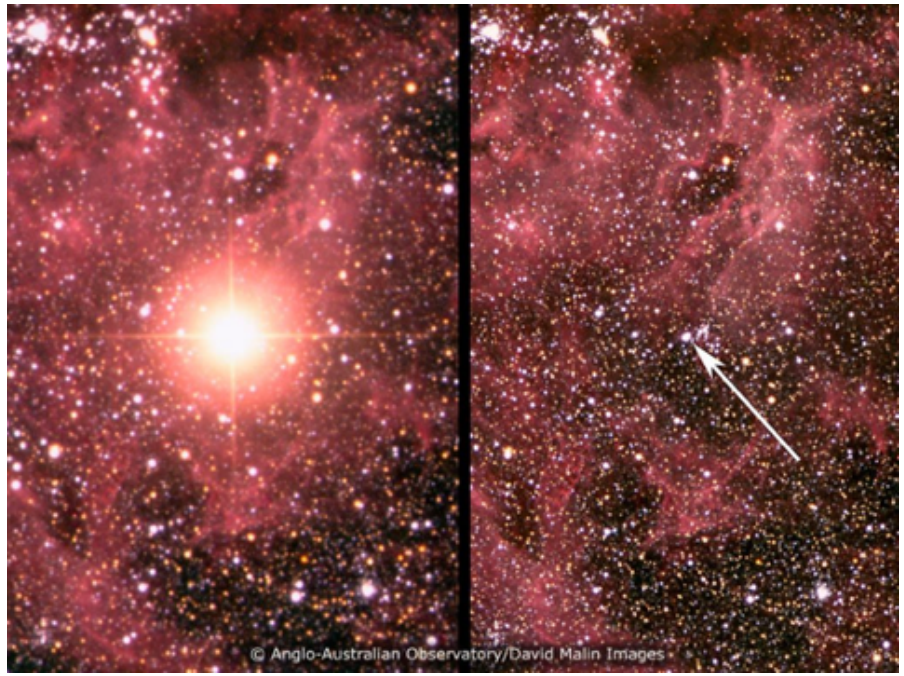
Pastorello & Fraser 2019

Results



- ILRTs: 8-15 Msun stars embedded in dusty cocoons, but their nature is still controversial
  - spanning from electron-capture SNe from super-AGB stars
  - non-terminal outbursts of lower mass supergiants
- LRNe: mergers in binary systems, such as V1309 Sco
- Giant outbursts and eruptions of very massive stars:
  - any massive stars enshrouded in a CSM
  - or with strong binary interaction

Impact and prospects for the future



SN1987A in LMC

Various transient events

connections

stellar evolution

Challenges:

- Increase the number of well-studied gap transients to draw robust conclusions on their observed variety
- To constrain their progenitor nature by using state-of-the-art instrumentation and theoretical models
- To determine if very massive stars end their evolution as powerful SN explosions