The Curious Case of iPTF14hls

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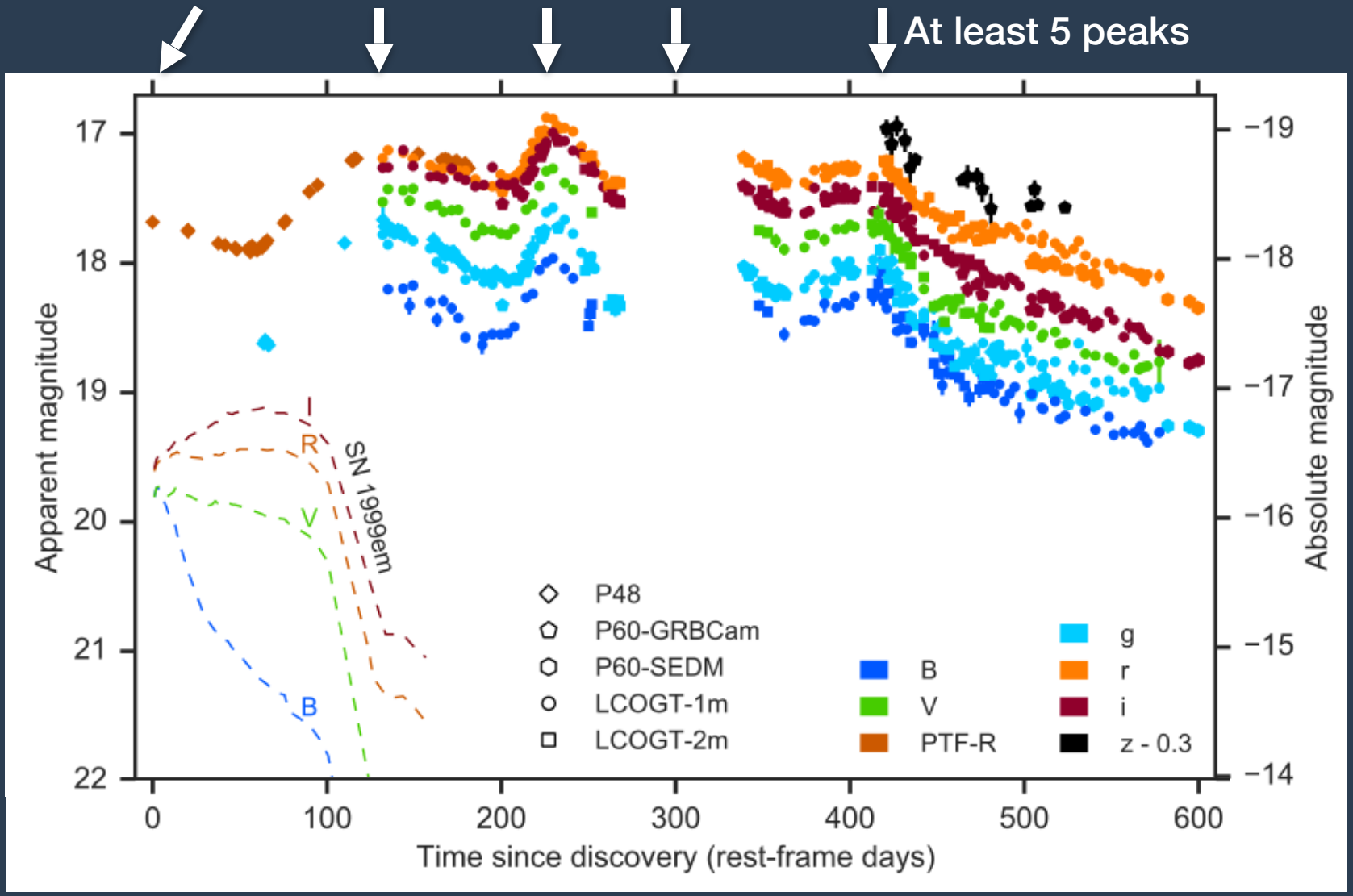
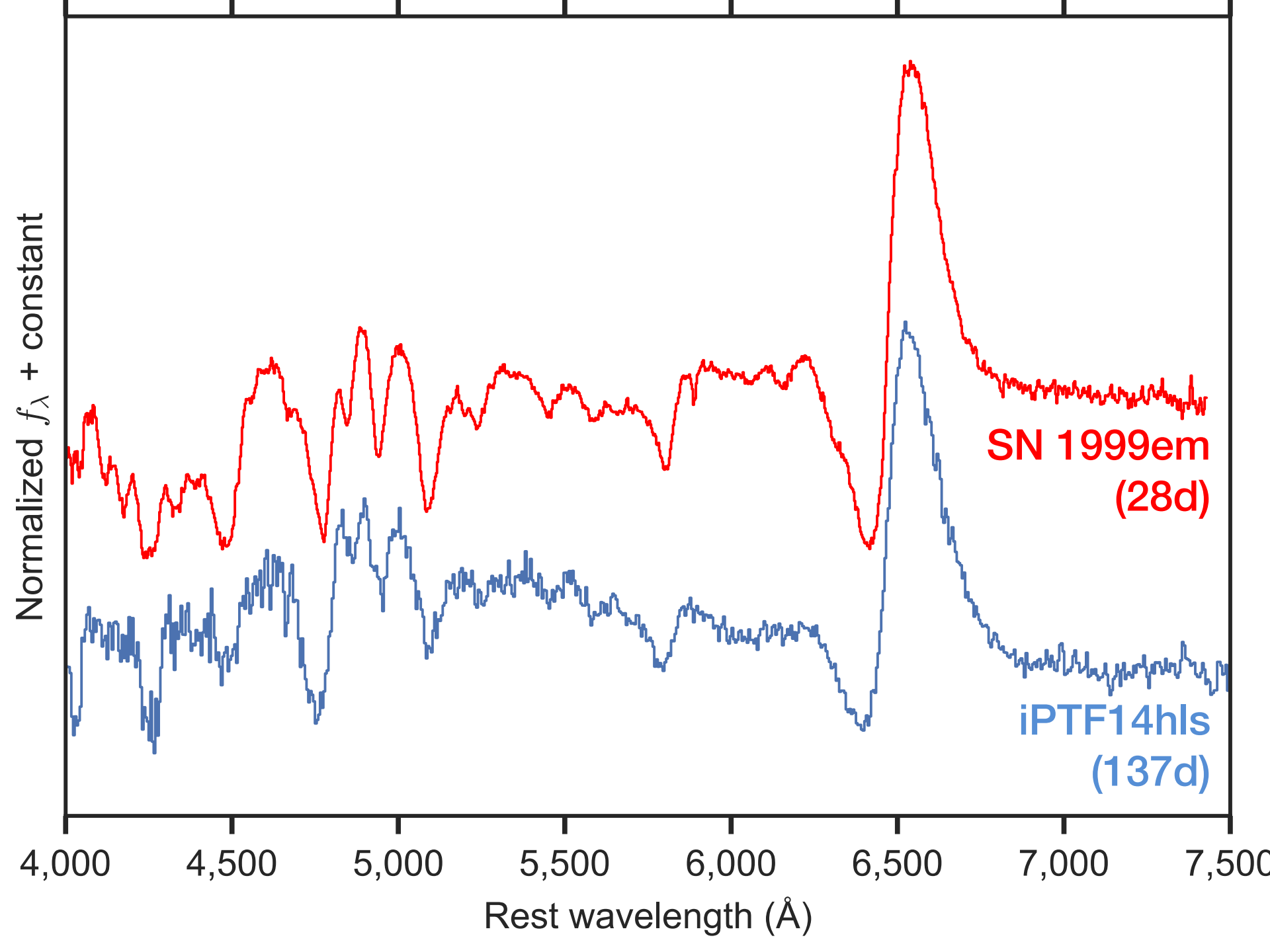
Tel Aviv University

Quintuple-Peaked Light Curve

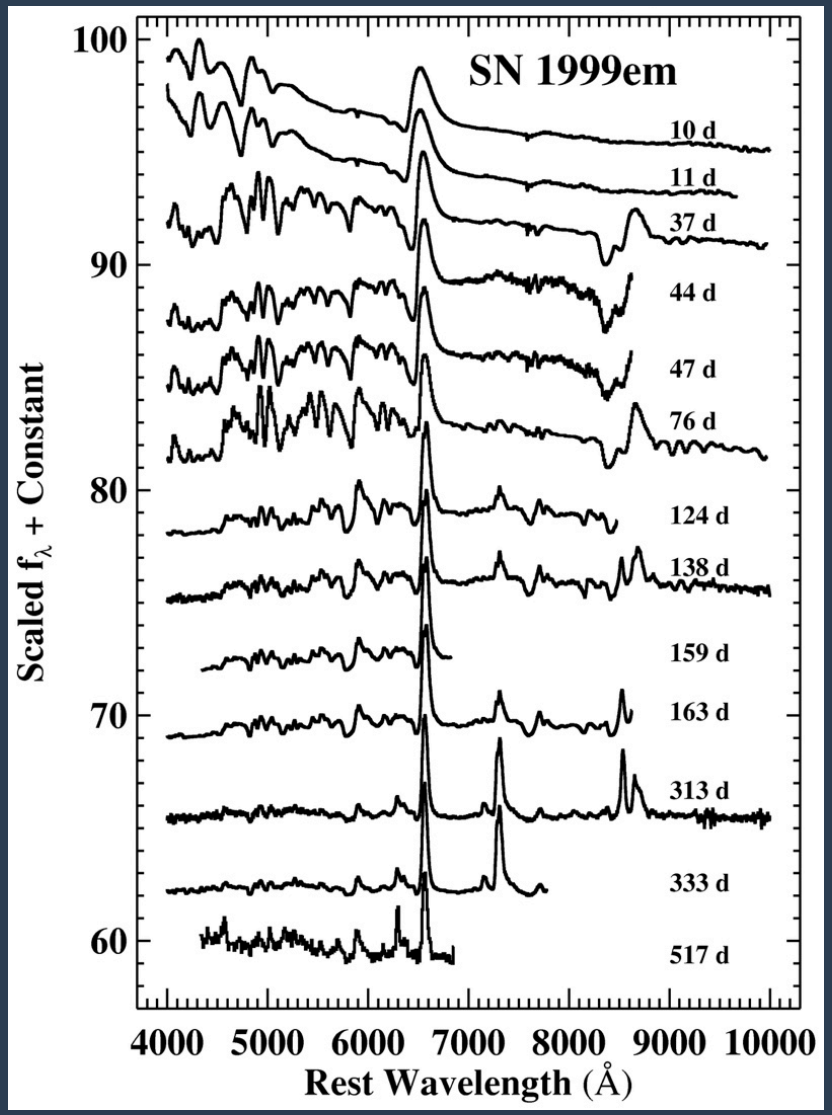


Last non-det is 140d before discovery

Arcavi et al. 2017

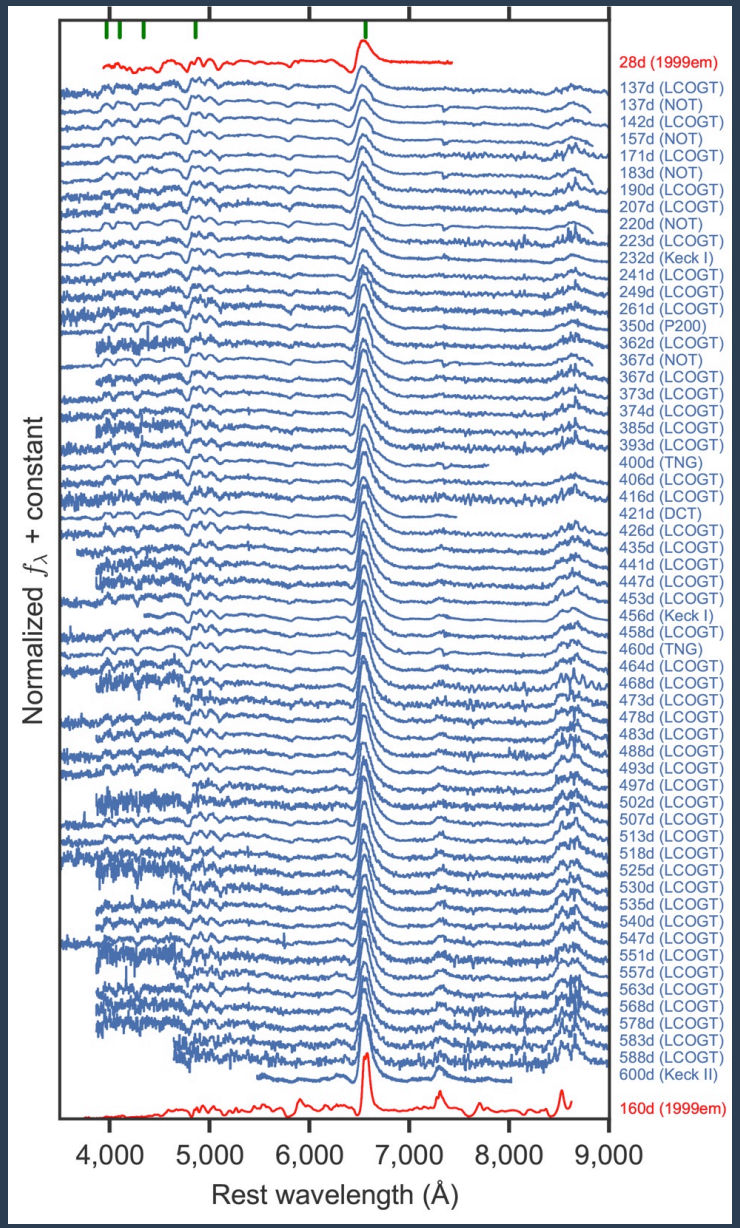

SN 1999em
(28d)
iPTF14hls
(137d)
Normalized f_λ + constant
4,000
4,500
5,000
5,500
6,000
6,500
7,000
7,500
Rest wavelength (Å)

SN 1999em (typical IIP)



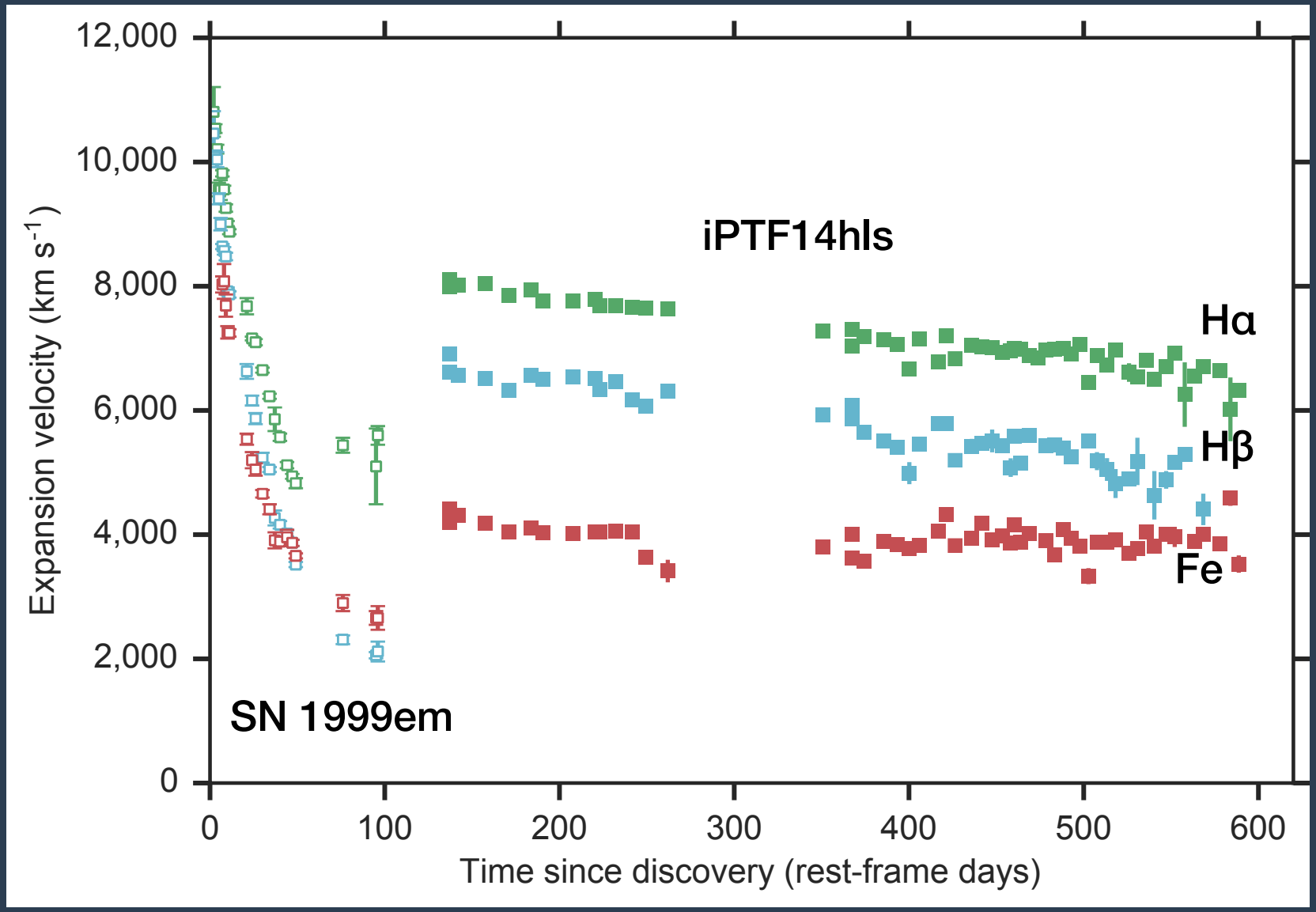
Leonard et al. 2002

iPTF14hls

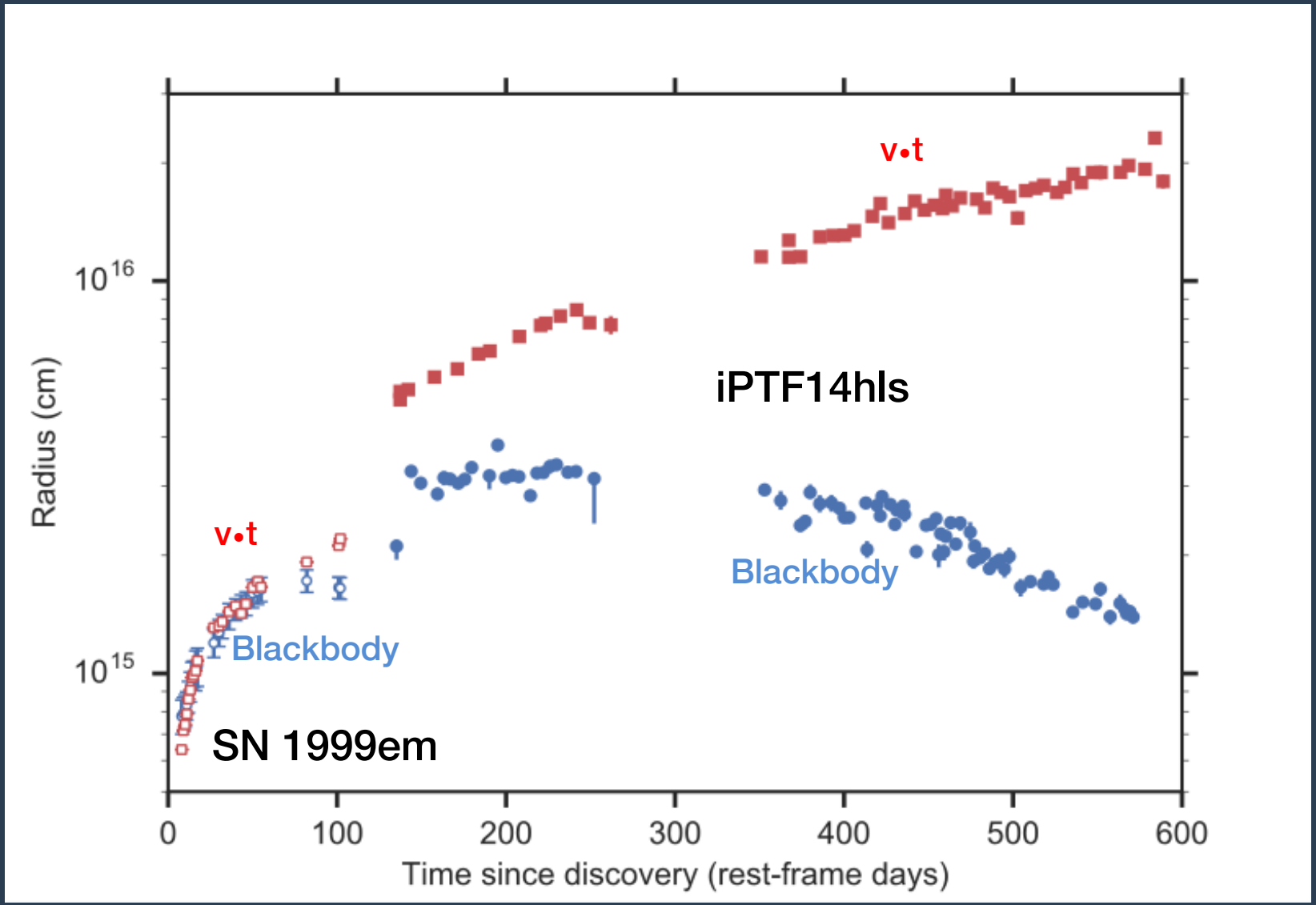


Arcavi et al. 2017

How can a Velocity Gradient be Constant in Time?

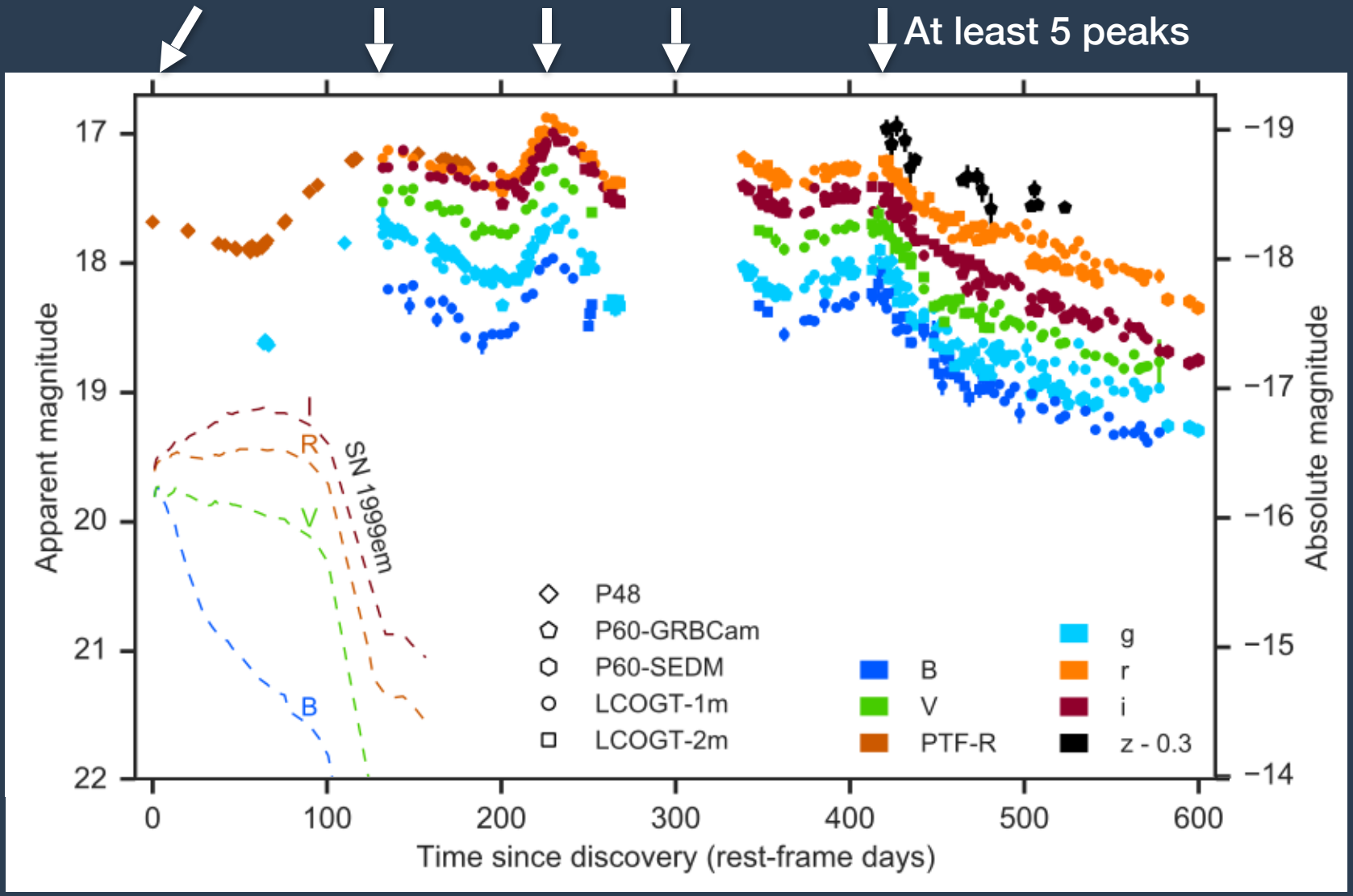


Photosphere Radius Estimates Diverge



Arcavi et al. 2017

Quintuple-Peaked Light Curve



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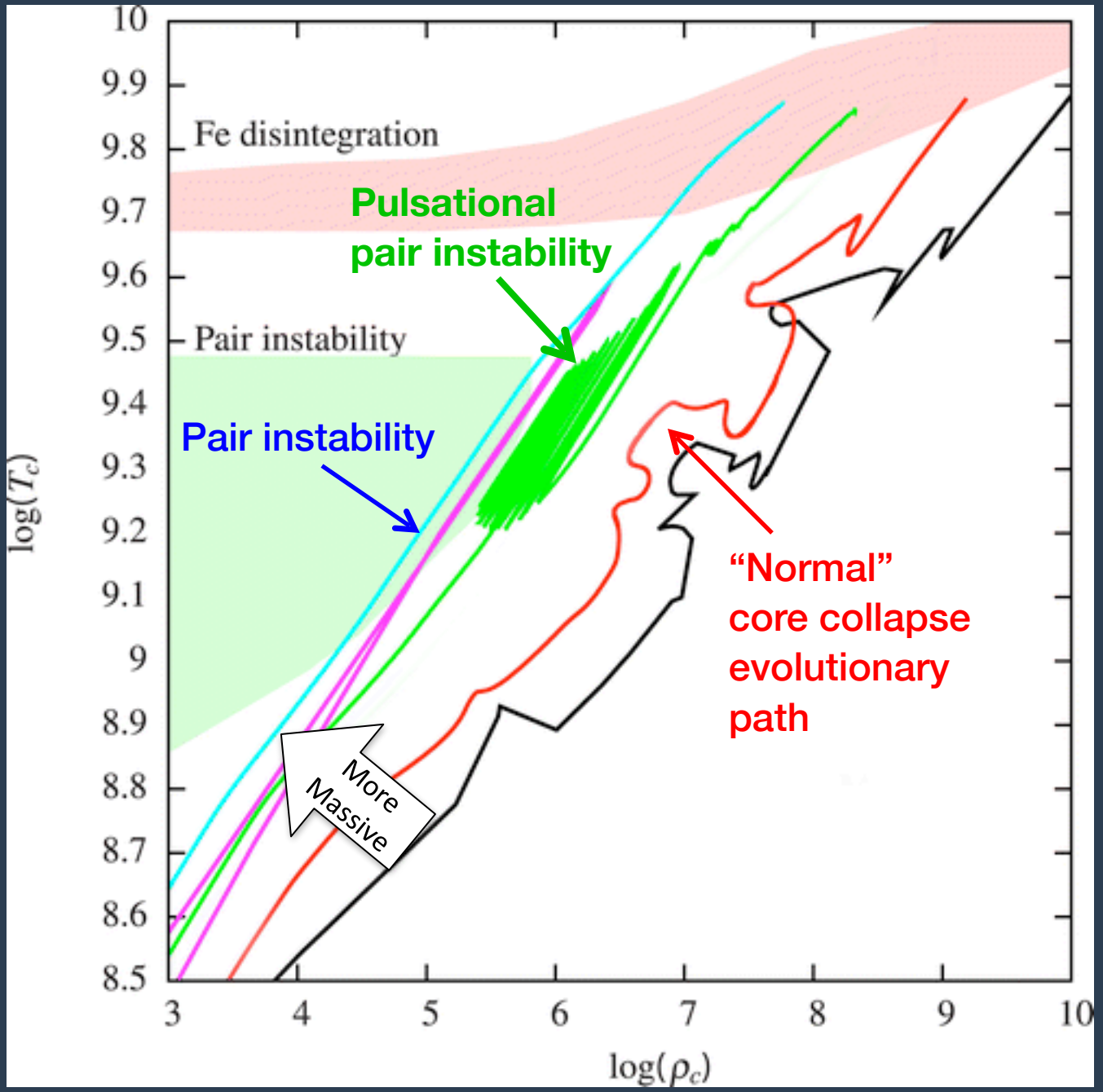
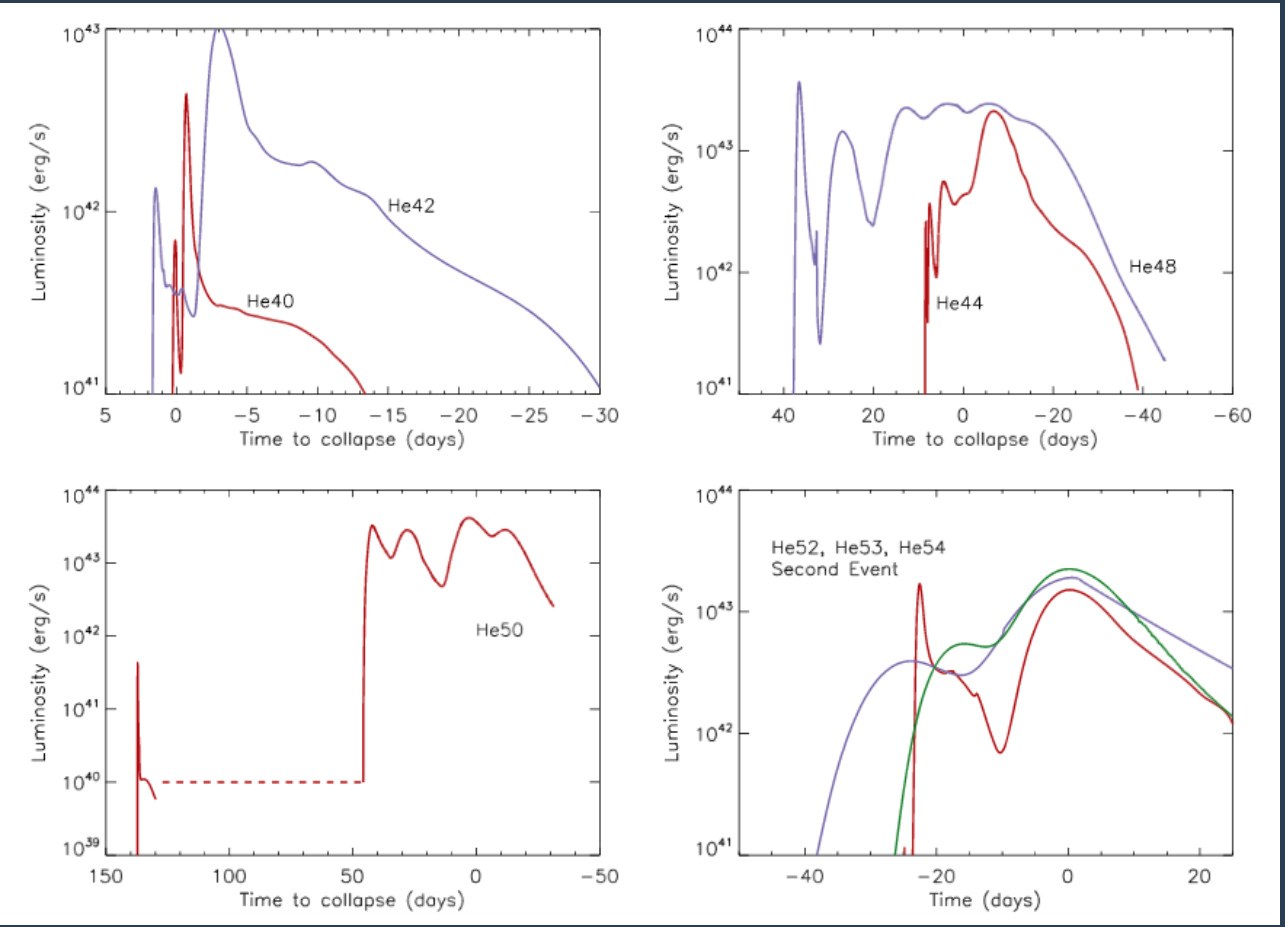


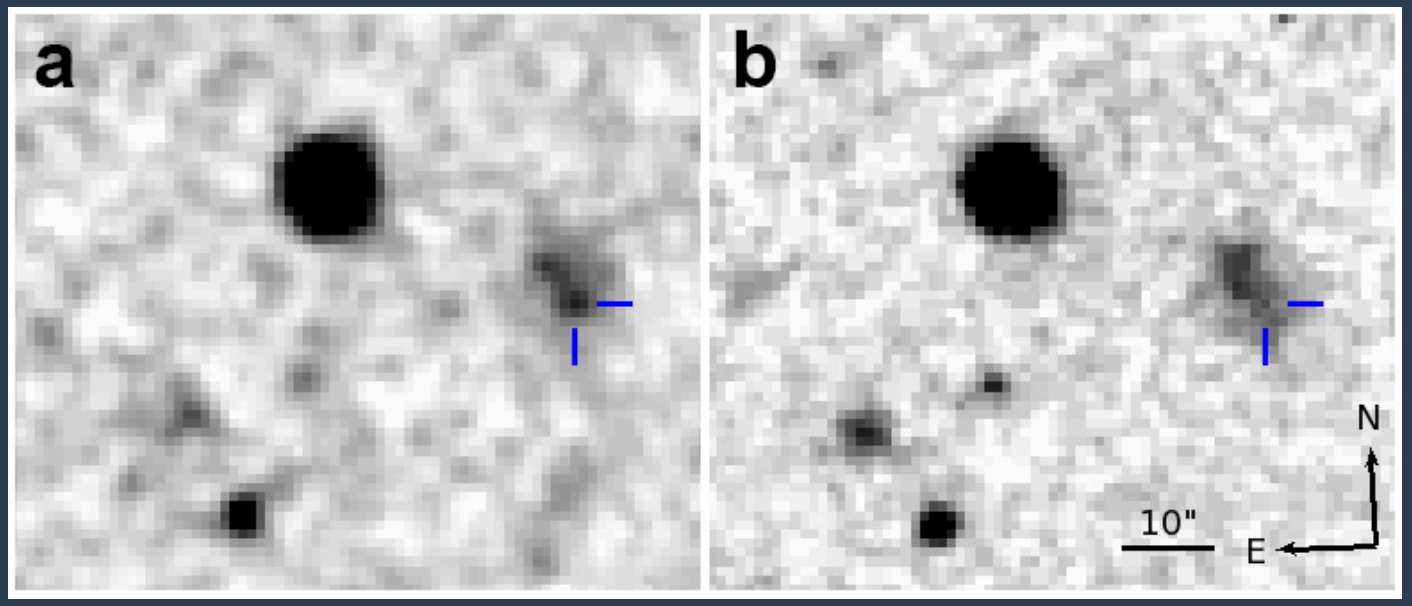
Adapted from Waldman 2008

Is 14hls a Pulsational Pair Instability Supernova?



Woosley 2017

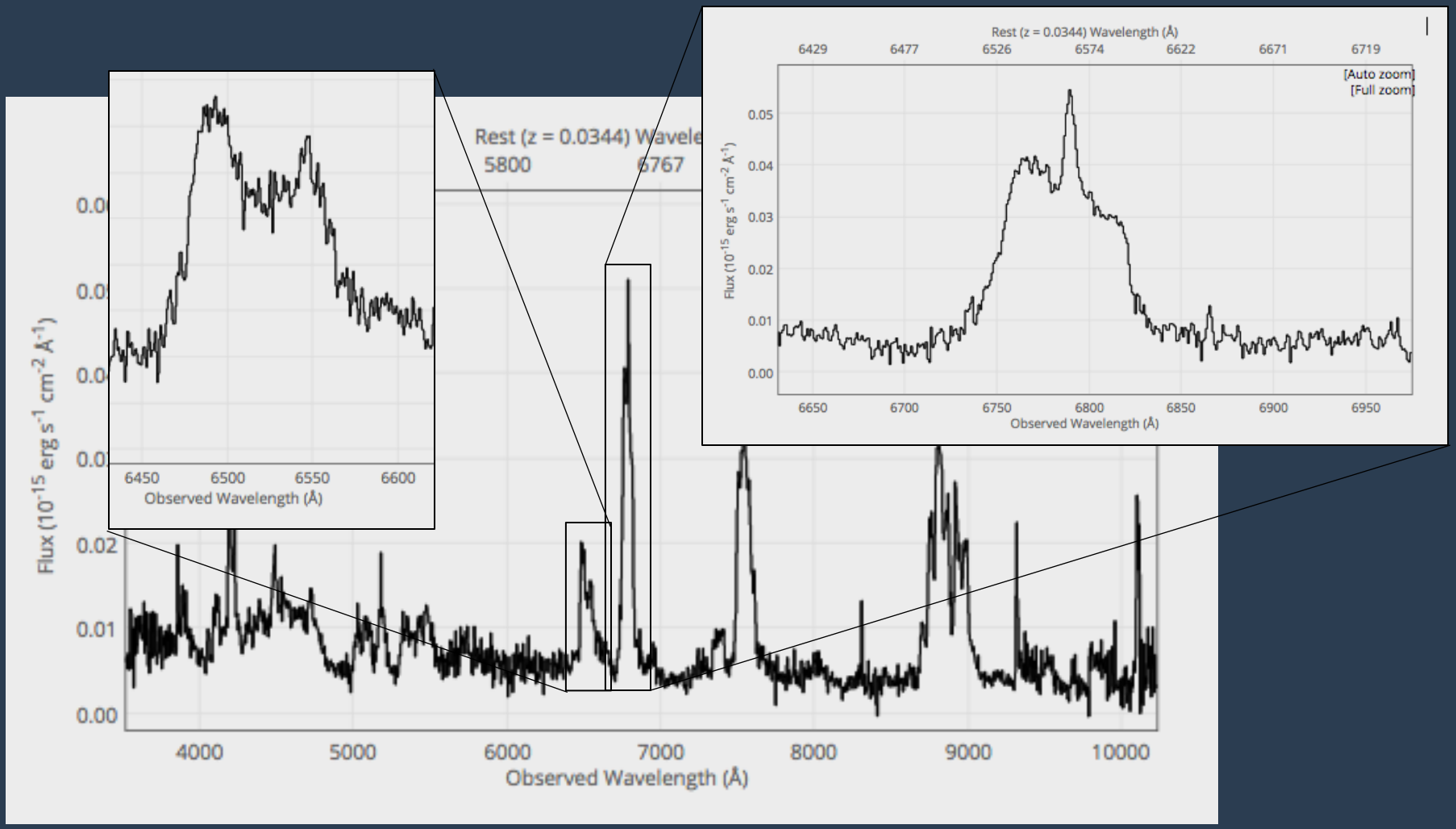
Evidence for a Historic Eruption



1954 1993

Arcavi et al. 2017

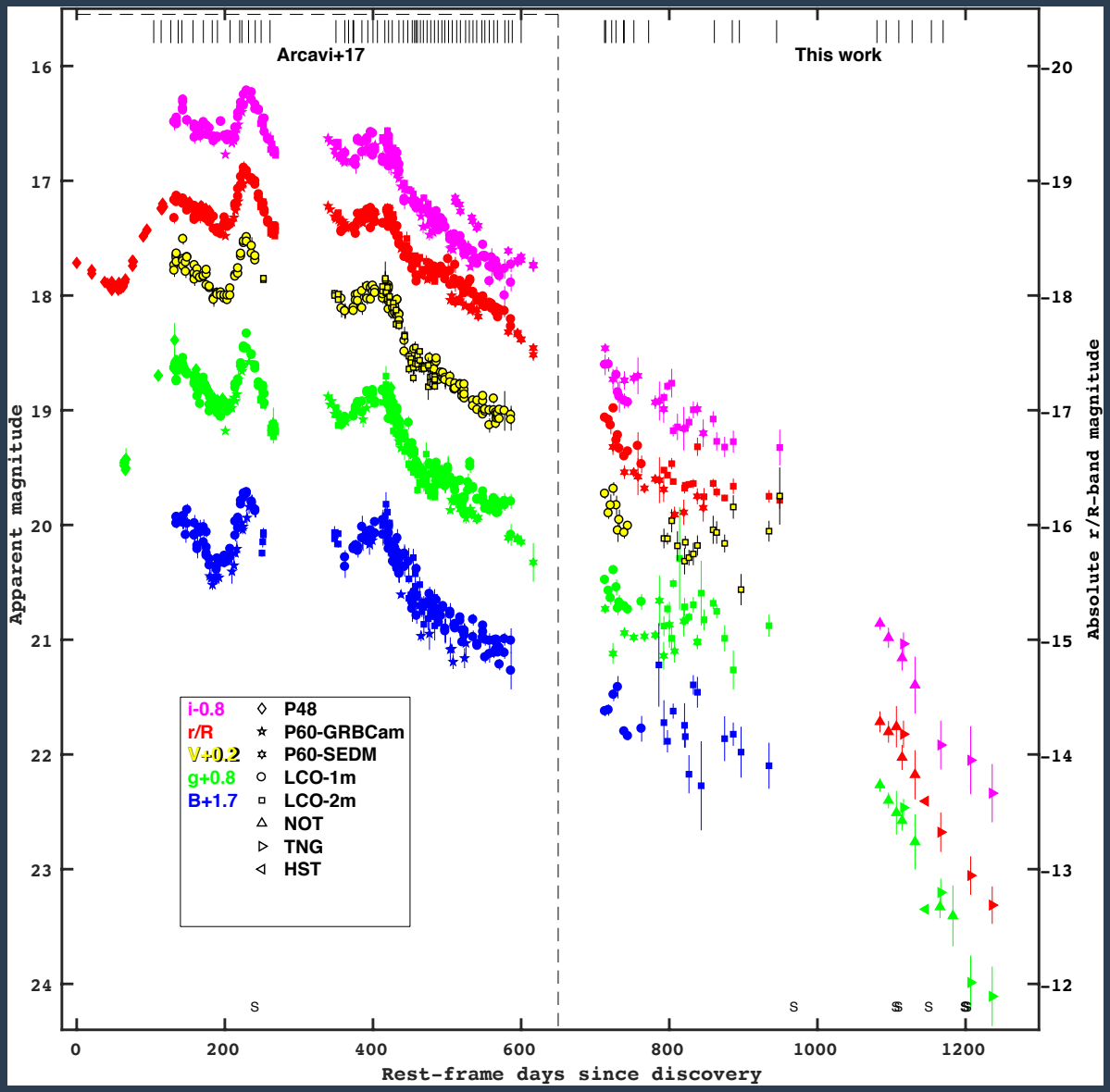
Late Spectra Show Line Structure = Interaction?



	LC Energetics	LC bumps	Velocity Evolution	1954 eruption
Soker & Gilkis (common env. jets)	✔?	✔?	?	✔?
Andrews & Smith (CSM)	✔?	✔?	?	✔?
Dessart (Magnetar)	✔	✖	✔	✖
Wang et al. (Fallback accretion)	✔	✔?	✔?	✖
Woosley (CSM, PPISN, Magnetar)	✔	✔	?	✔

Different models

Late Sudden Drop in Light Curve



Sollerman et al. accepted

Don’t Know What it is But Here’s Another One?

SN 2018aad Might be Another iPTF14hls at z=0.025

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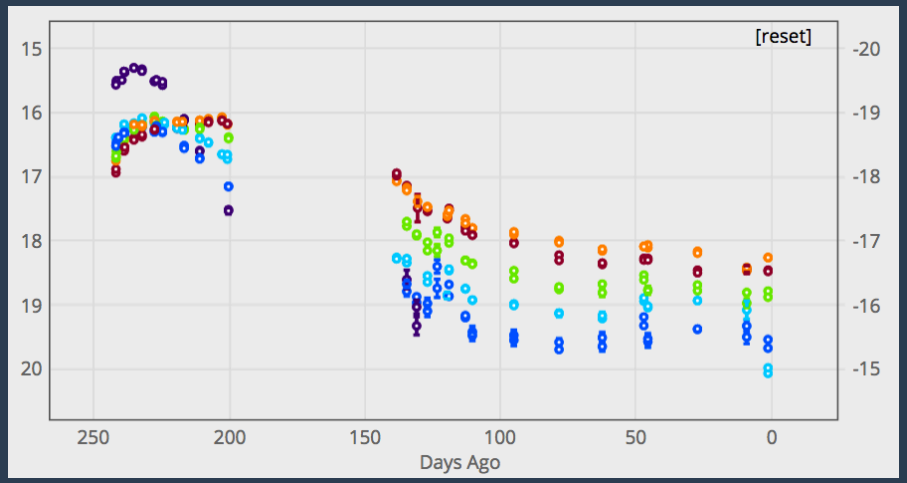
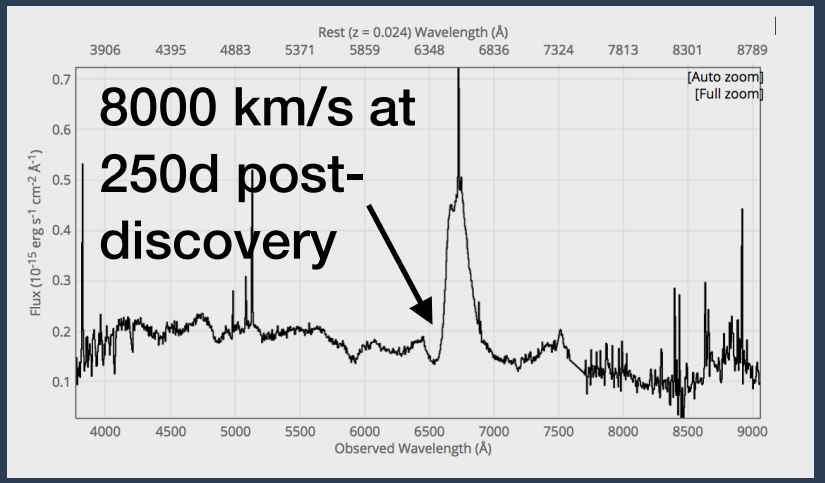
on 20 Oct 2018; 20:25 UT
Credential Certification: Iair Arcavi (arcavi@gmail.com)

Subjects: Optical, Supernovae, Transient

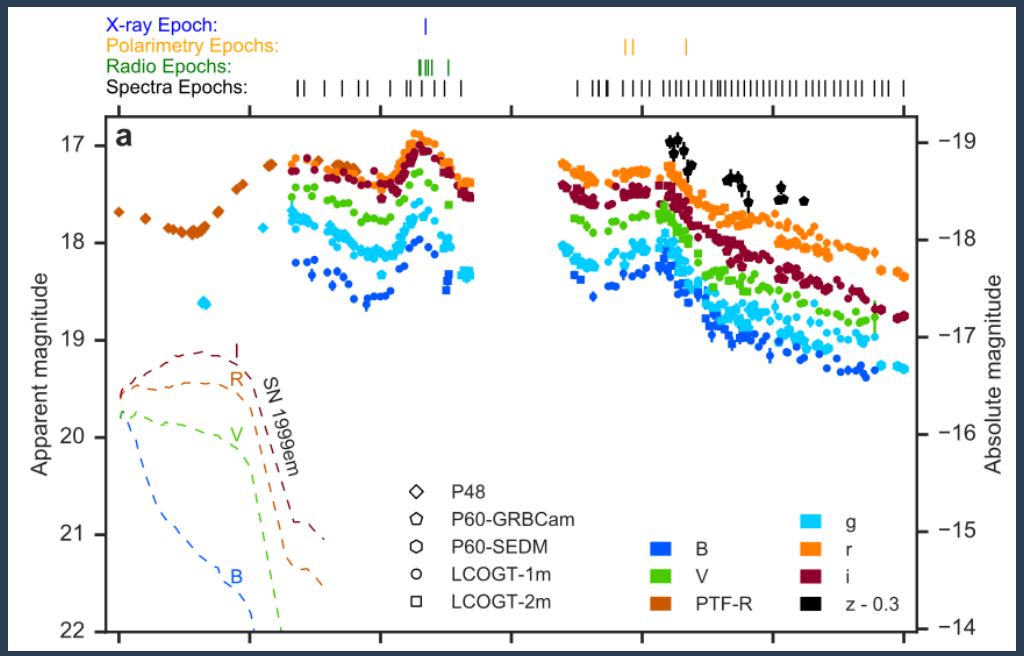
Tweet

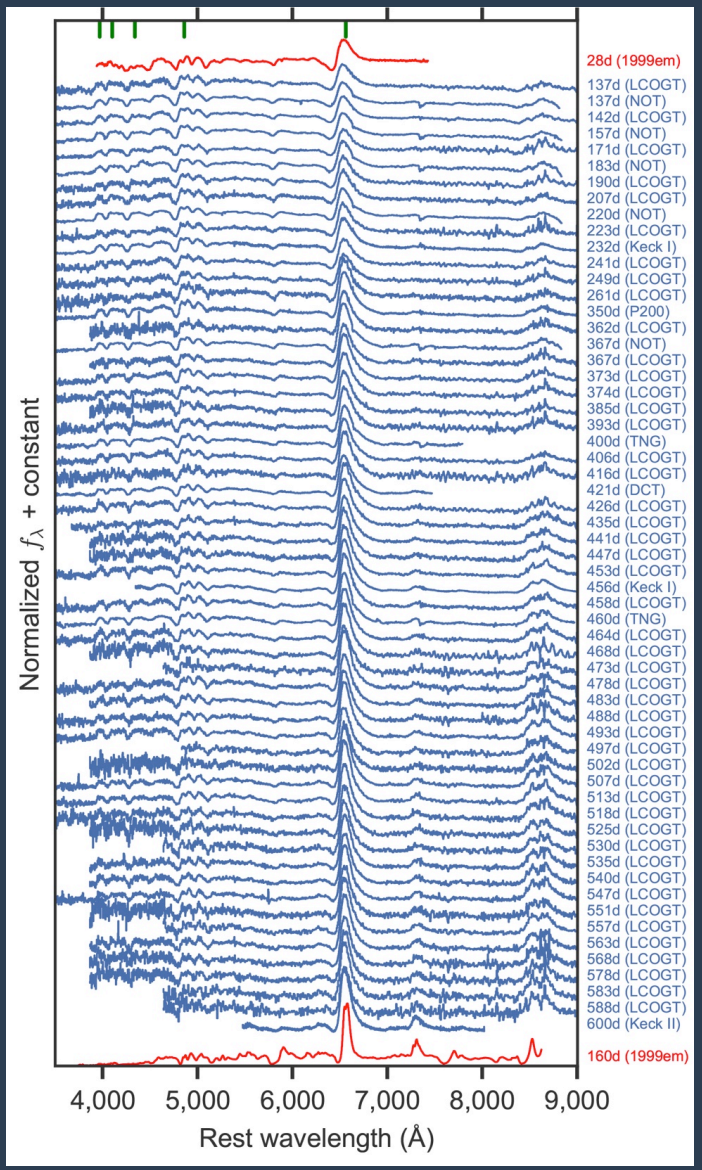
SN 2018aad (ASASSN-18eo; Nicholls et al. 2018, ATel #11391) was classified as a Type II supernova at z=0.01 (Hosseinzadeh et al. 2018, TNSCR 1784) based on a broad H-alpha P-Cygni





What is iPTF14hls?



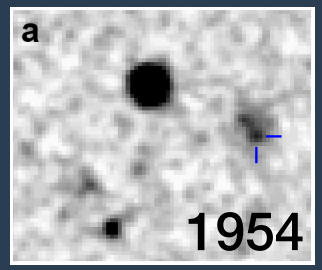


E_{rad} ~ few x 10^{50} erg

T ~ 5000-6000 K

R_{ph} ~ 2 x 10^{15} cm

L_{bol} ~ few x 10^{42} - 10^{43} erg/s



[M_H ~ few tens of solar masses

E_{kin} ~ 10^{52} erg]