



Scientific contributions of the telescopes of the Asiago Observatory

Florence, 26/2/2024

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Asiago Astrophysical Observatory

Largest astronomical observatory in Italy

2 sites: Pennar (1035 m) and Mt. Ekar (1370 m)

3 telescopes class 1-2 m

Managed by INAF-OAPd and University



'Galileo' T122 telescope

Ø: 122 cm

Inaugurated 1942, largest telescope in Europe*

Still used for research, outreach and education
(see Pizzella's talk)

B&C low resolution spectrograph



*in operation, ignoring the 'Leviathan'

Schmidt telescope

Ø: 67/92 cm

Built 60's, originally in Pennar, now in Ekar

4k x 4k CCD (1 sq. deg.) imager (*uBVgri*)

Since 2020 only in robotic mode (except with students)



'Copernico' T182 telescope

Ø: 182 cm

Inaugurated 1973, largest telescope in 

- AFOSC low-res spectrograph, imager and polarimeter

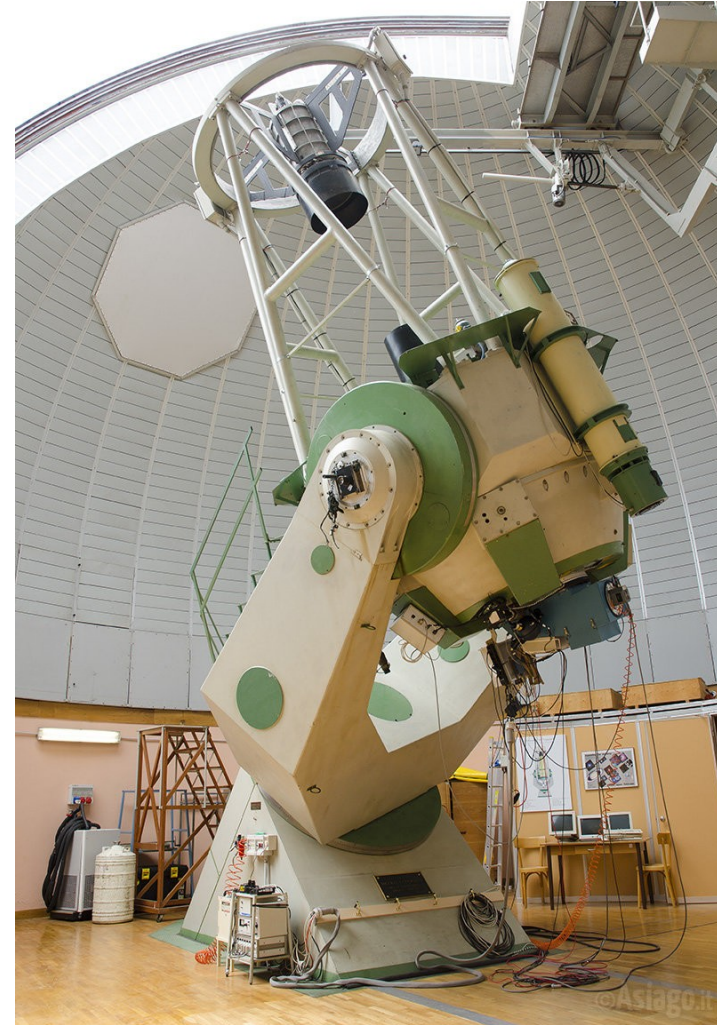


- Echelle high-res spectrograph



- AQUEYE fast photons counter

(see Zampieri's talk)



Science with small telescopes

20-30 m telescopes are coming, 1-2 m are still useful?

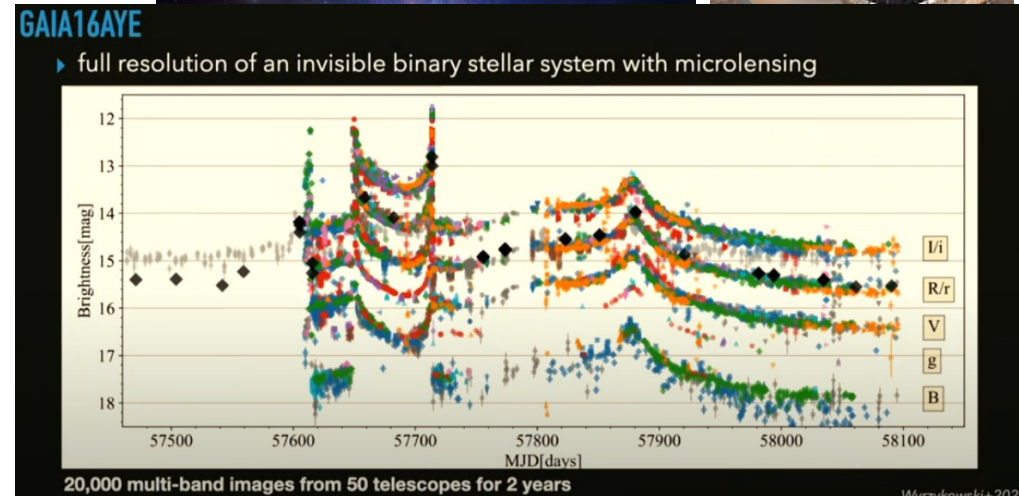
For Time Domain Astronomy, **Yes!**

Transients (GRBs, Novae, SNe...) require fast response (ToOs) and flexible scheduling, easier at a small telescope

Follow-up/monitoring of variable sources (microlensing, AGNs, TDEs, Miras...) need:

- *yrs-long* campaigns
- *frequent* (~daily) observations
- *100s hrs*

impossible to get at large telescopes



Asiago flexibility and rapid response

T122: request a specific night with just an e-mail

T182: submit a ToO few hrs before night starts

observers can swap nights

All T182 proposals: 2-yrs long Large Programs →

extended follow-up campaigns, multiple nights/month

Schmidt: robotic observations overridden by

GRB or GW trigger (still human intervention)

Oversubscription ~1 (at JWST~9...)

DEPARTMENT OF PHYSICS AND ASTRONOMY - PADOVA UNIVERSITY

GALILEO TELESCOPE OBSERVING SCHEDULE

FEBRUARY 2024

Date	Moon	Instrument	Set-up	Observer	Project
1 Th	"	B. & C.	1200tr/mm (R, 25°)	CAZZOLA	Binary stars
2 Fr	"	"	"	OCHNER (until 20:00)/CAZZOLA	Binary stars
3 Sa	L.Q.	"	300tr/mm (5°)	OCHNER	Service
4 Su	"	"	"	OCHNER	Service
5 Mo	"	B. & C.	300tr/mm (5°)	MUNARI	Novae monitoring
6 Tu	"	"	"	PIZZELLA	NEON SCHOOL
7 We	"	"	"	PIZZELLA	NEON SCHOOL
8 Th	"	B. & C.	"	PIZZELLA	NEON SCHOOL
9 Fr	N.M.	"	"	PIZZELLA	NEON SCHOOL
10 Sa	"	"	"	OCHNER (until 20:00)/PIZZELLA	NEON SCHOOL
11 Su	"	"	"	PIZZELLA	NEON SCHOOL
12 Mo	"	B. & C.	1200tr/mm (B, 14.45°)	MUNARI	Novae monitoring
13 Tu	"	"	300tr/mm (5°)	OCHNER	Service
14 We	"	"	"	OCHNER	Service
15 Th	"	"	600tr/mm (9.2°)	IJIMA	Symbiotics
16 Fr	F.Q.	"	"	IJIMA	Symbiotics
17 Sa	"	"	"	"	"
18 Su	"	"	300tr/mm (5°)	OCHNER (until 20:00)	Outreach
19 Mo	"	B. & C. + IFI	300tr/mm (5°)	SPOLON	Occultations
20 Tu	"	"	"	SPOLON	Occultations
21 We	"	B. & C.	300tr/mm (5.5°)	CIROI	Il Cielo come Laboratorio
22 Th	"	"	"	CIROI	Il Cielo come Laboratorio
23 Fr	"	"	"	CIROI	Il Cielo come Laboratorio
24 Sa	F.M.	"	1200tr/mm (R, 25°)	CAZZOLA	Binary stars
25 Su	"	"	"	CAZZOLA	Binary stars
26 Mo	"	B. & C.	300tr/mm (5.5°)	CIROI	Il Cielo come Laboratorio
27 Tu	"	"	"	CIROI	Il Cielo come Laboratorio
28 We	"	"	"	OCHNER (until 20:00)/CIROI	Il Cielo come Laboratorio
29 Th	"	"	1200tr/mm (R, 25°)	CAZZOLA	Binary stars

We remind that:

- (1) In case of a planned outreach visit, the observer must temporarily leave the telescope to Paolo Ochner (about 30 minutes).
- (2) It is possible to use free or reserved nights after a request to Stefano Ciroi (stefano.ciroi@unipd.it).



SN 2021csp: 1st Type Icn SN

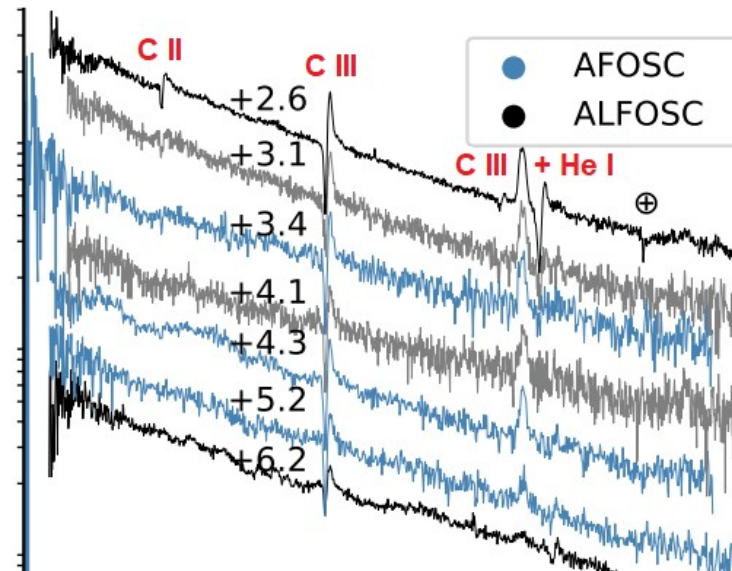
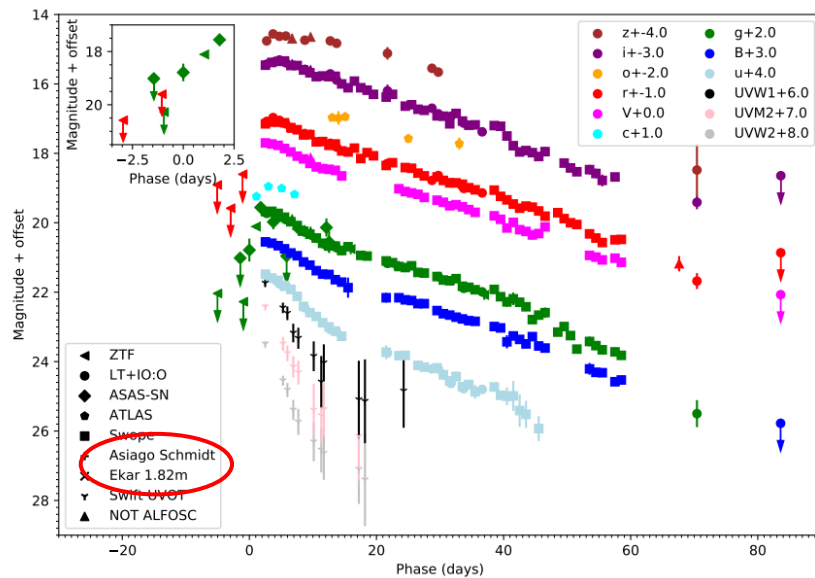


SN ejecta can 'interact' with a CSM \rightarrow interacting SNe, narrow em lines with P Cyg profiles. CSM H-rich \rightarrow SNe IIn; He-rich \rightarrow SNe Ibn.

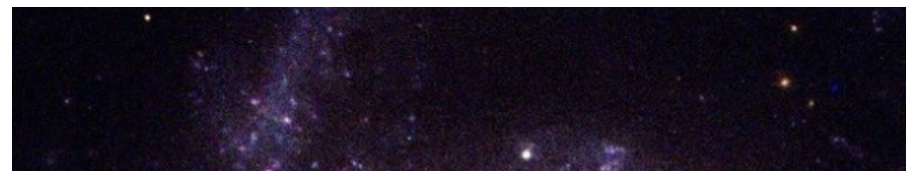
SNe with H-, He-poor CSM were predicted (Smith 17; Woosley 17) but not observed, until 2021.

Fraser+21: 3 early AFOSC spectra, 3 1-hr ToOs in 3 consecutive nights

Prototype,
now 6 SNe Icn in TNS



SN 2023ixf



Closest and brightest SN in 10 years

Peak $V=10.8$ mag \rightarrow amateurs can observe

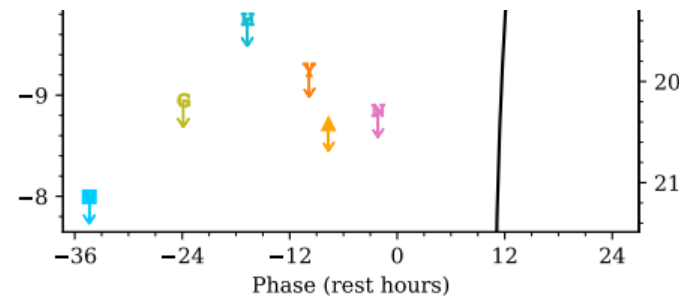
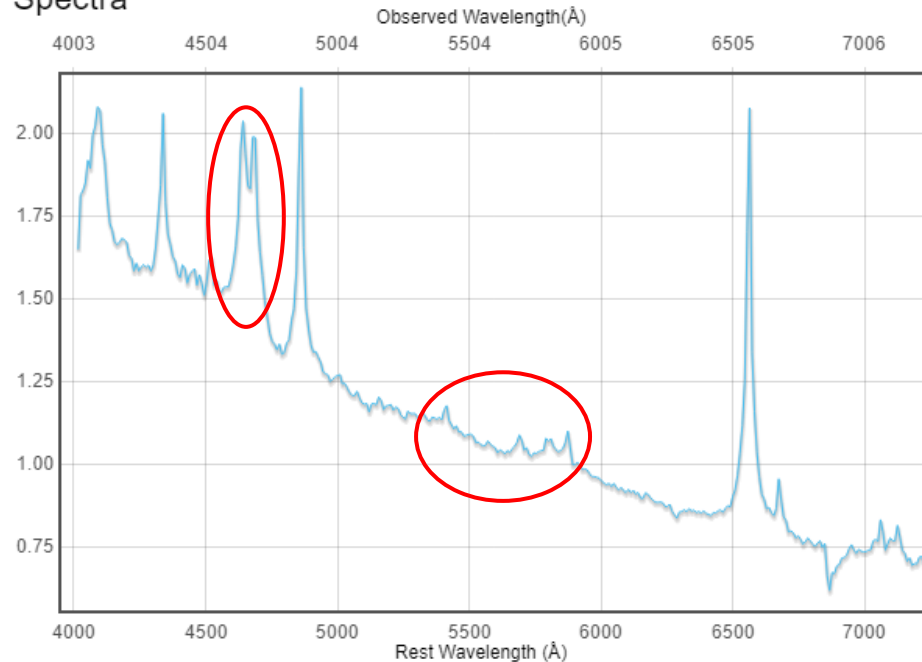
Detections few hours pre-discovery (Hosseinzadeh+23) \rightarrow
constrain on rise time and progenitor type

Classification spectrum (Perley+23):

Narrow em. lines from highly ionized atoms =
'flash spectroscopy features' (Gal-Yam+14)

Generally fade in few days \rightarrow 2/3 spectra showing them (Bruch+21)

Spectra



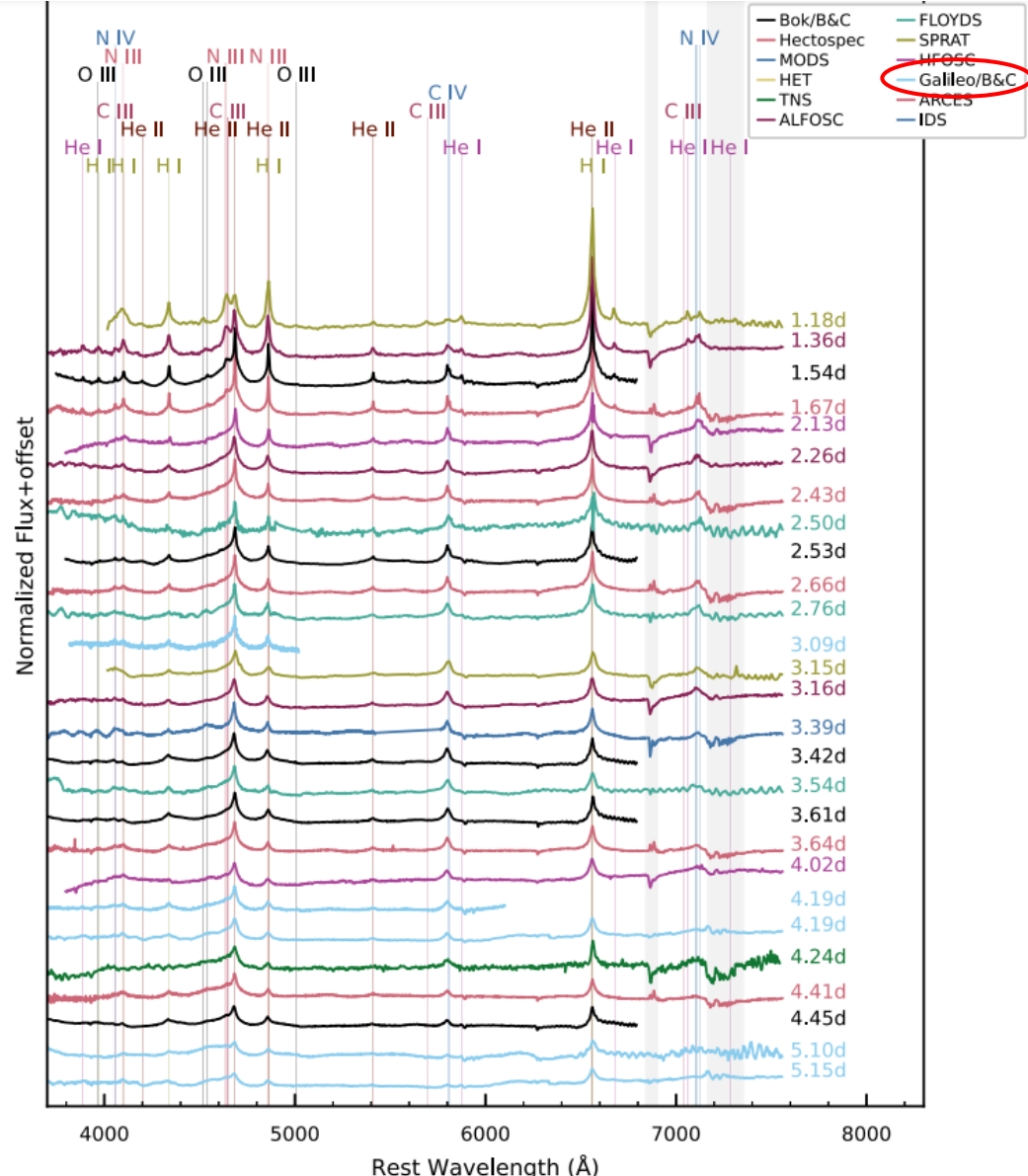
SN 2023ixf

Bostroem+23 get intra-night evolution of them

58 spectra in 15 days (!), 9 by T122

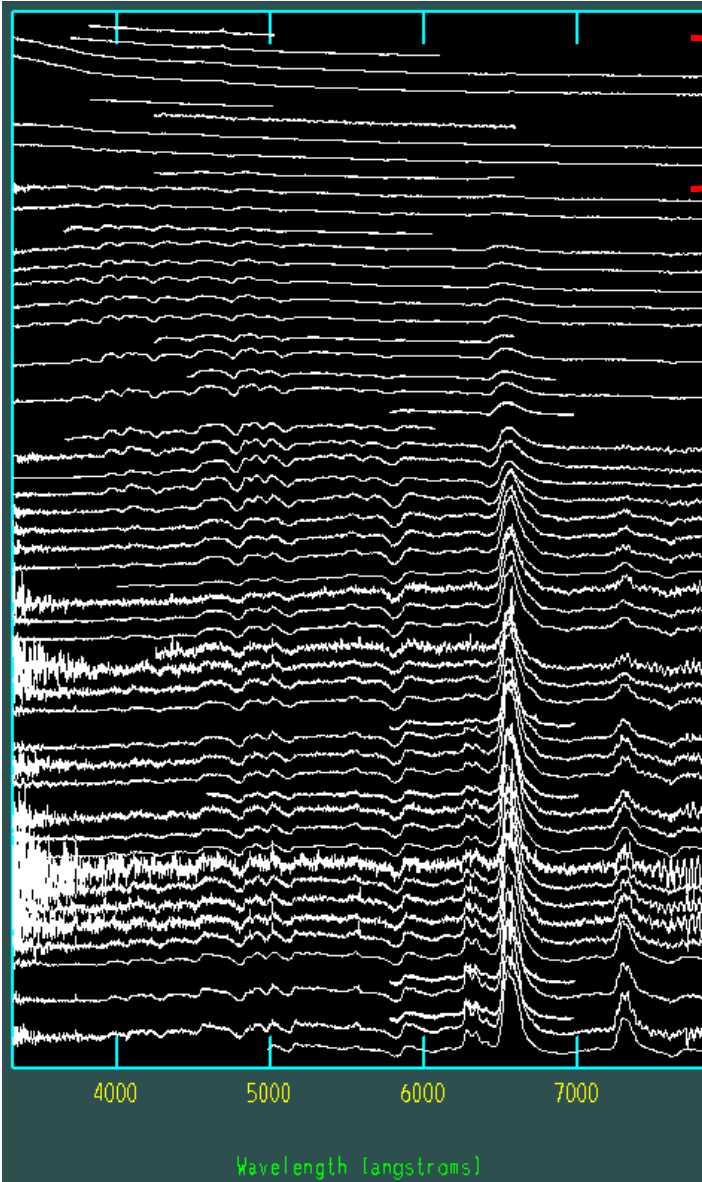
Unprecedented study on variation of
CSM density, structure and composition

Determination of mass-loss rate



SN 2023ixf

Follow-up continued for months
>60 spectra from Asiago only!
(until January, and counting...)



First 9 published in Bostroem+23
(>30 citations in 4 months...)

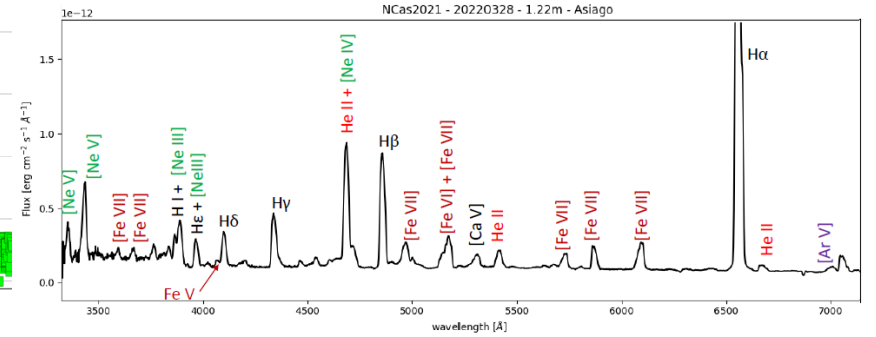
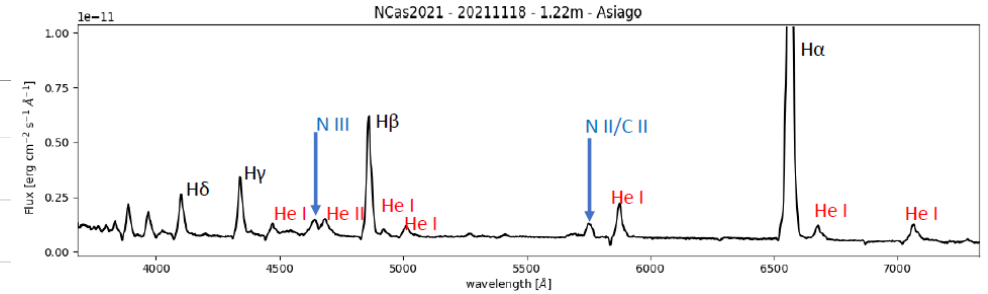
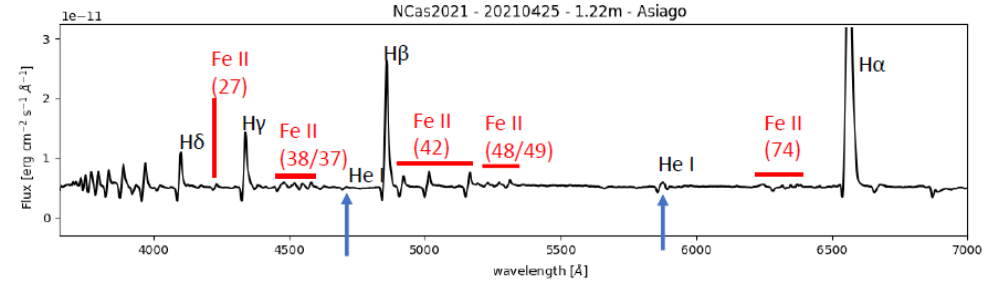
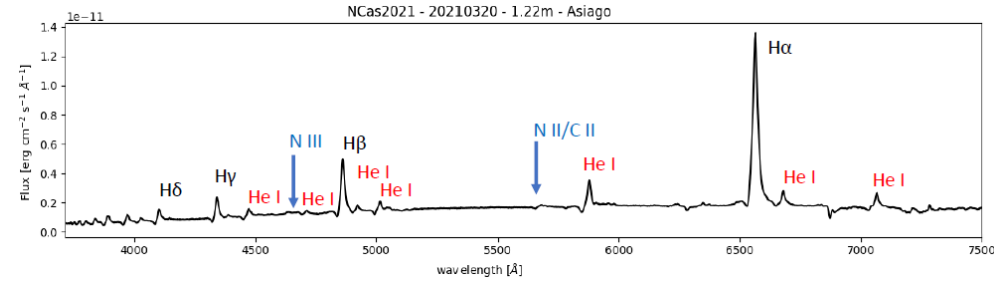
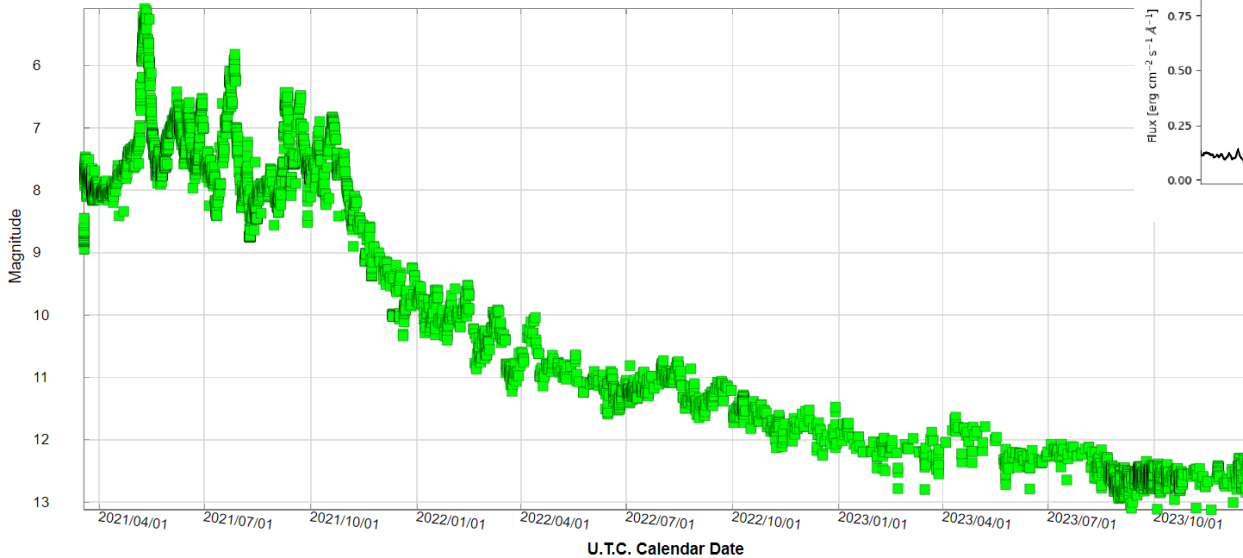
Nova Cas 2021

Longest Nova on record: still visible after 3 yrs!

>200 spectra from T122 (and counting)!

Hybrid evolution: He/N → Fe II → He/N again → [Ne]

All hybrid Novae do this if followed long enough?



Luminous Red Novae



Gap transients: stellar explosions in $-10 < M_V < -15$ mag range

Non-compact merger of stars in a common envelope,
from $< 1 M_{\odot}$ to $\sim 50 M_{\odot}$

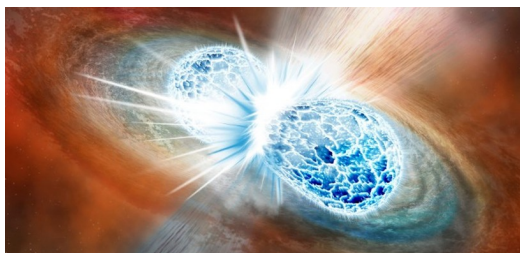
8 objects published (so far)

2-peaks light curve

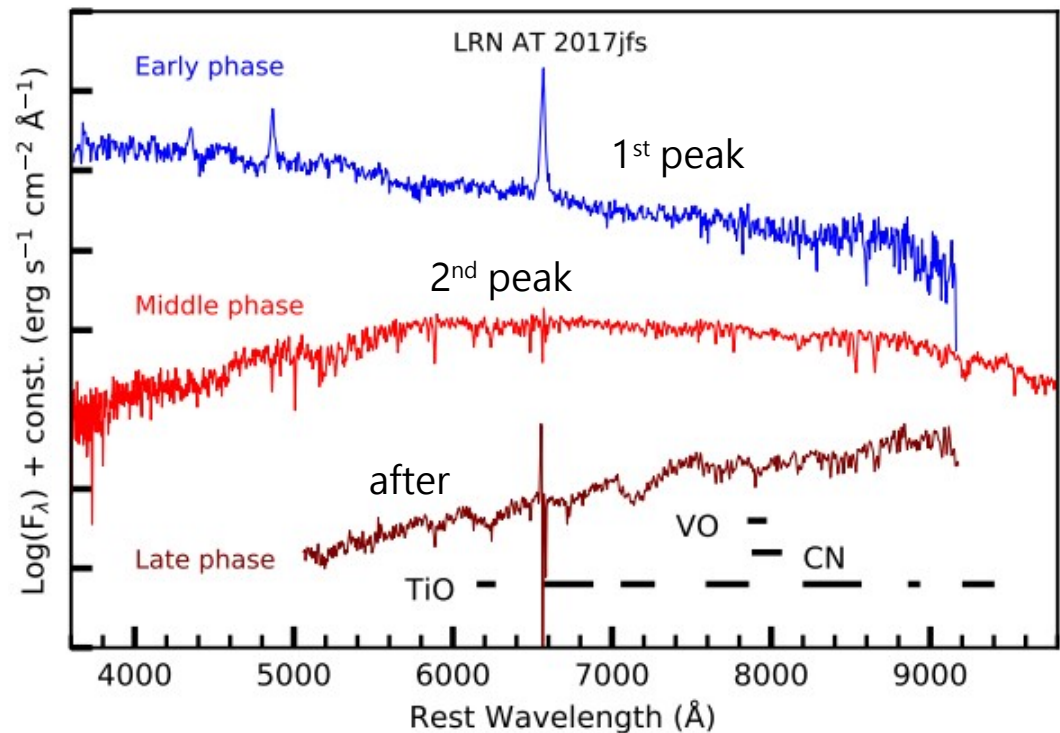
Spectra evolution:

Hot, H in em. \rightarrow G/K star, no H α , metals in abs.

\rightarrow M star, molecular bands



★ SN 2009ip	★ SN 2008S	★ M85 OT	★ UGC 8246 OT	★ AT 2017jfs	★ M101-2015OT1	★ V838 Mon
★ SN 2000ch	★ AT 2017be	★ PTF10fqg	★ AT 2018aes	★ NGC4490OT-2011OT1	★ V1309 Sco	★ M31 RV
★ AT 2017gfo	★ NGC 300 OT	★ SN 2010dn	★ AT 2018hso	★ SNhunt248		



Publications

In the last 3 years 18 refereed papers using data from Asiago telescopes

Countless AstroNotes, circulars...

→ 1-2 m class telescopes are still scientifically productive

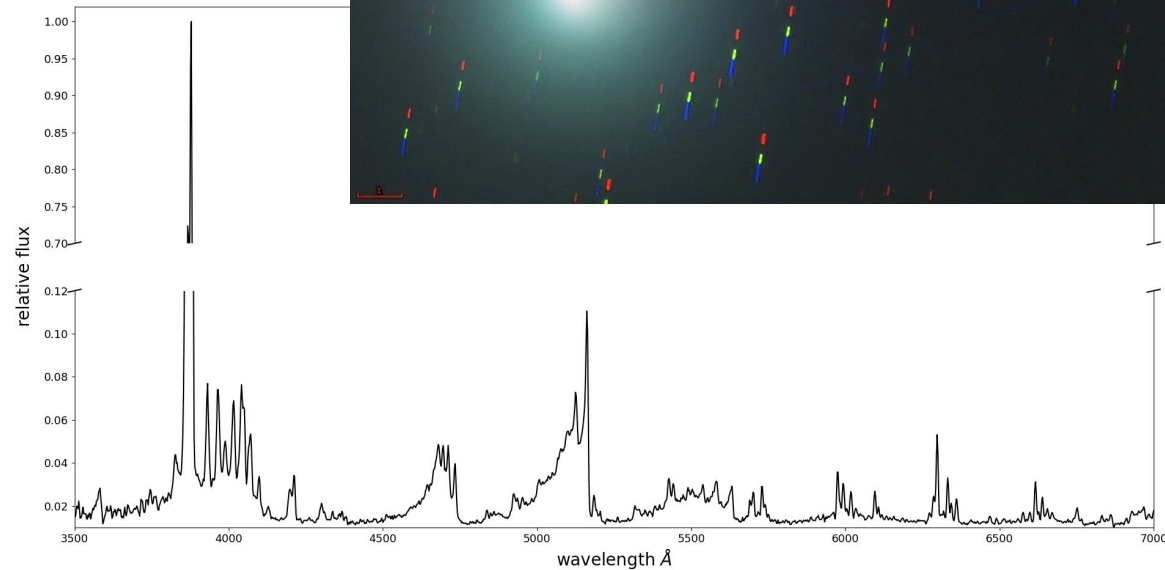
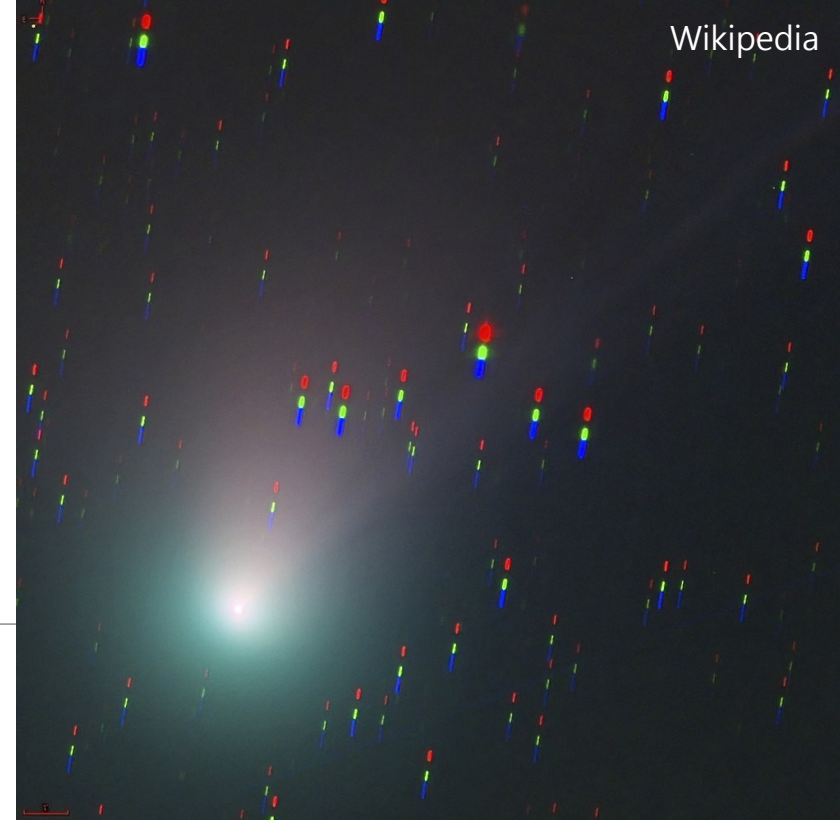


...and even comets!

Project of a book: Atlas of cometary spectra:

133 spectra of 37 comets taken at T122 and T182,
+ imaging from Schmidt, in last > 10 yrs

Managed by a group of Msc Degree students @UniPd



BHTOM workshop

Organized by Lukasz Wyrzykowski
(Warsaw University)

How a network of small telescopes can be
scientifically productive

Asiago Schmidt started to contribute
last September

Vietri sul Mare, SA, 15 April



15 April 2024

BHTOM-IT Salerno 2024

bhtom-it-2024.bhtom.space

UNIVERSITÀ
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OPTICON
RadioNet
Pilot

The poster features a circular frame containing a night sky with the Milky Way galaxy and a coastal town at the bottom. A large, stylized ring with a pink-to-yellow gradient is centered in the foreground. The text '15 April 2024' is at the top, 'BHTOM-IT Salerno 2024' is in the middle, and the website 'bhtom-it-2024.bhtom.space' is at the bottom left. Logos for 'UNIVERSITÀ PARTECIPAZIONE' and 'OPTICON RadioNet Pilot' are at the bottom right.

Conclusion and Future

Asiago telescopes are still relevant in the transient field

T182 will become robotic → more efficiency (see Tomasella's talk)

Plans to upgrade CCDs at all 3 telescopes (money permitting...)

Waiting for EM counterparts of GW events during O4 (part 2)

More scientific discoveries ahead (thanks to LSST)

