

The Z CamPaign 2013

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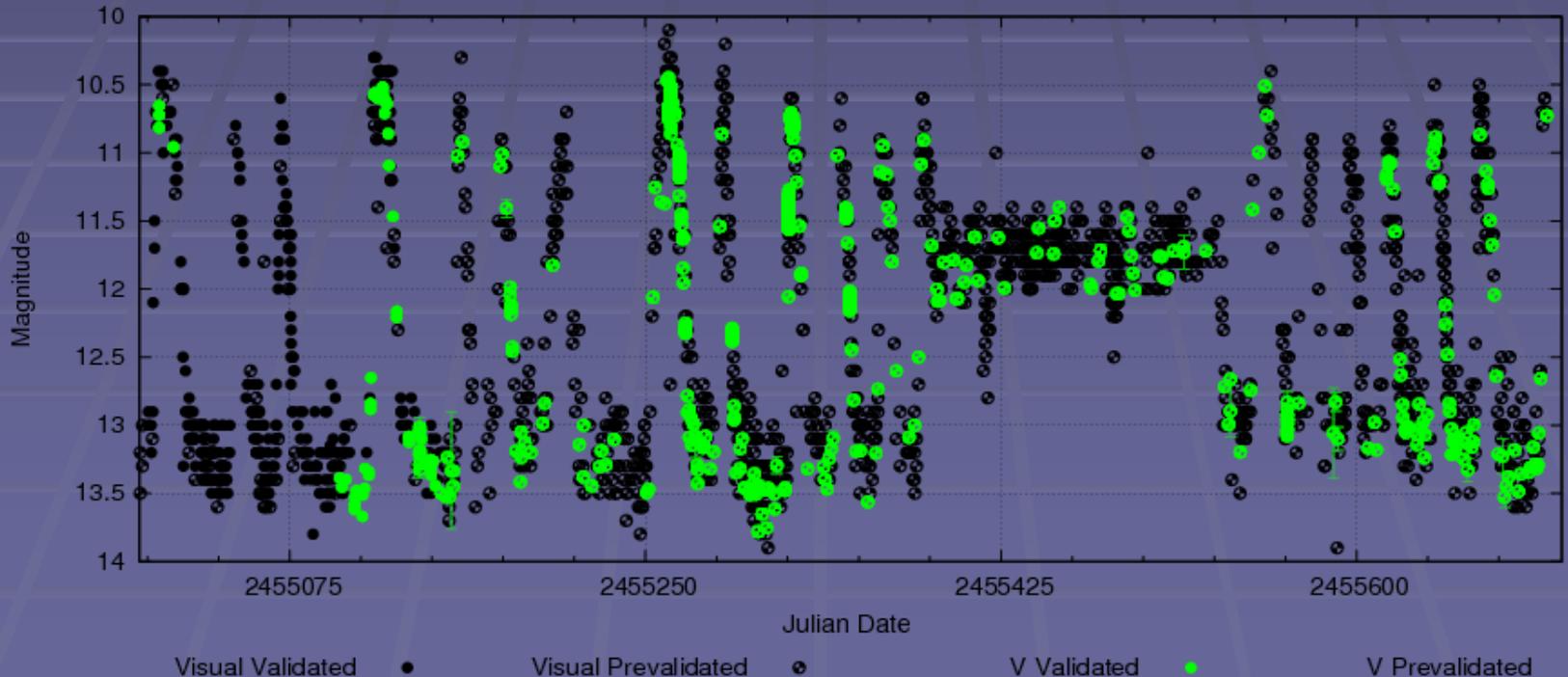
AAVSO

April 2013

What are Z Cam stars?

- Dwarf novae, outburst amplitudes 2-5 magnitudes, relatively short cycle lengths of 10-40 days
- Exhibit occasional “standstills” after outbursts

AAVSO DATA FOR Z CAM - WWW.AAVSO.ORG



Is it a duck?



- UGZ can be classified by their light curves alone.
- Orbital period is not a definitive characteristic, even though they are all on the long side of the period gap, 3 to 10 hours.
- It has to quack like a duck or it isn't a duck.
- *If it doesn't exhibit standstills, it isn't a Z Cam.*

Outbursts from Standstills?

Another well-quoted characteristic is that “standstills are always initiated by an outburst,” and “standstills always end with a decline to quiescence” (Hellier, 2001).

At least three Z Cam stars appear to go into outburst from standstill, HX Peg, AH Her and AT Cnc.

Science Goals

- To determine convincingly **which CVs are** indeed **UGZ** and which are imposters.
- To improve the overall data available on each of these stars and **fill the gaps in the light curves**.
- To determine if some UGZ actually do go into **outburst from standstill**, or if perhaps we have just missed the sudden drop to quiescence before the next outburst, leading to the appearance of outburst from standstill behavior.
- To make any other **serendipitous discoveries** about 'UGZ-ness' that come to light as a result of improved coverage.
- To **publish** the results in a peer-reviewed journal such as the Journal of the AAVSO.

History: A Source of Ambiguity

- Research has revealed that historically, the definition of Z Cams has changed over time.
- The first dwarf nova, U Gem (discovered 1855) had long periods of quiescence followed by occasional outbursts every 100 days on average.

More dwarf novae are discovered and observed

- SS Cyg was discovered in 1896.
- The classification of U Gem stars was introduced.
- The early definition was based on light curves of stars that stayed at minimum for the majority of the time, but at intervals between 40 and 100 days they erupted by 3-5 magnitudes.
- By 1928 there were two-dozen or more stars classified as UG or suspected of being UG.

- Two stars, Z Cam and RX And, discovered in 1904 and 1905 respectively, were initially classified as UG.
- But years of close observation revealed these two stars to have much shorter periods (at that time, defined as the time between maxima) and they spent very little time at minimum.
- This caused A. A. Nijland to propose a new class of variable stars, the Z Cam type

A classification is born

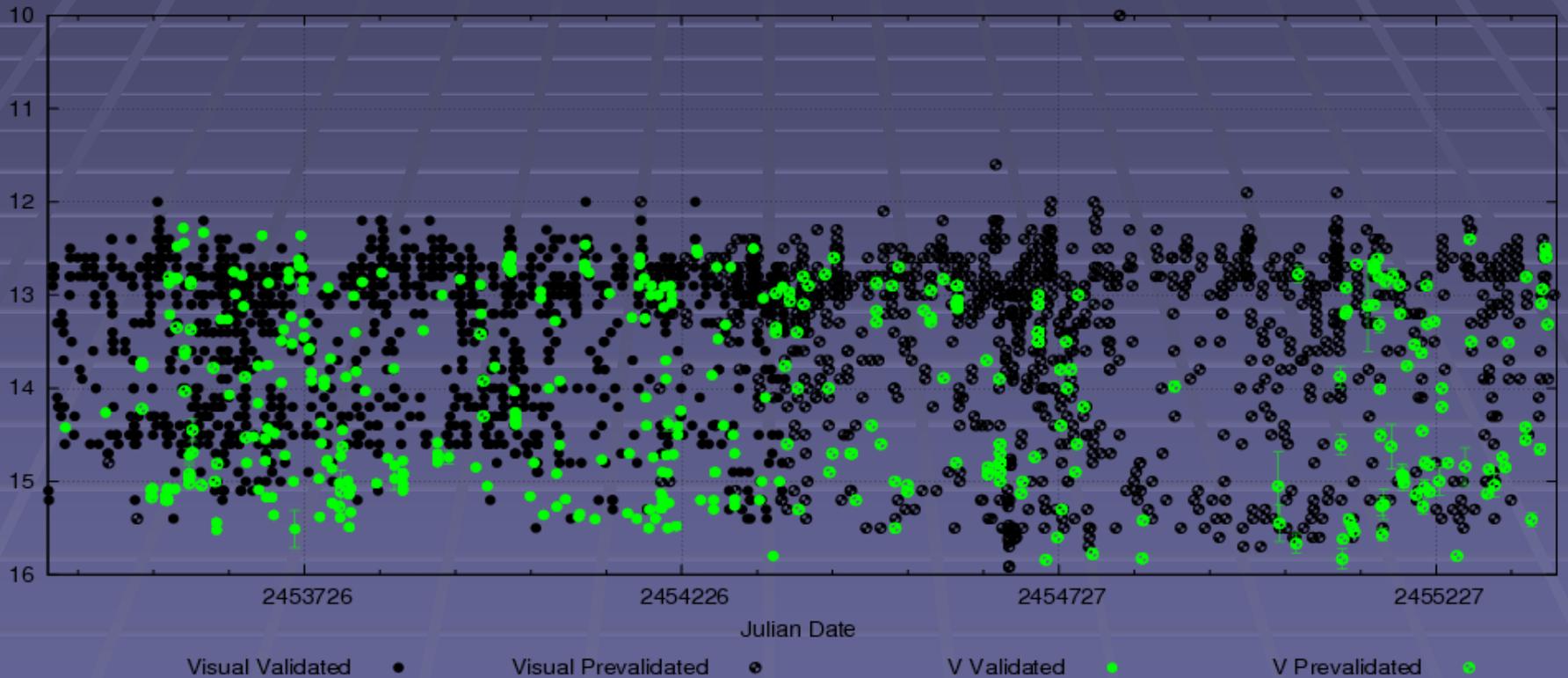
This new classification was further bolstered by support from the Director of the British Astronomical Association Variable Star Section, Felix De Roy, in a 1932 paper, A New Variable Star Class, The Z Camelopardalis Type, describing the state of knowledge of these stars to date (De Roy 1932).

The first defined the “crucial features for the Z Cam type.”

- 1. The short duration of minimum.
- 2. The irregularity of the light curve, described as rare for U Gem types and almost the norm for Z Cams.
- 3. The lesser amplitudes of variation compared to U Gems, 2.64 magnitudes for Z Cams versus 3.8 magnitudes for U Gems.
- 4. A “curious and very special feature” where the variable remains nearly constant at a magnitude in between the maximum and minimum.

Z Cam stars; busy beavers

AAVSO DATA FOR AB Dra - WWW.AAVSO.ORG



The evolution of the definition

- Campbell and Jacchia (1941) “from time to time they take a sort of vacation, and remain at almost constant brightness.” Standstills are a footnote to the description based primarily on the hyperactive nature of Z Cams.
- Elvey and Babcock (1943) write, “Whenever they go through their regular variations, they behave similarly to the short period group of SS Cygni stars. However, these stars may remain for weeks at relatively constant brightness, approximately one-third from maximum to minimum brightness.”

Standstills now matter most

- By 1971, the term “standstills” was in use and is described in The Variable Star Observers Handbook (Glasby 1971) as the main distinguishing feature of Z Cam type variables.
- “The major difference, and that which justifies their inclusion in a separate group, is the periods of standstill.”

According to the GCVS

“Z Camelopardalis type stars. These also show cyclic outbursts, differing from UGSS variables by the fact that sometimes after an outburst they do not return to the original brightness, but during several cycles retain a magnitude between maximum and minimum. The values of cycles are from 10 to 40 days, while light amplitudes are from 2 to 5 magnitudes in V.”

Candidates vs. Imposters

- We propose that there are over 60 UGZ suspects or candidates in the literature.
- Upon closer examination, and based on the modern definition, there are perhaps a couple dozen.
- If this is true, Z Cams are a rare and interesting class of stars like Recurrent Novae and R CrBs.

Imposters in the mix

- AB Dra
- CN Ori
- AM Cas
- FO Per
- SV CMi

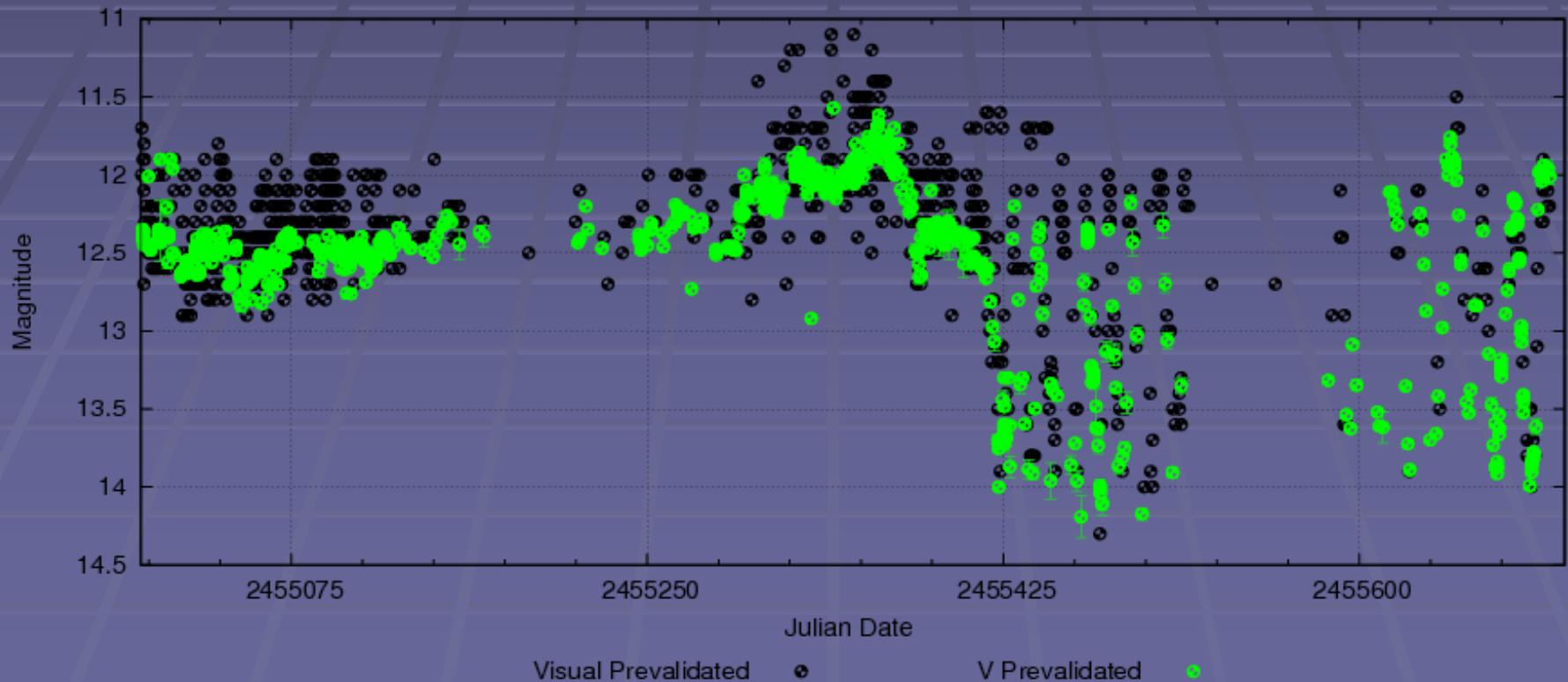
Analysis of decades
of historical data
has led us to determine
these are not ducks



Outburst from Standstill

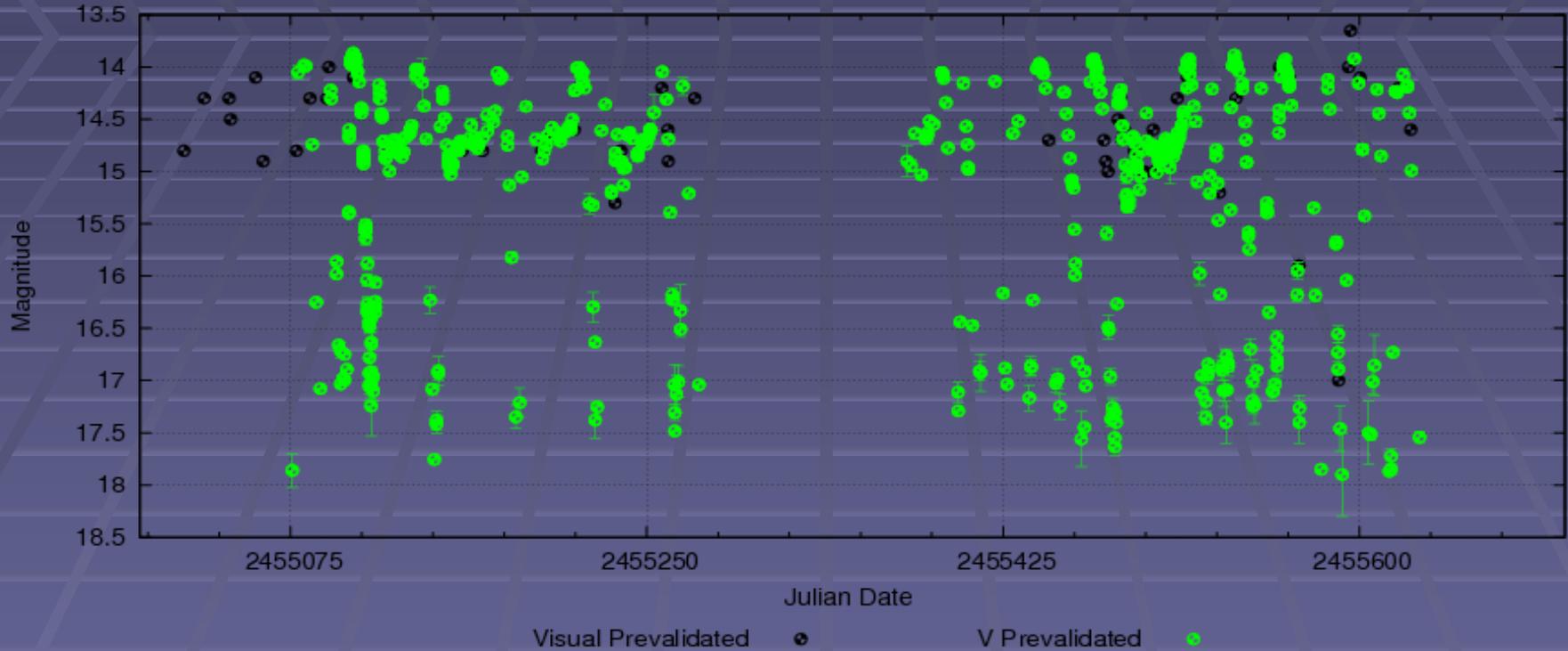
AH Her went from a prolonged standstill to maximum light before returning to quiescence and its 'normal' outburst cycle.

AAVSO DATA FOR AH HER - WWW.AAVSO.ORG



Discoveries

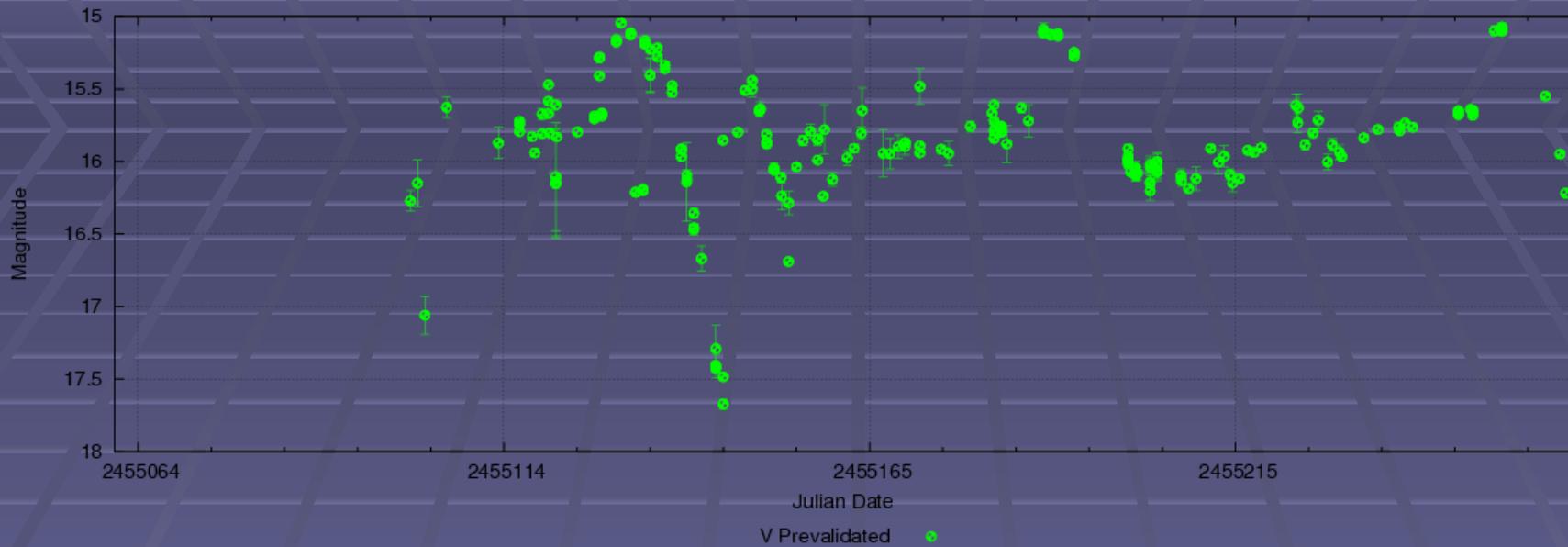
AAVSO DATA FOR IW AND - WWW.AAVSO.ORG



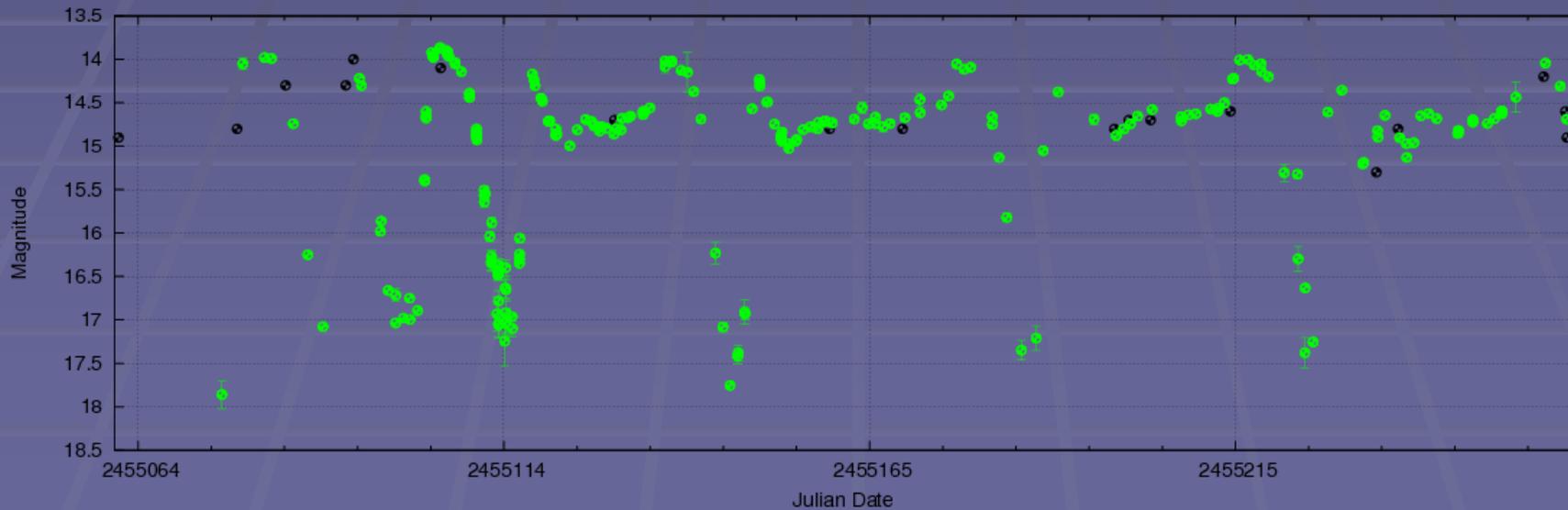
- IW And has proved to be very unusual
- She's an odd duck

V513 Cas: Another odd duck

AAVSO DATA FOR V513 Cas - WWW.AAVSO.ORG



AAVSO DATA FOR IW And - WWW.AAVSO.ORG



Results

- Of 64 CV systems listed as Z Cams in the literature we have confirmed 19 as Z Cam variables.
- 24 others are NOT Z Cam stars.
- The remaining stars are most likely not Z Cams but require more long term monitoring.

Published Results

Two new Z Cams confirmed

The First Historical Standstill of WW Ceti
Simonsen, M. Stubbings, R.

2011JAVSO..39..132

Leo5 is a Z Cam Type Dwarf Nova
Wils, P. Krajci, T. Simonsen, M.

2011JAVSO..39

Other publications

- The Z Campaign Simonsen, M., 2011, JAVSO, 39, 66
- Z Cam stars in the twenty-first century, Simonsen et al, in preparation



URLs

CVnet: the AAVSO CV Section site

<https://sites.google.com/site/aavsocvsection/>

Z CamPaign Page

<https://sites.google.com/site/aavsocvsection/z-campaign>

The Z Cam List

<https://sites.google.com/site/thezcamlist/>

That' s All Folks!

