

Seven years on the ROAD (Remote Observatory Atacama Desert)

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A stylized silhouette of a mountain range in shades of brown and tan, positioned at the bottom of the slide. The mountains are jagged and layered, creating a sense of depth. The background behind the mountains is a gradient of blue and teal.

Several intermediate steps to final destination

- Roll-off-roof observatory at my backyard, Belgium (stoped due to weather)
- Shared use of an observatory in New Mexico
- Found the ultimate destination-> ROAD



ROAD @ San Pedro

- San Pedro de Atacama, Spaceobs (A. Maury)
- Very touristic with restaurants, hotels, internet, power and water
- 2500 m elevation
- Exceptional number of clear nights:

01.08.11-31.07.12	321 nights
01.08.12-31.07.13	320 nights
01.08.13-31.07.14	335 nights
01.08.14-31.07.15	312 nights
01.08.15-31.07.16	312 nights
01.08.16-31.07.17	315 nights
01.08.17-31.07.18	324 nights



ROAD equipment off the shelf

- 40cm f/6.8 optimized Dall Kirkham (ODK) from Orion Optics, UK
- ASA DDM 85 direct drive mount (Astrosystems Austria)
- FLI ML16803 CCD with UBVRI Astrodon photometric filters
- MAXIM DL, CCDCommander, LesvePhotometry



SPACEOBS, Chile



ROAD: Remote Observatory Atacama Desert, Chile



Courtesy Y. Beletsky

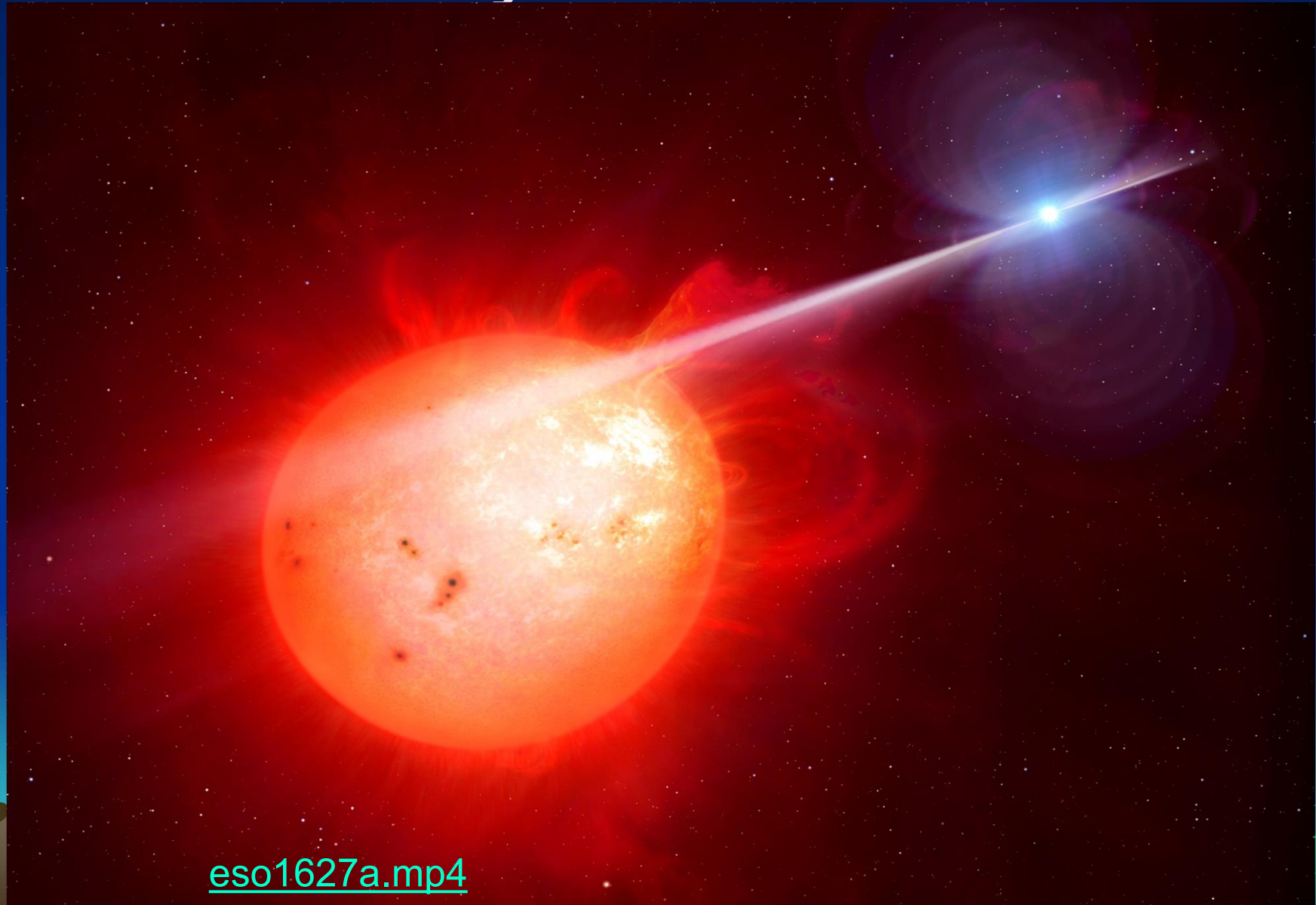
[Mad Telescope.mp4](#)

ROAD highlights

- AR Sco, first white dwarf pulsator (Nature paper)
- J1407 ring system
- WD1145 a zombie star
- Intensive novae observations
- Cataclysmic variables
- Luminous blue variables
- RR Lyr stars
- ...
- **Most of the papers (65+) with co-authorship can be found on ARXIV
searching for Hambsch**

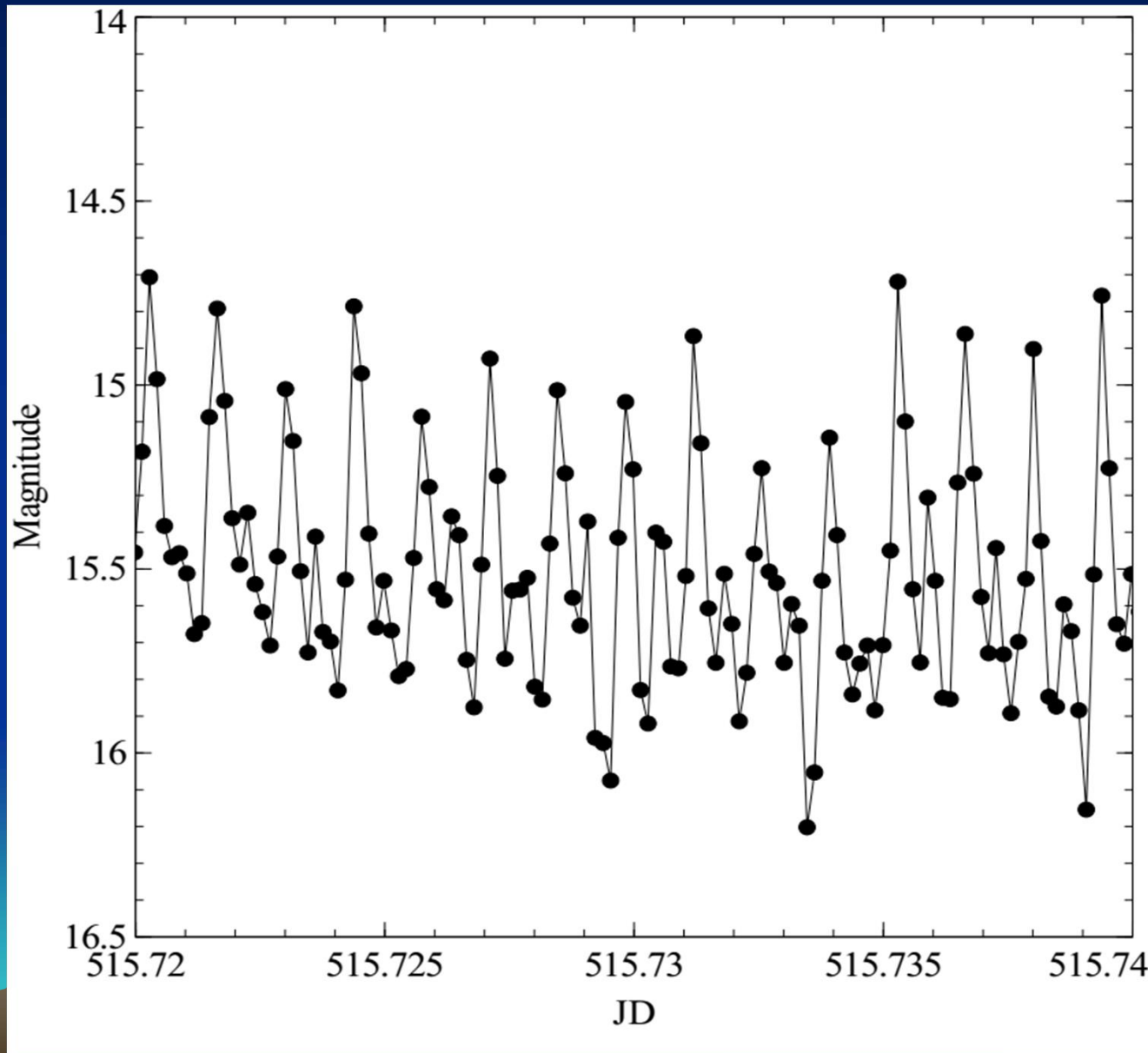


Artist's impression of the exotic binary star AR Sco



[eso1627a.mp4](#)

AR Sco light curve during one night

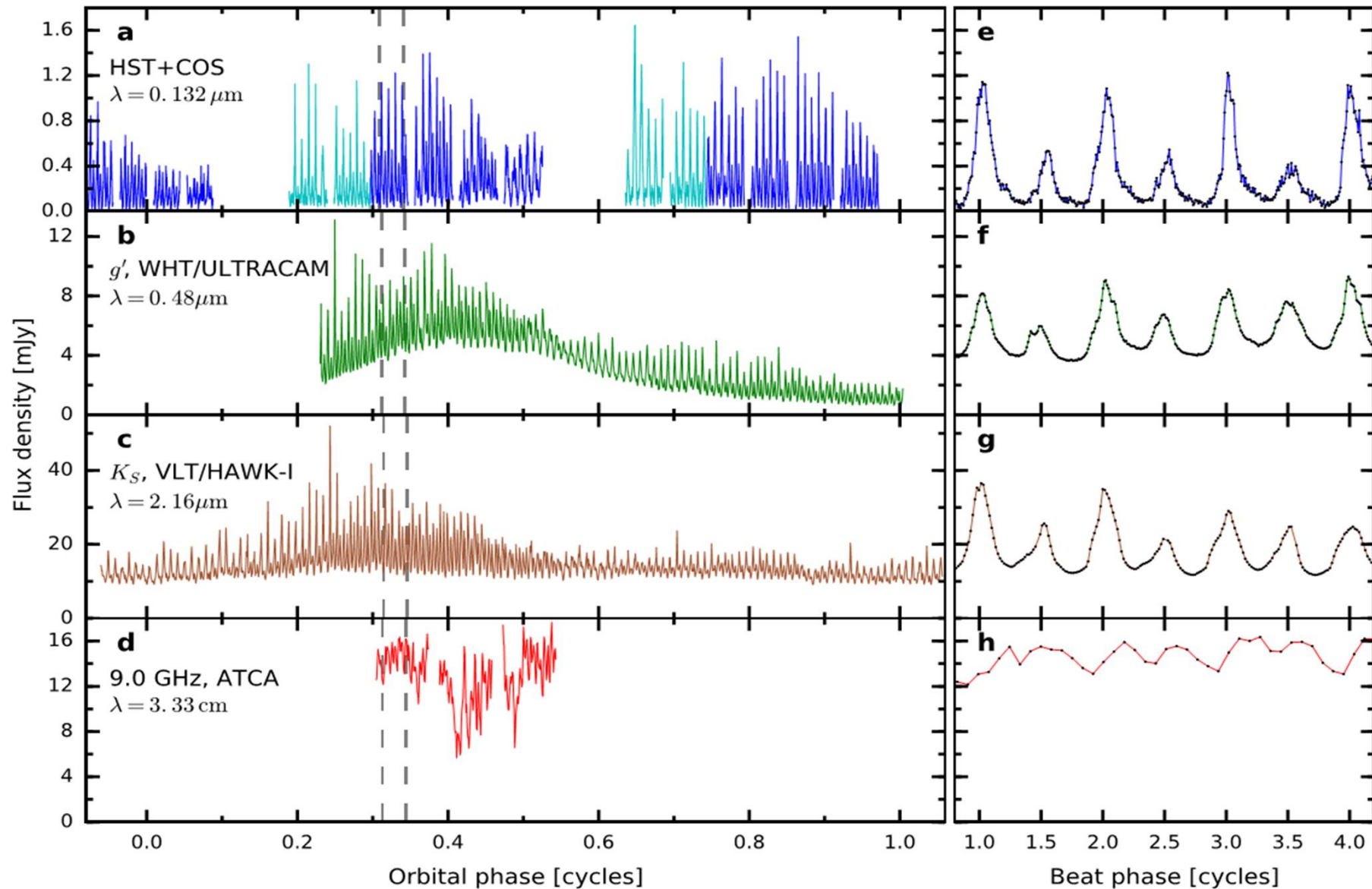


High time resolution observations
at ROAD
(10 s exposure)

Changes of about
1 mag in about 1 minute

Periods: 1.97 min and 3.56h

High-speed measurements in different wavelengths



UV

g'

K

Radio

Ring system around the star J1407

- Discoverd by a survey in search of exoplanets
- The first of a kind discoverd by the transit method
- Very special as 200 x larger than the Saturn system
- As for Saturn satellites form gaps between the rings
- If the system would have a distance to Earth like Saturn,
it would be visible during daytime with a diameter of 14 x the full moon
- 30 separate rings with at least two gaps (Exomoons)
- Mass of the moons in the system about that of the Earth or Mars
- Period of the system (J1407b) first proposed to be about 10y, but now
unclear based on investigation of historical photographic plates

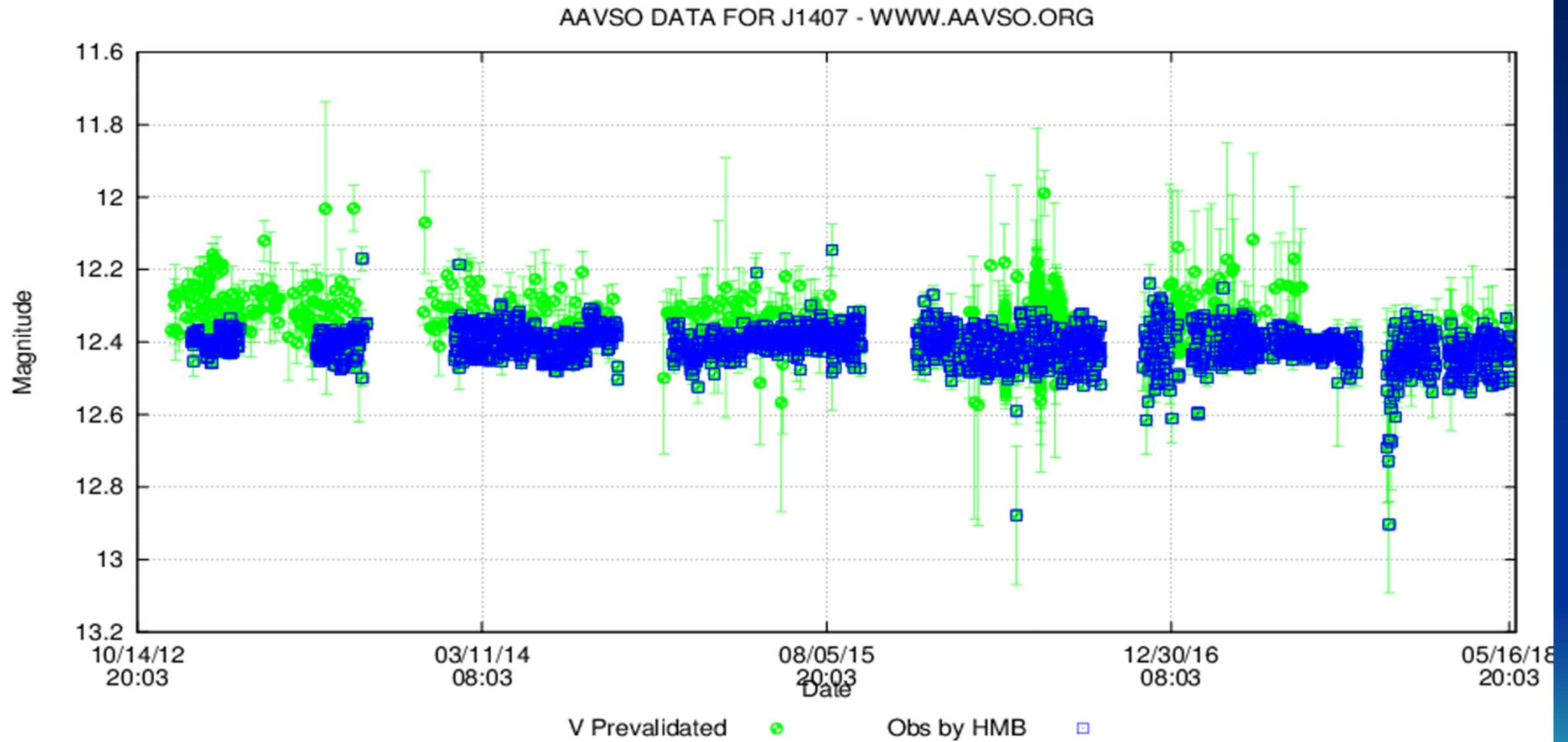
[Video eclipse](#)



Daylight



Observations of J1407



- 4 observers: HMB (blue points)

WD1145 a zombie star

Discovered by the Kepler satellite

Periode ~ 4.5h

Distance 570 lj

First white dwarf (WD) with a transiting object

WD mass 0.6 solar mass

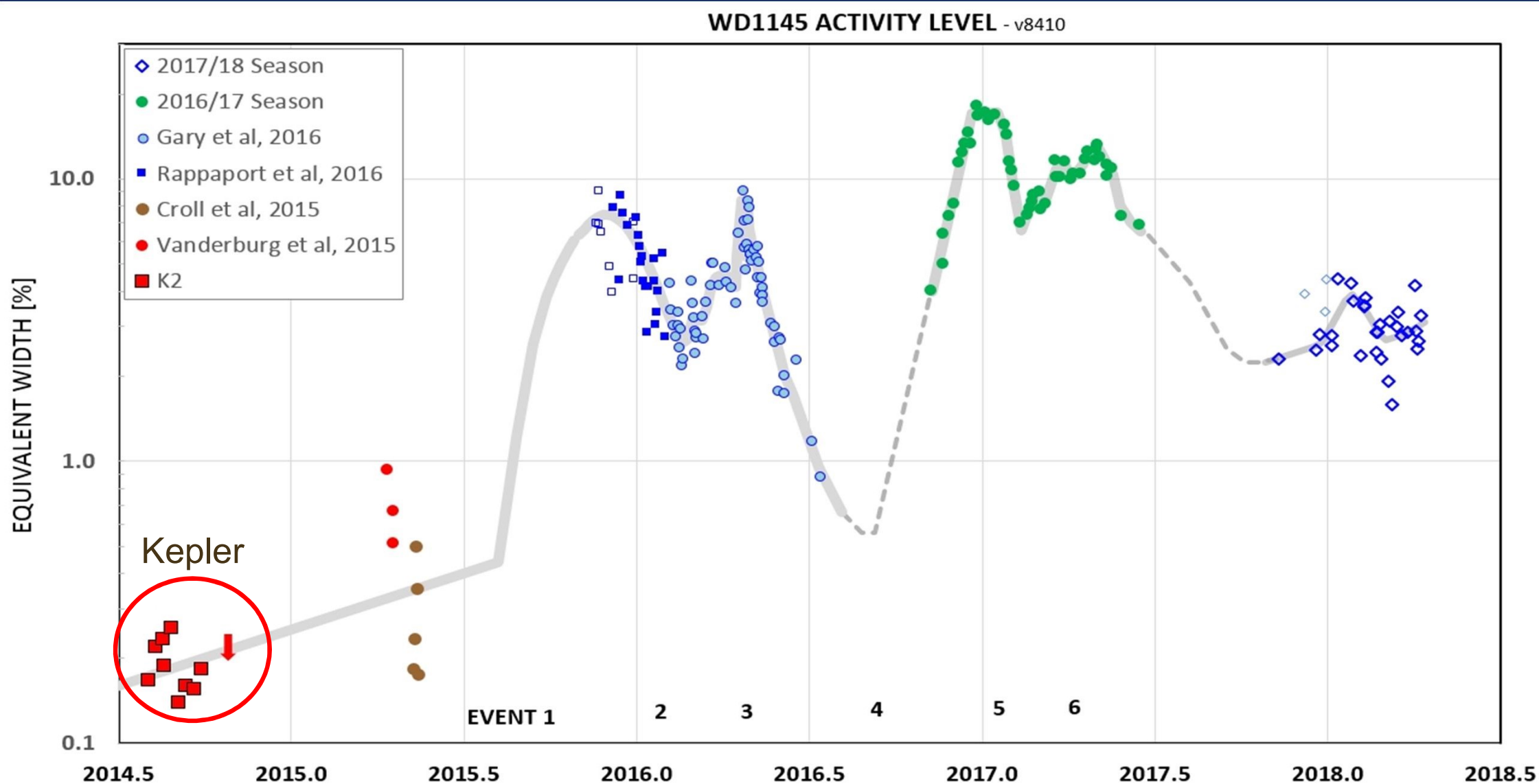
WD radius 0.02 solar radius

Temperature 15900 k

V mag : 17.2

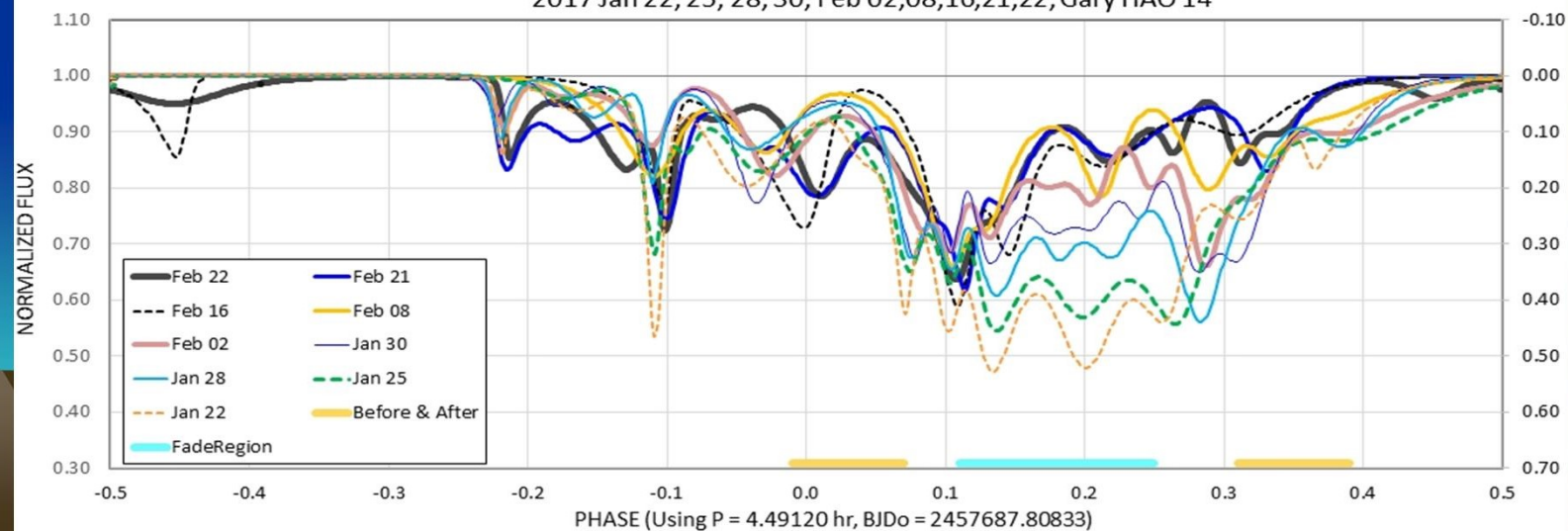
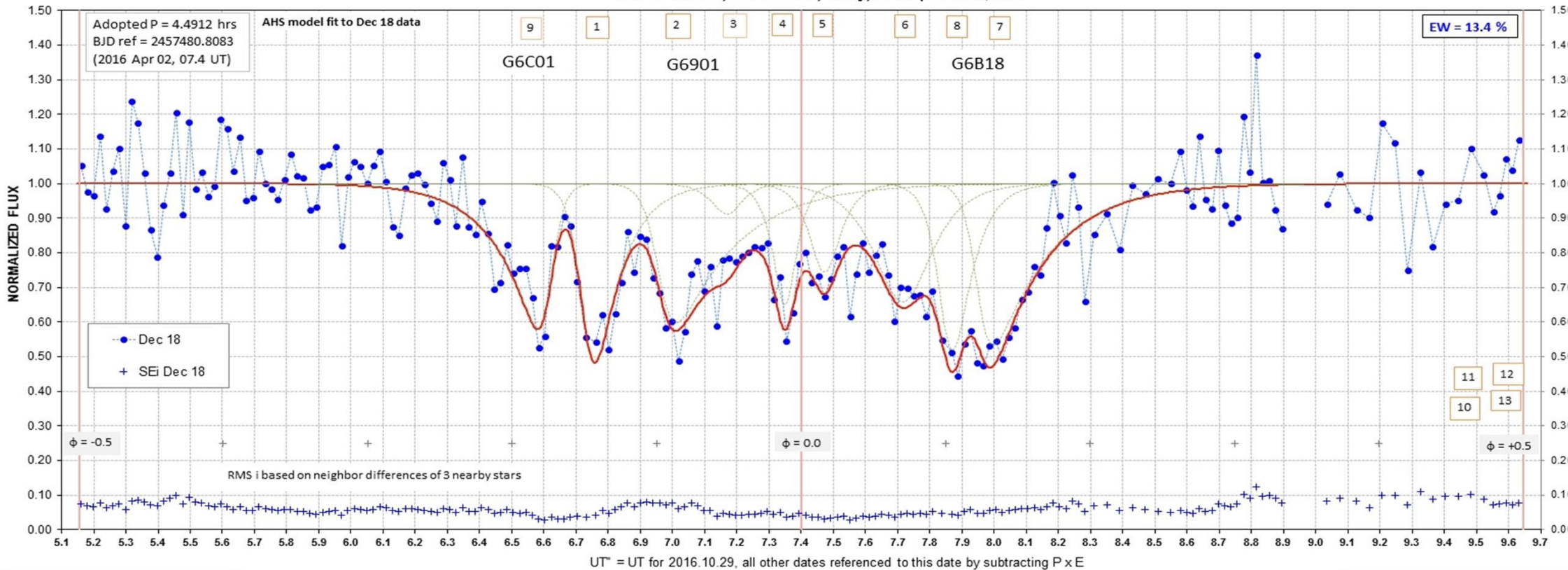
WD1145 activity

<http://www.brucegary.net/zombie5/>



WD1145

WD 1145+017, 2016.12.18, Gary, HAO (Arizona) v6C21



Observation of galactic novae (collaboration U. Munari)

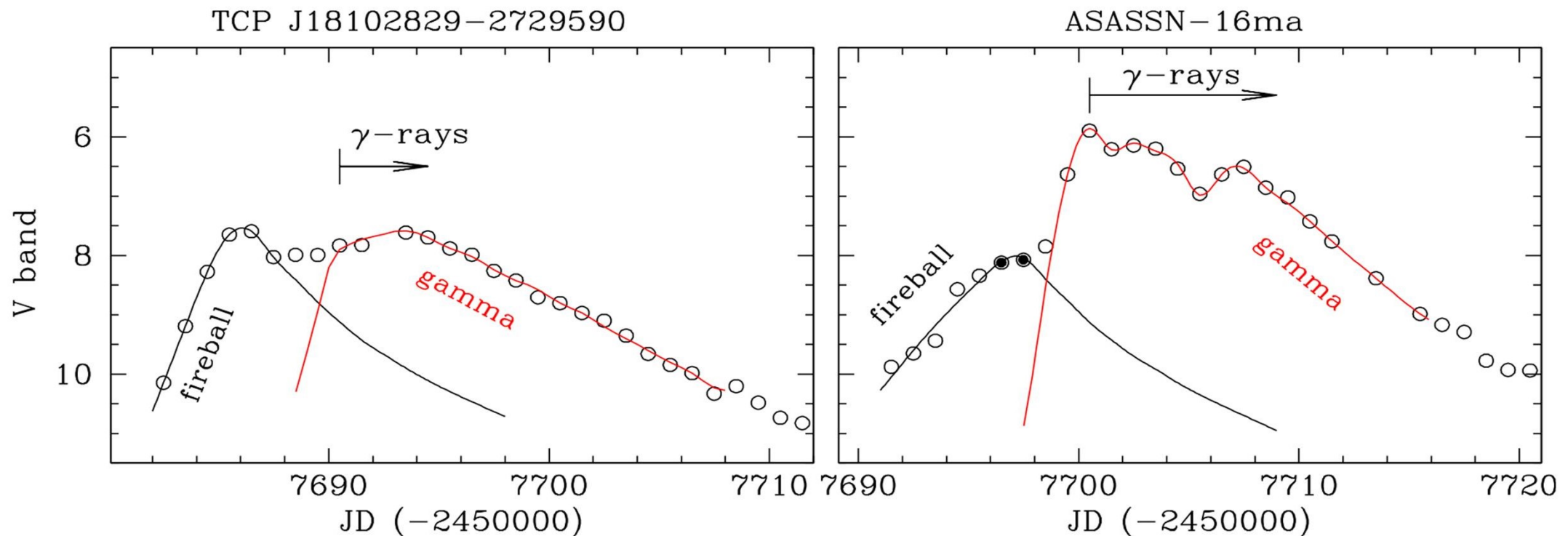


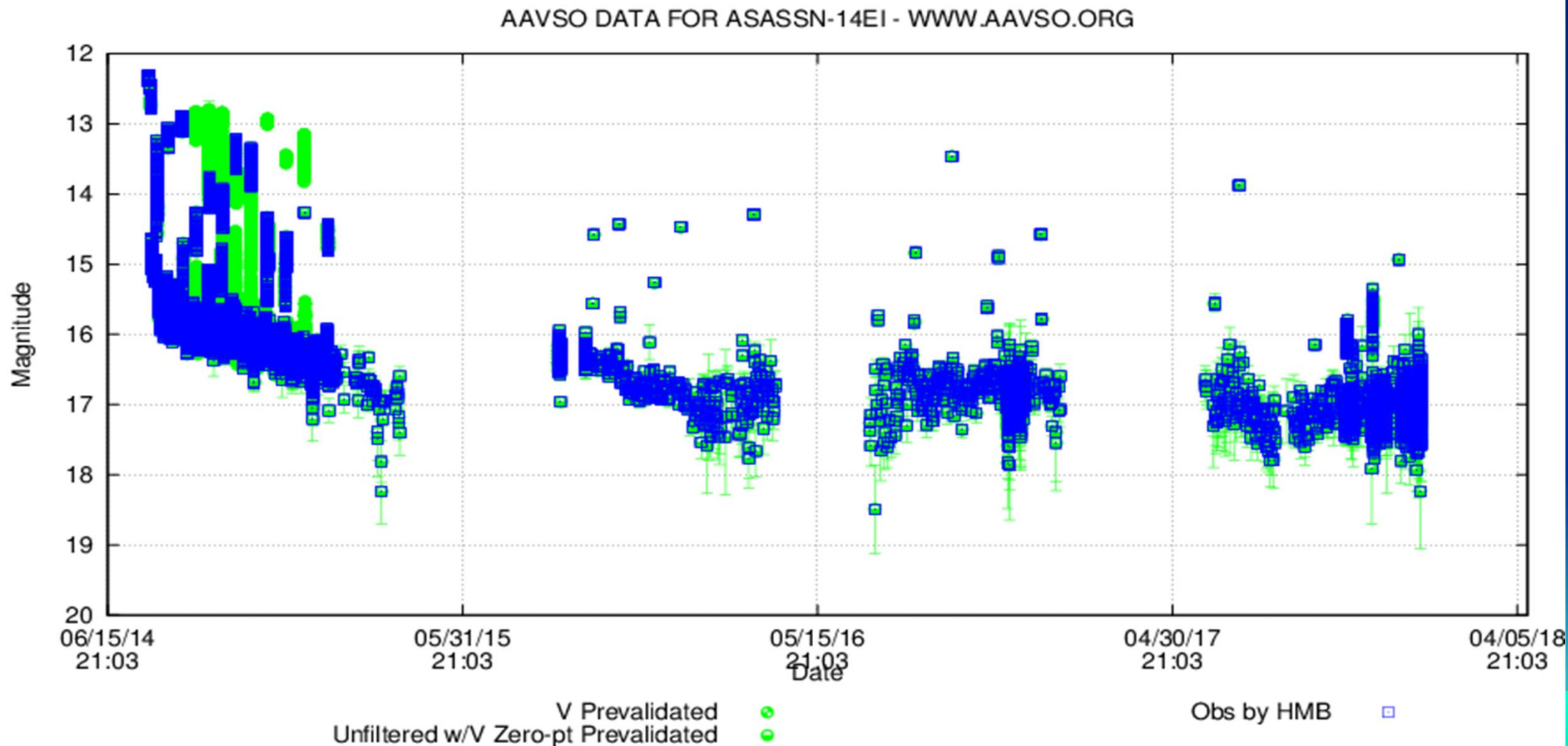
Figure 15. Deconvolution of the lightcurve of the two program Bulge novae detected by Fermi-LAT. The *fireball* component is the one associated with free ballistic expansion of ejecta (see sect. 5). The *gamma* component appears and evolves in parallel with the emission detected in γ -rays (see sect. 6). The filled dots are the same as in Figure 12. The dip around JD=2457705 in the gamma component for ASASSN-16ma corresponds to a similar dip in the γ -ray flux recorded by Fermi-LAT (cf. Li et al. 2016).

Dip for 16ma in γ -rays also recorded by Fermi-LAT

ASASSN-14ei

cataclysmic variable (collab CBA, VSNET)

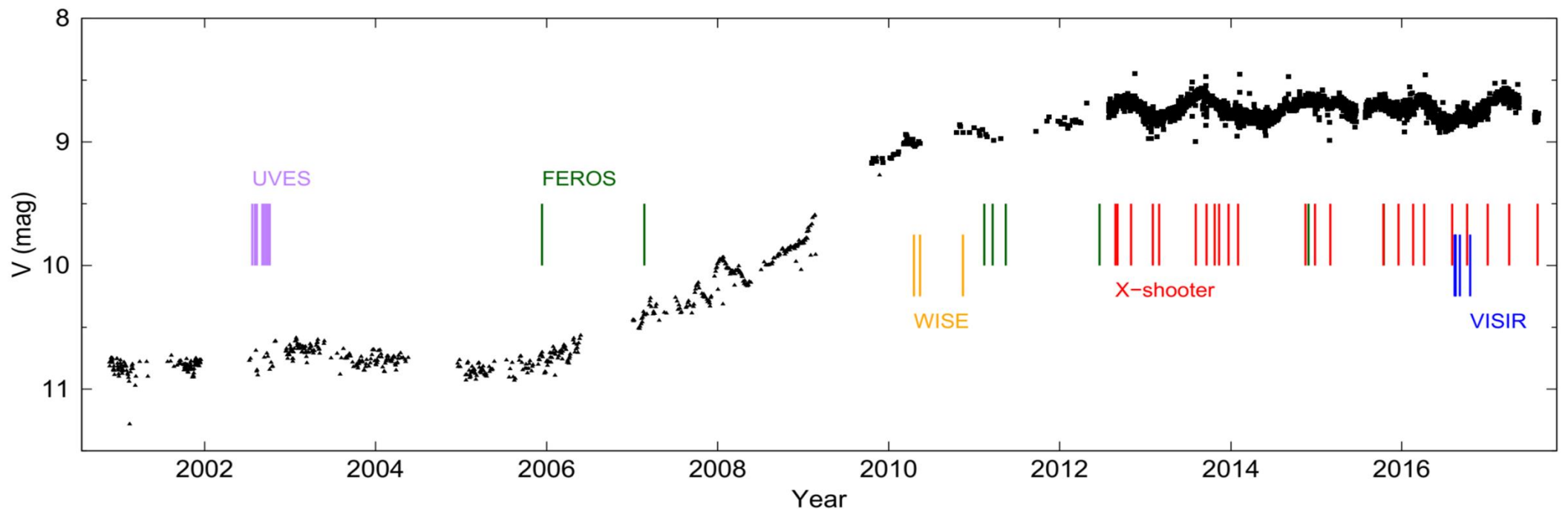
More than 25 echo outbursts to date



R71 (LMC V0733)

Luminous Blue Variable (Collab ESO)

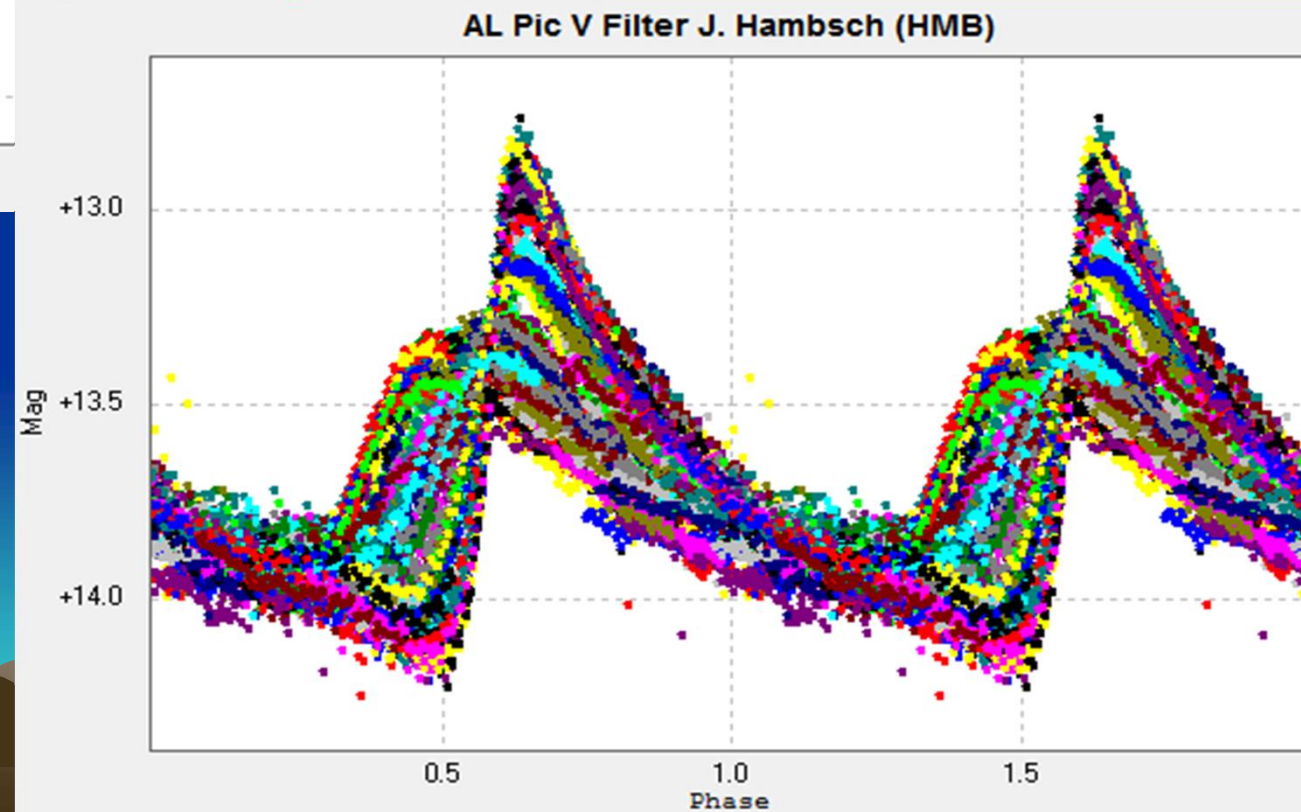
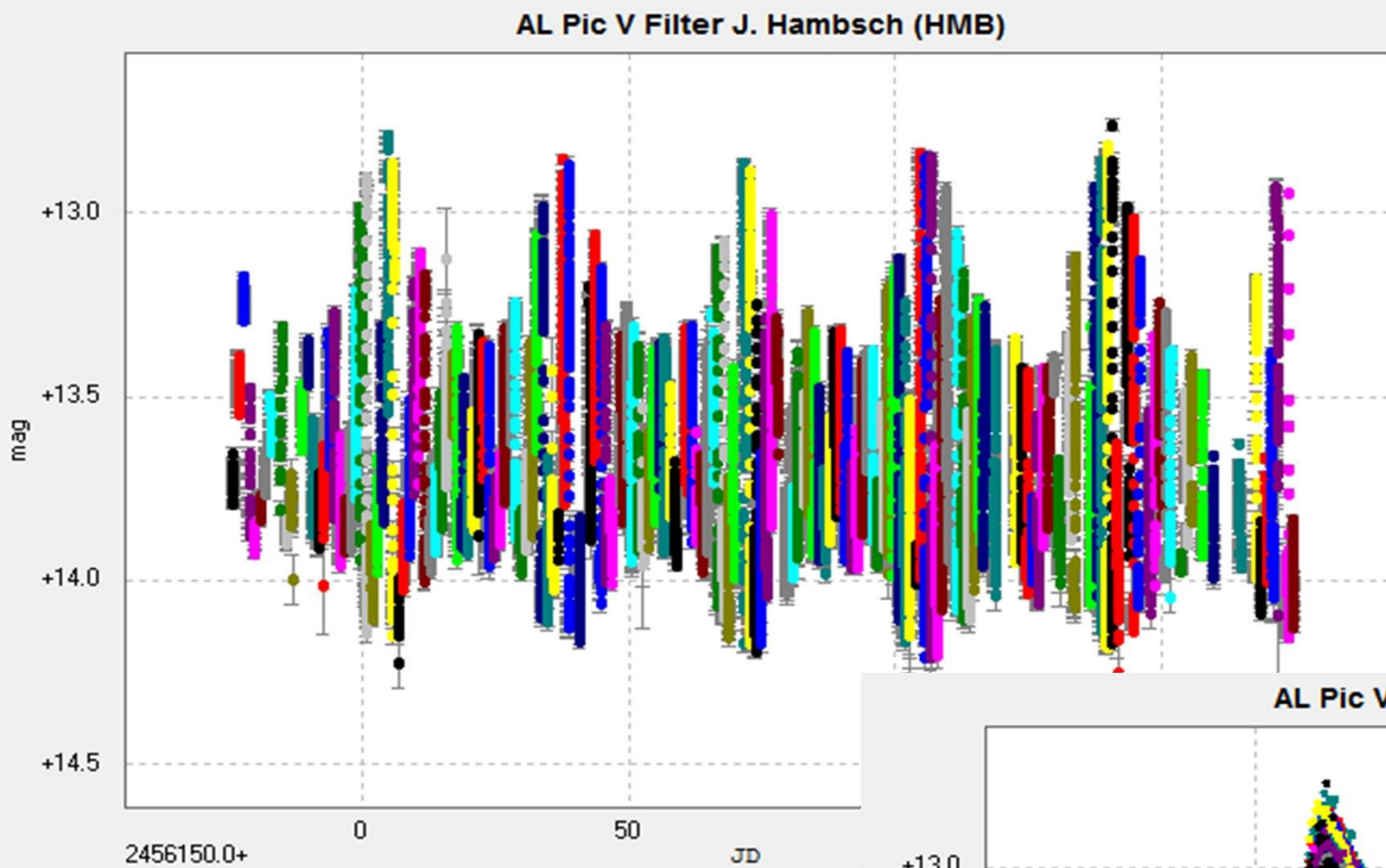
Near continuous coverage compared to previous years



<https://arxiv.org/pdf/1709.00160.pdf>

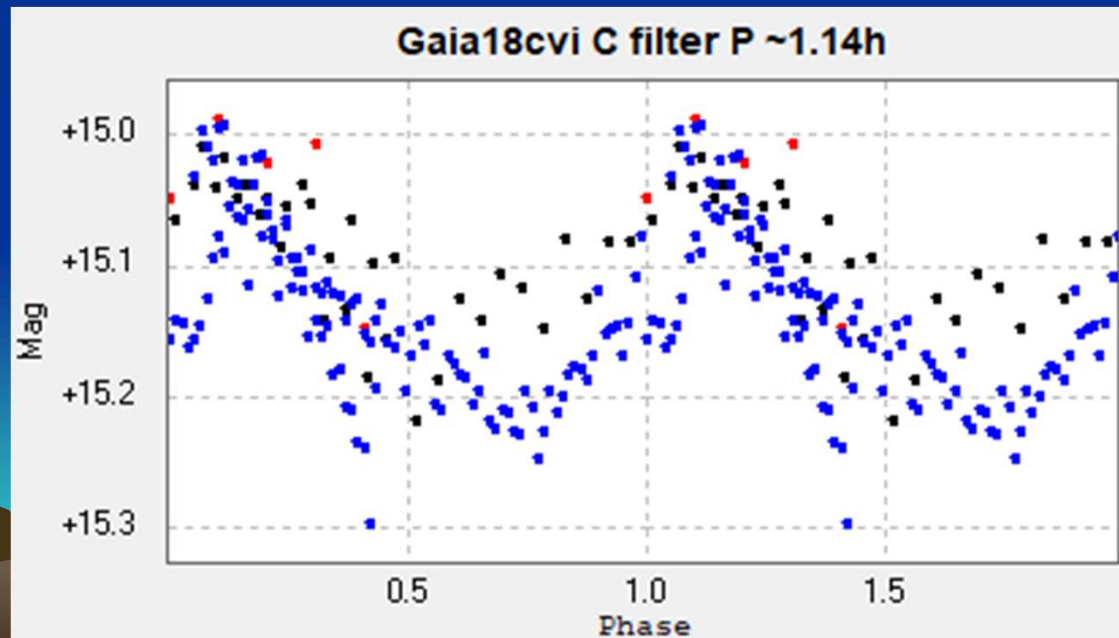
AL Pic

RR Lyr w.
Blazhko effect



GAIA alert follow up so far

- Gaia18bmt (data with AAVSO)
- Gaia18cnz (V, I filters)
- Gaia18cmn (V, I filters)
- Gaia18cvi (CV, C filter observed for three nights)



Conclusions

- Variable stars observations open lots of possibilities for an amateur to contribute to scientific research
- Participation in AAVSO Alerts and requests for observations (e.g. PALE RED Dots campaign, ASASSN- targets, GAIA alerts,...)
- Collaboration with many prof. astronomers (see ARXIV: Hambsch, 65+ refereed papers)



Thank you for your attention

www.EVS2019.be

14-15 September 2019

