

Latest Results on Accreting Pulsating WDs: GW Lib, V455 And and SDSS0745+45

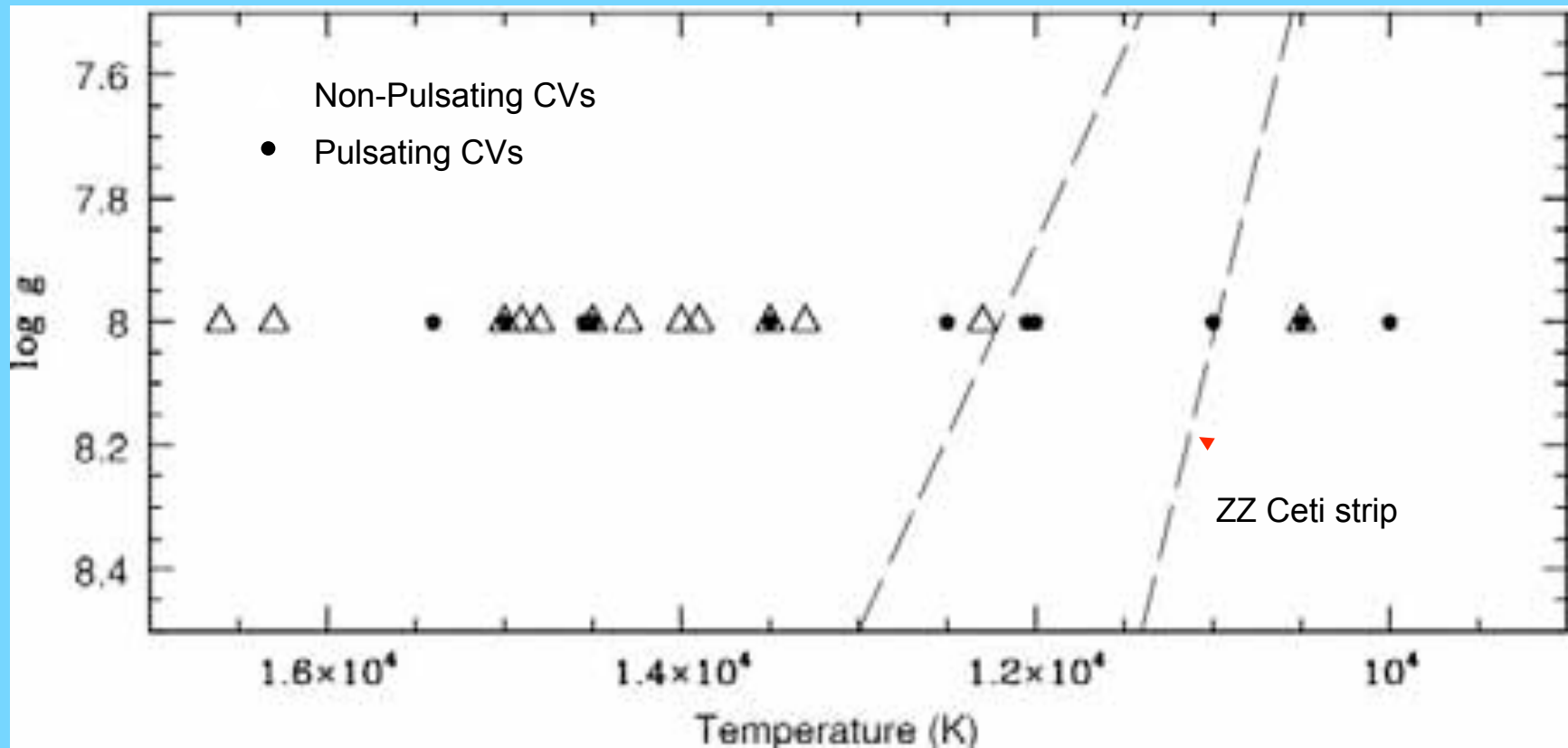


Paula Szkody, Anjum Mukadam +++++++

Woburn October 30, 2010

What we know about Accreting Pulsators:

- Instability strip is wider than for ZZ Ceti
- Objects can stop pulsating (outbursts)



13 possible pulsators

Known Recent Outbursts

- SDSS0745+45 Oct 2006
- GW Lib April 2007
- V455 And Sept 2007

GW Lib Pre-outburst

Fourier Transform

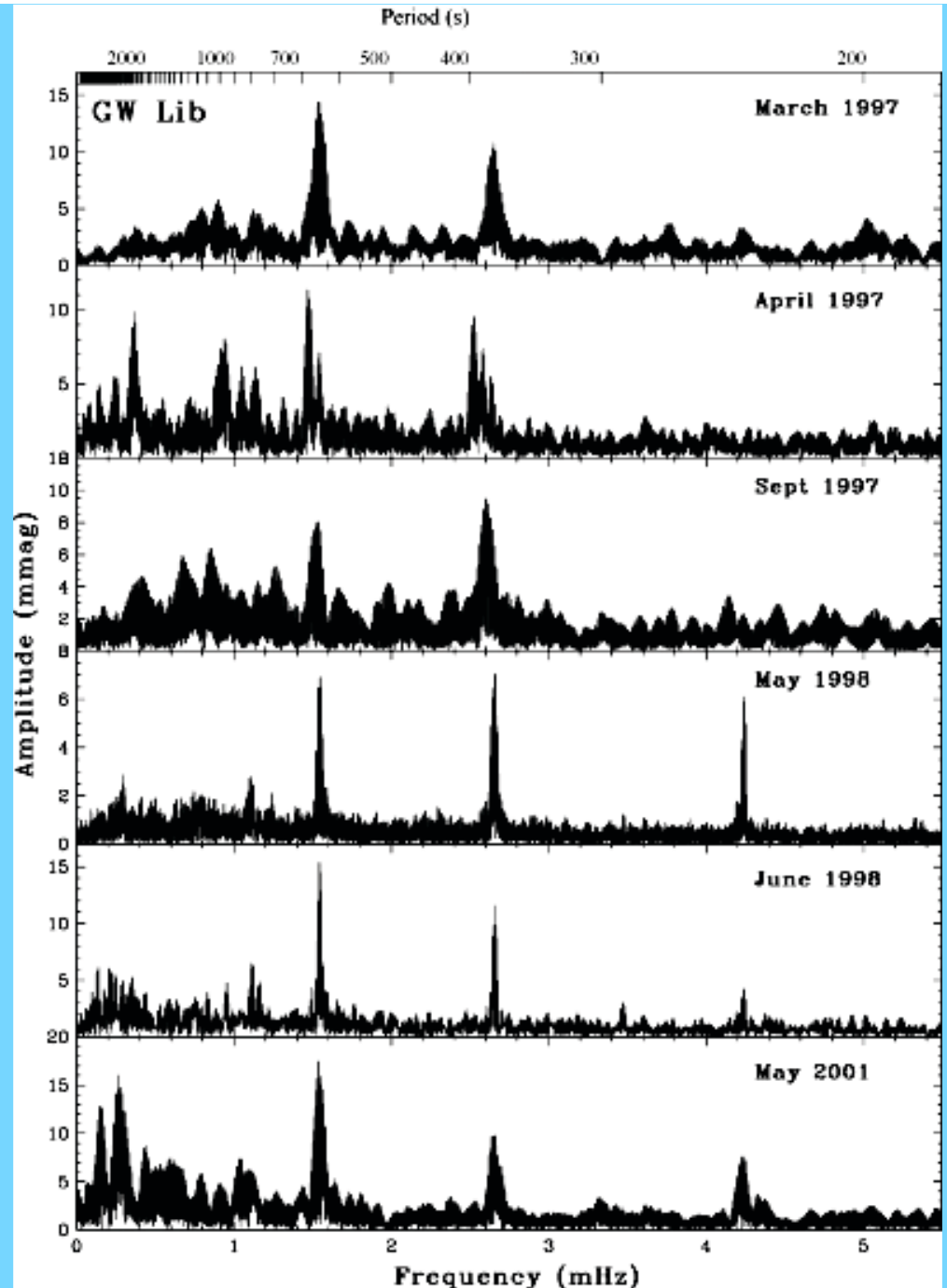
Long monitoring prior to 2007 outburst (Van Zyl et al 2004, MNRAS)

$$P_{\text{orb}} = 76 \text{ min (spectra)}$$

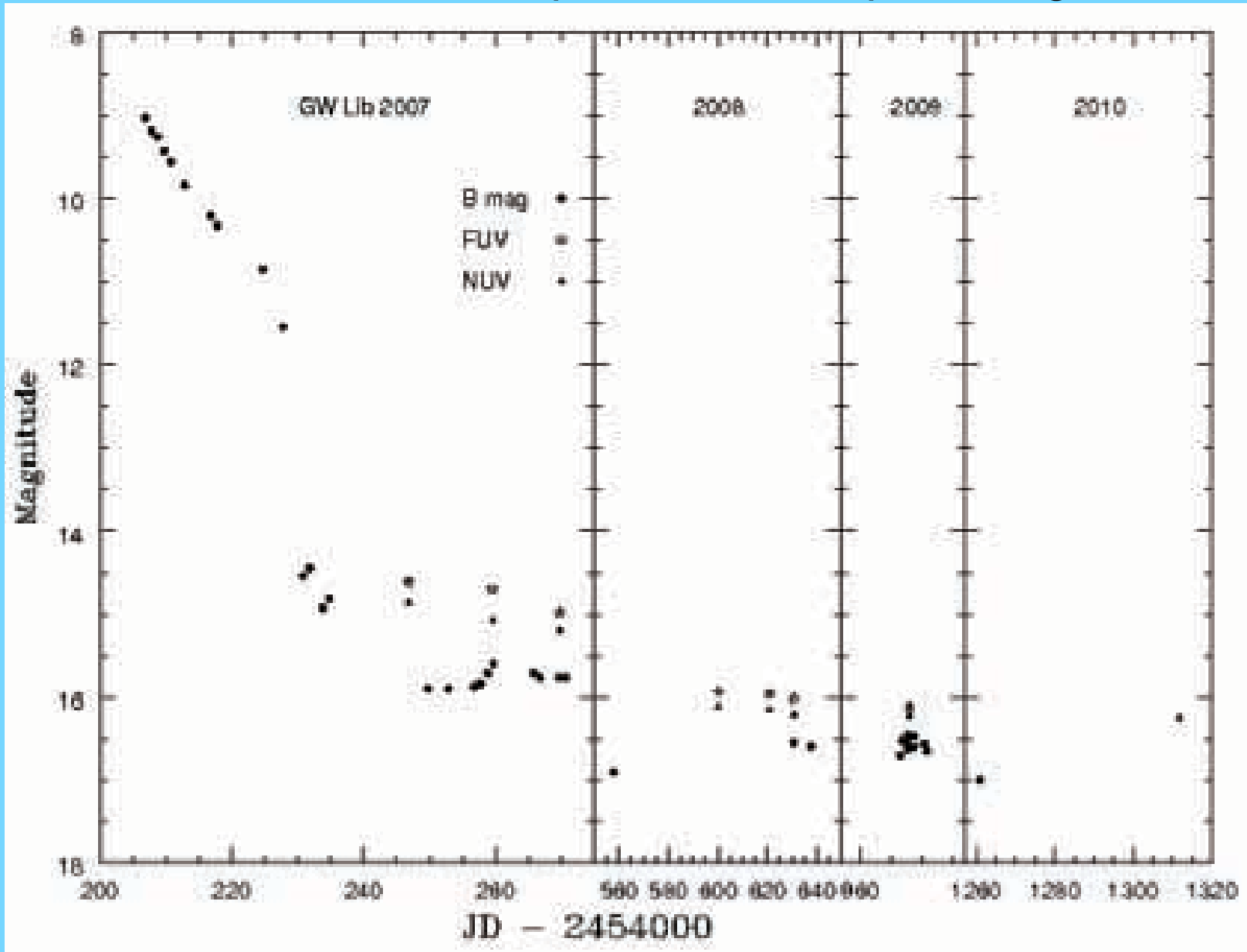
$$P_{\text{wdspin}} = 97\text{s? (spectra)}$$

$$P_{\text{pulse}} = 650, 376, 236\text{s}$$

$$P_{\text{long}} = 2.1 \text{ hrs}$$



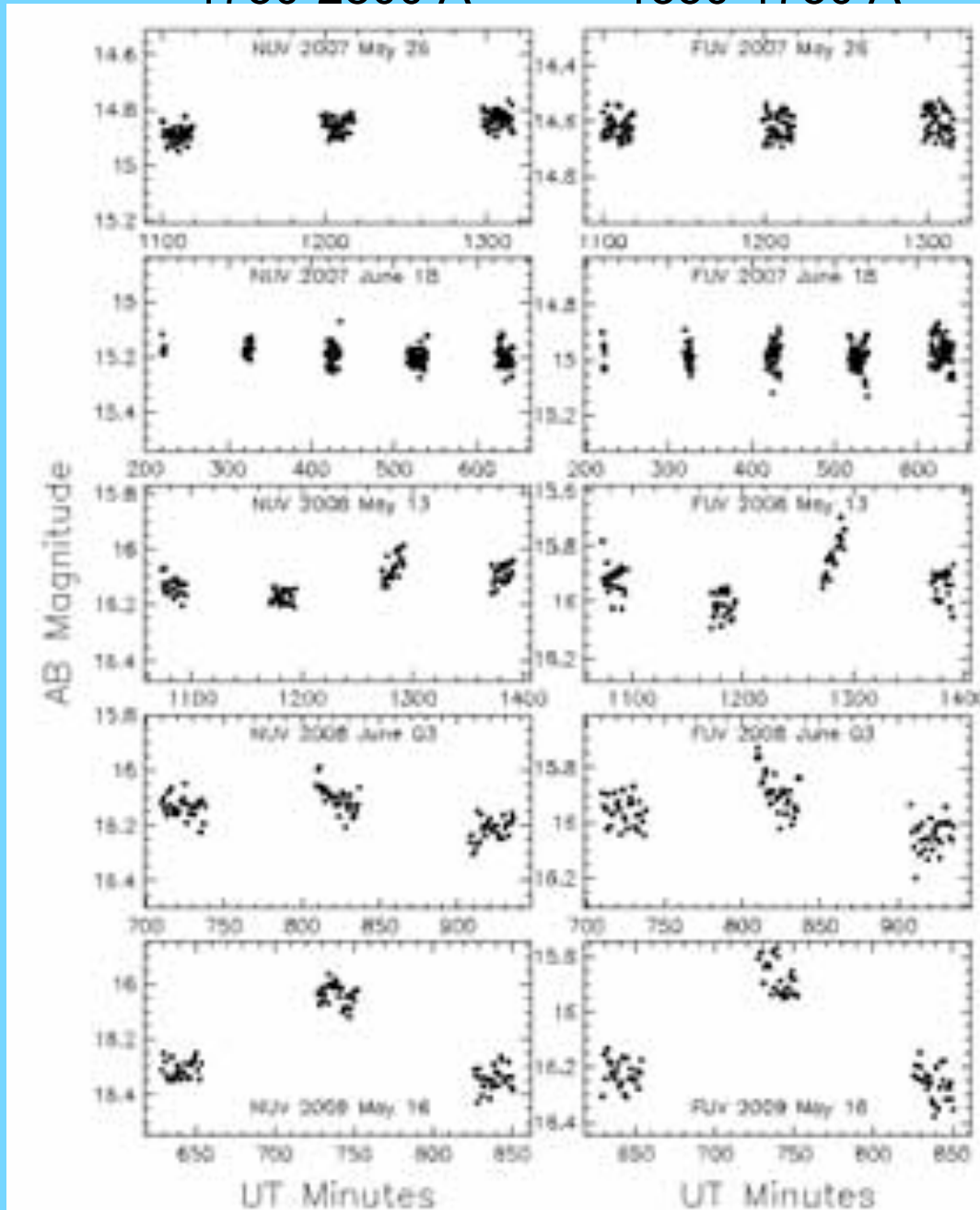
GW Lib outburst Apr 12 2007 amp ~9 mags



GALEX

1750-2800 Å

1350-1750 Å



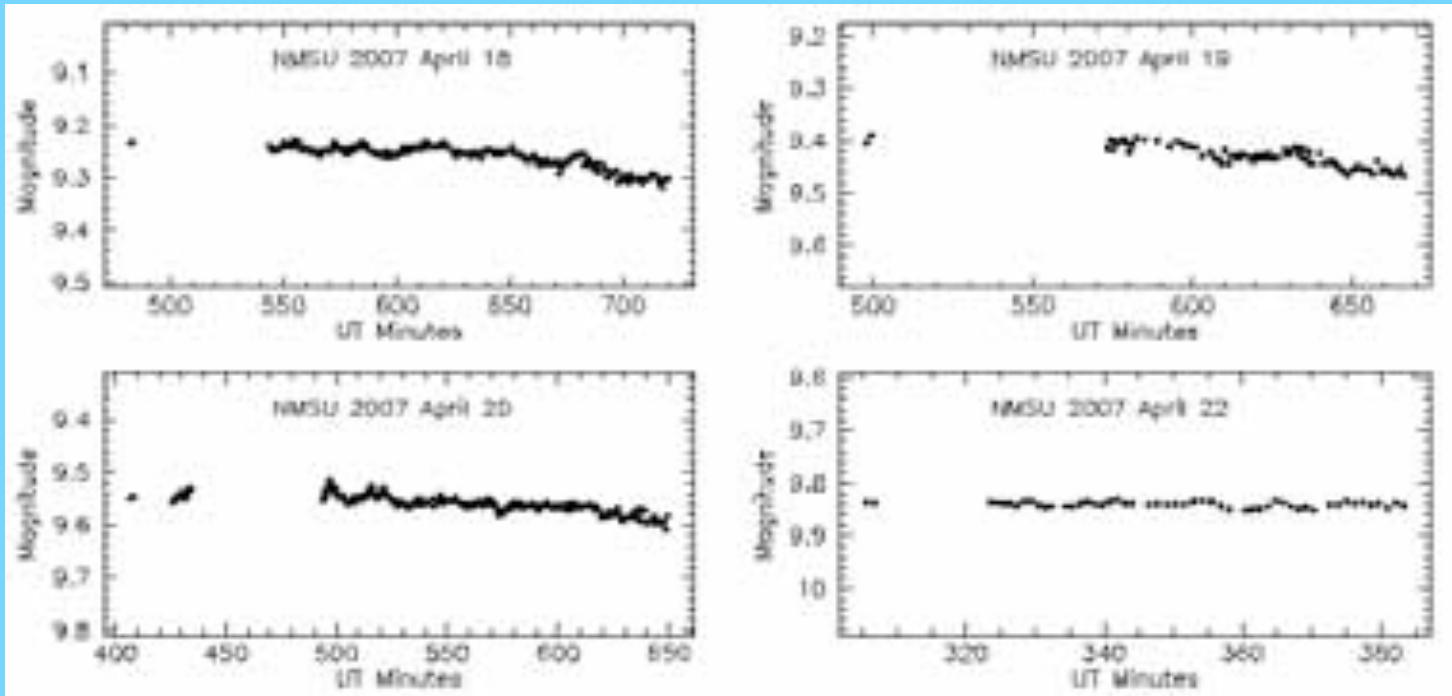
flat
2007

2008
4 hr
variation
starts

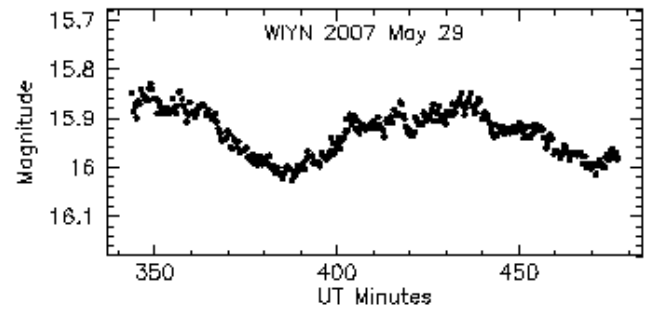
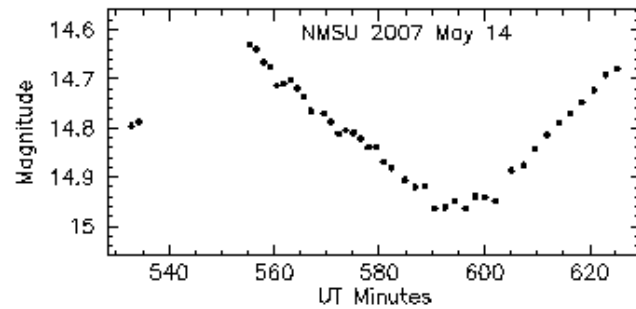
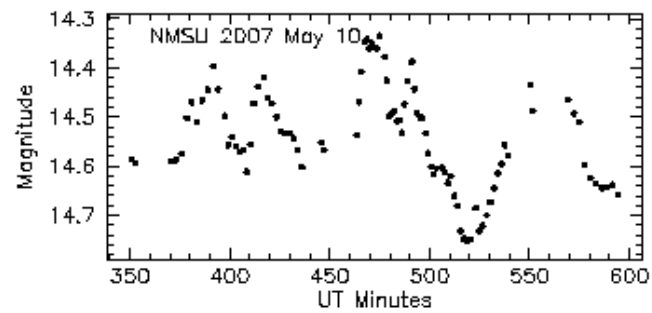
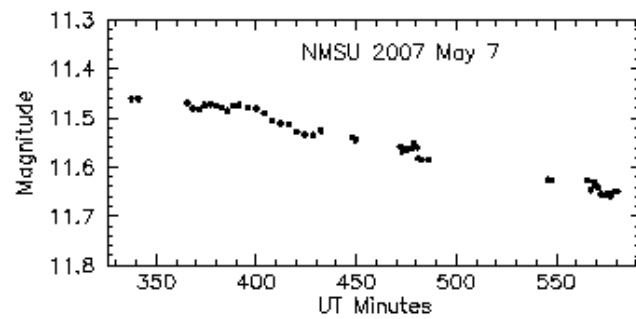
2009
amp

grows

Optical April 2007 peak



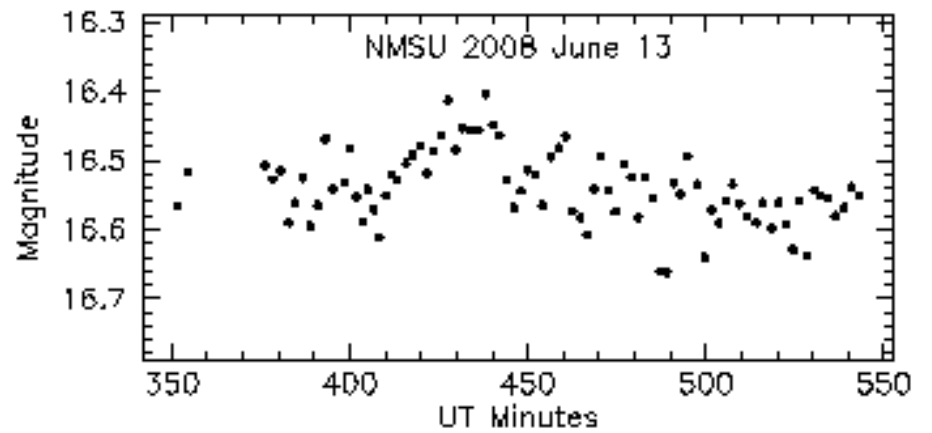
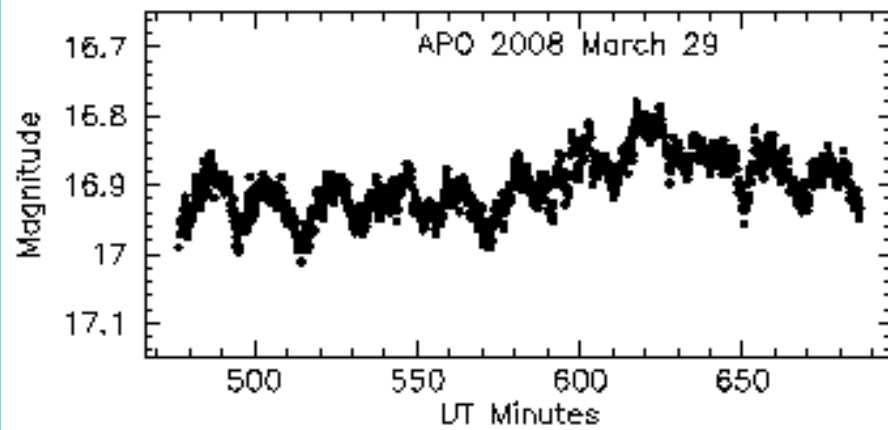
May 2007 transition



rapid
decline

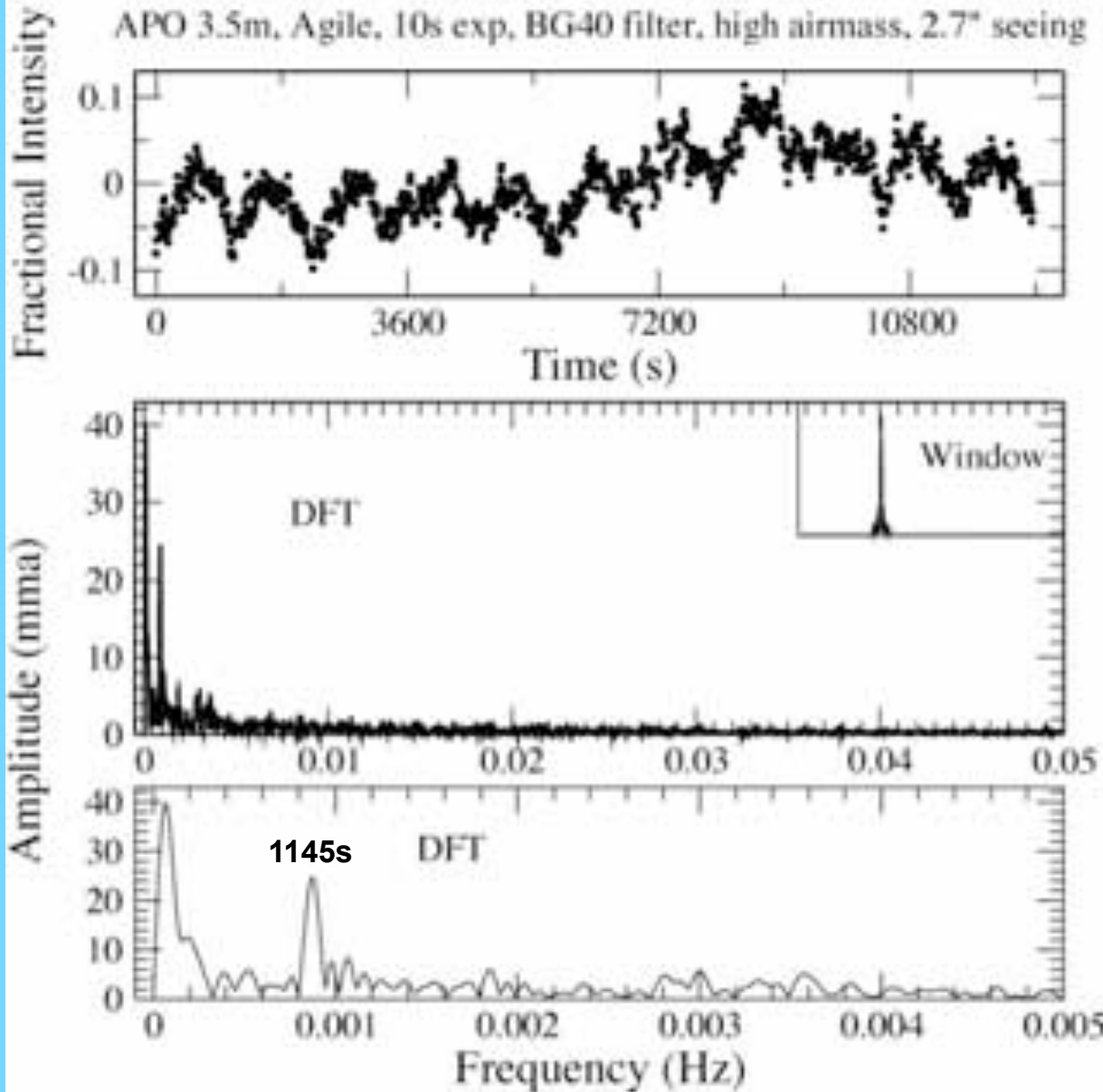
80 min
SH

1 year later: 2008: new periods emerge



GW Librae (29 March 2008)

APO 3.5m, Agile, 10s exp, BG40 filter, high airmass, 2.7" seeing



**A new opt
periodicity is
apparent 1 yr
after outburst**
**not seen in UV
(May-June)**

Before outburst:
P=650, 370, 230s

After outburst:
P=1145 \pm 3 s

Mar-Jun 2008

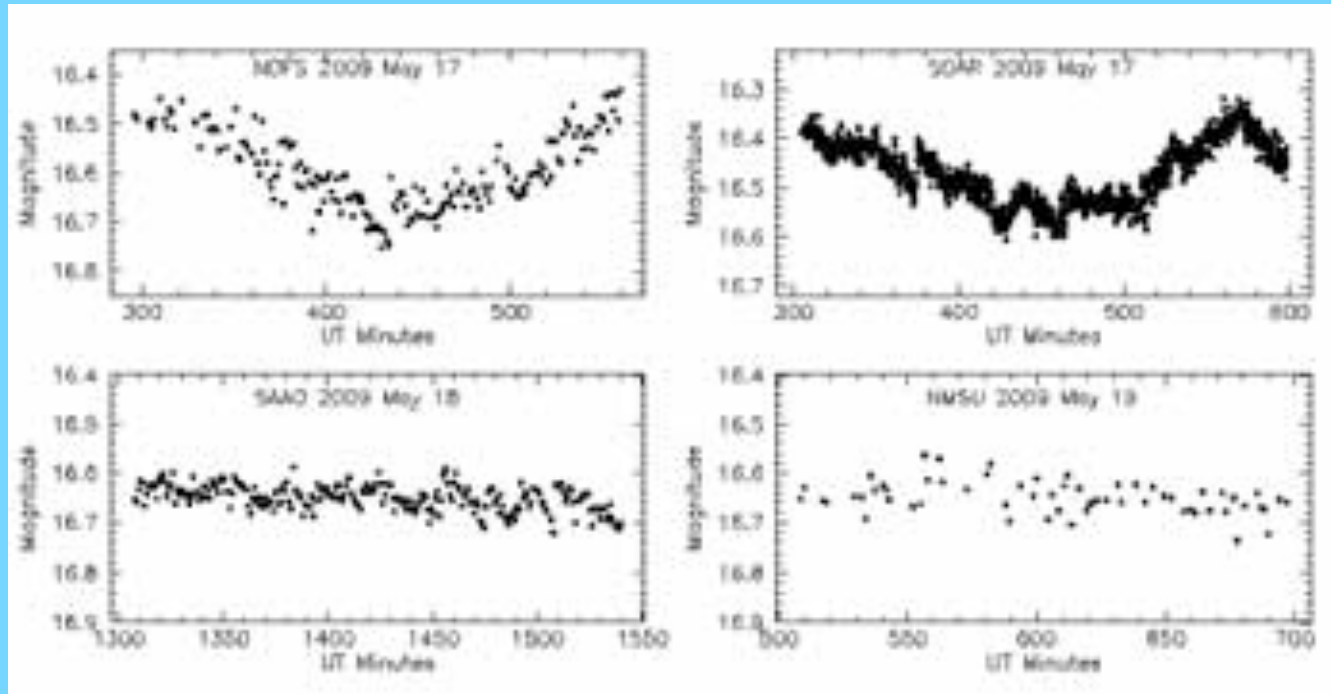
Copperwheat et al.
2009 MNRAS

Scwieterman et al.
2010 JSARA

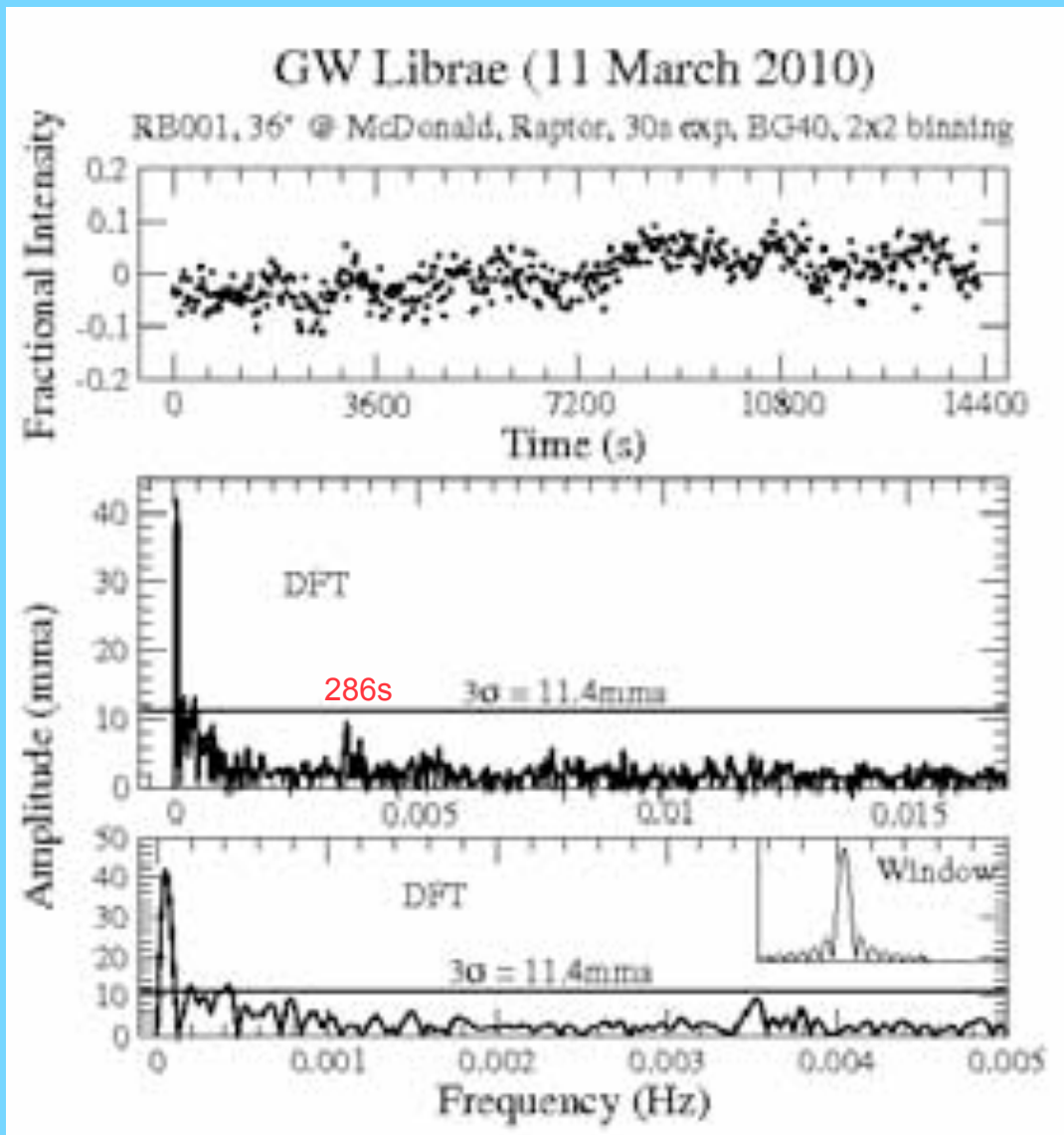
2009: long periods come and go

4 hr wave
(was 2 hr
pre-outburst)!

gone
(in 1 day)!



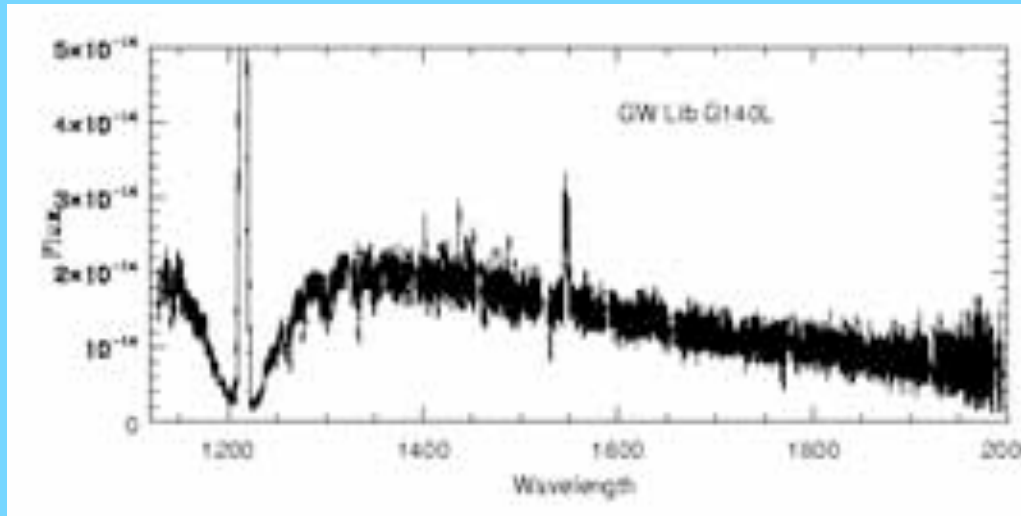
3 yrs past outburst - still no pulsations



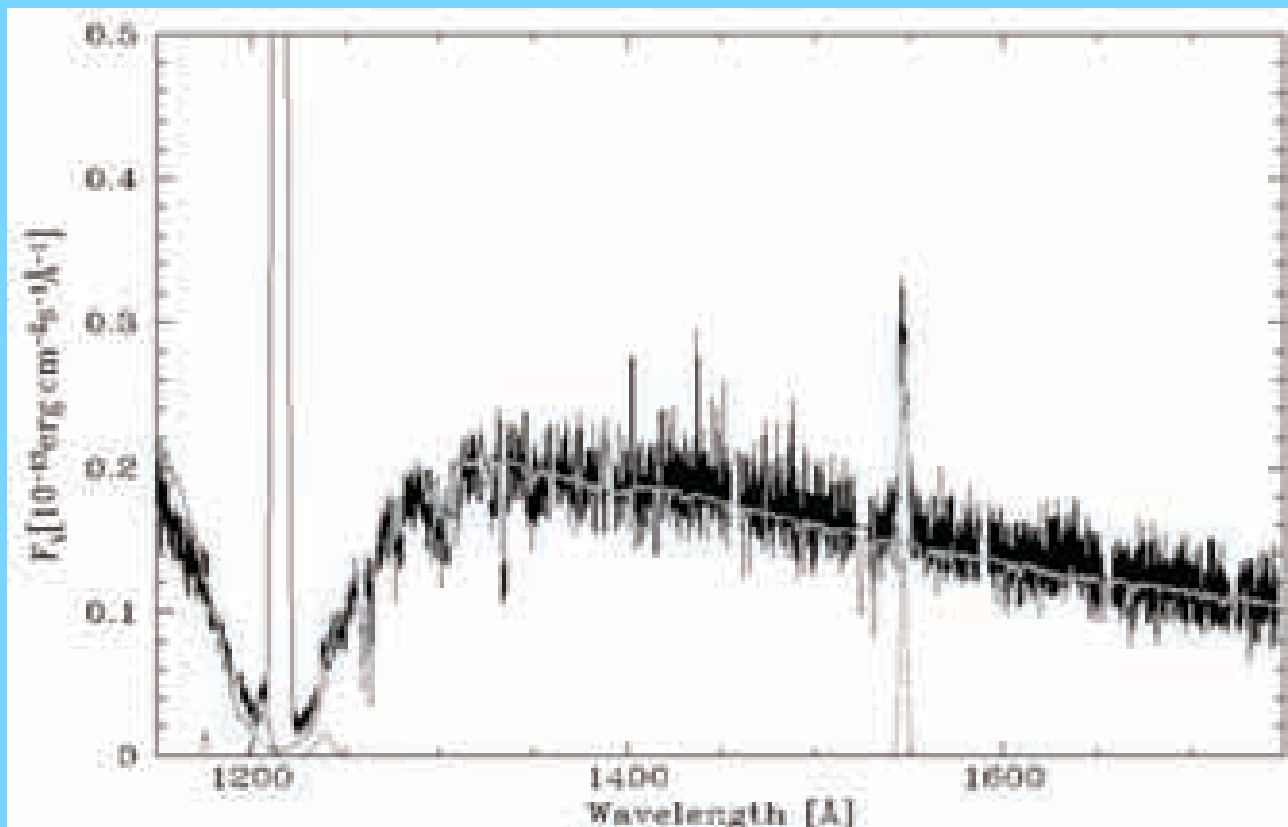
D.E. Winget &
J. J. Hermes

Pre-outburst were:
650, 370, 230 sec
Amps at 15 mma

HST 3
yrs past
outburst



COS spectrum
March 11, 2010



Log g=8
T=18,600K
(Pre-outburst
was ~15,000K)

At 3 yrs past outburst:

GW Lib was $> 3600\text{K}$ hotter than quiescence

WZ Sge was $\sim 1500\text{K}$ hotter than quiescence

Our data 2007-2010

**V455 And outburst:
amp ~ 8 mag**

Araujo-Betancor
et al 2005

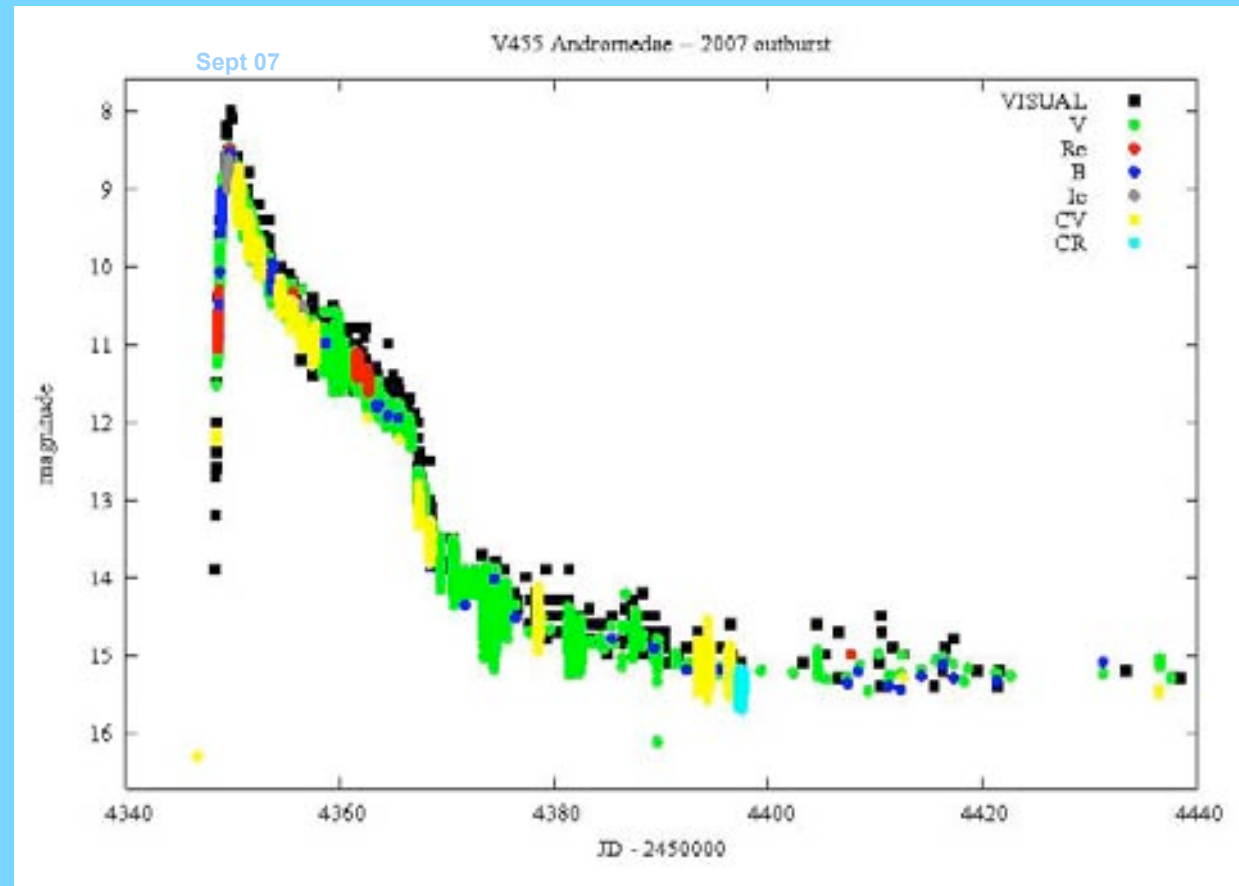
$P_{\text{orb}} = 81 \text{ min (ec)}$

$P_{\text{phot}} = 83 \text{ min (SH?)}$

$P_{\text{pulse}} = 300\text{-}360 \text{ sec}$

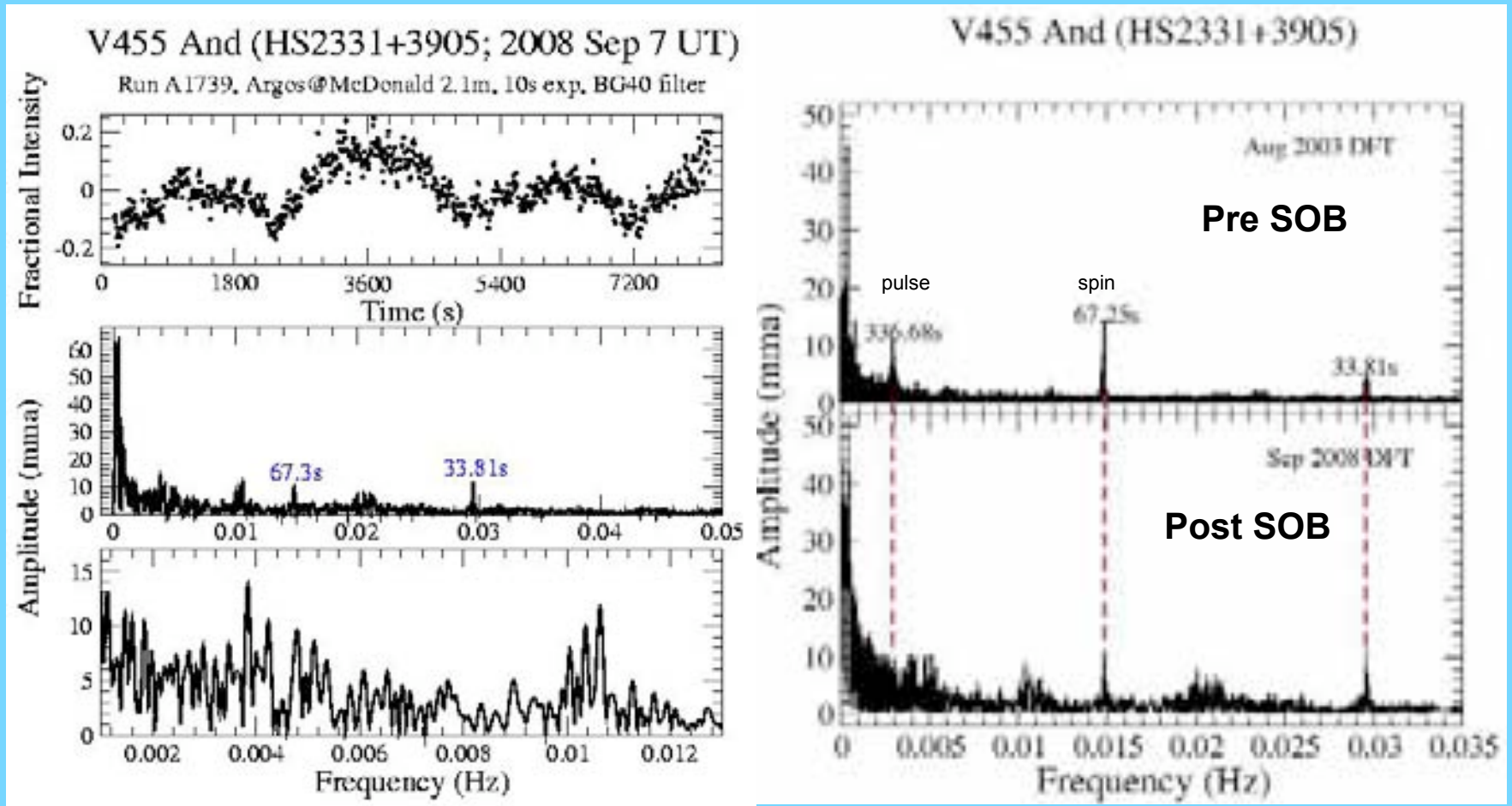
$P_{\text{spin}} = 67 \text{ sec}$

$P_{\text{spec}} \sim 3.5 \text{ hr (?)}$



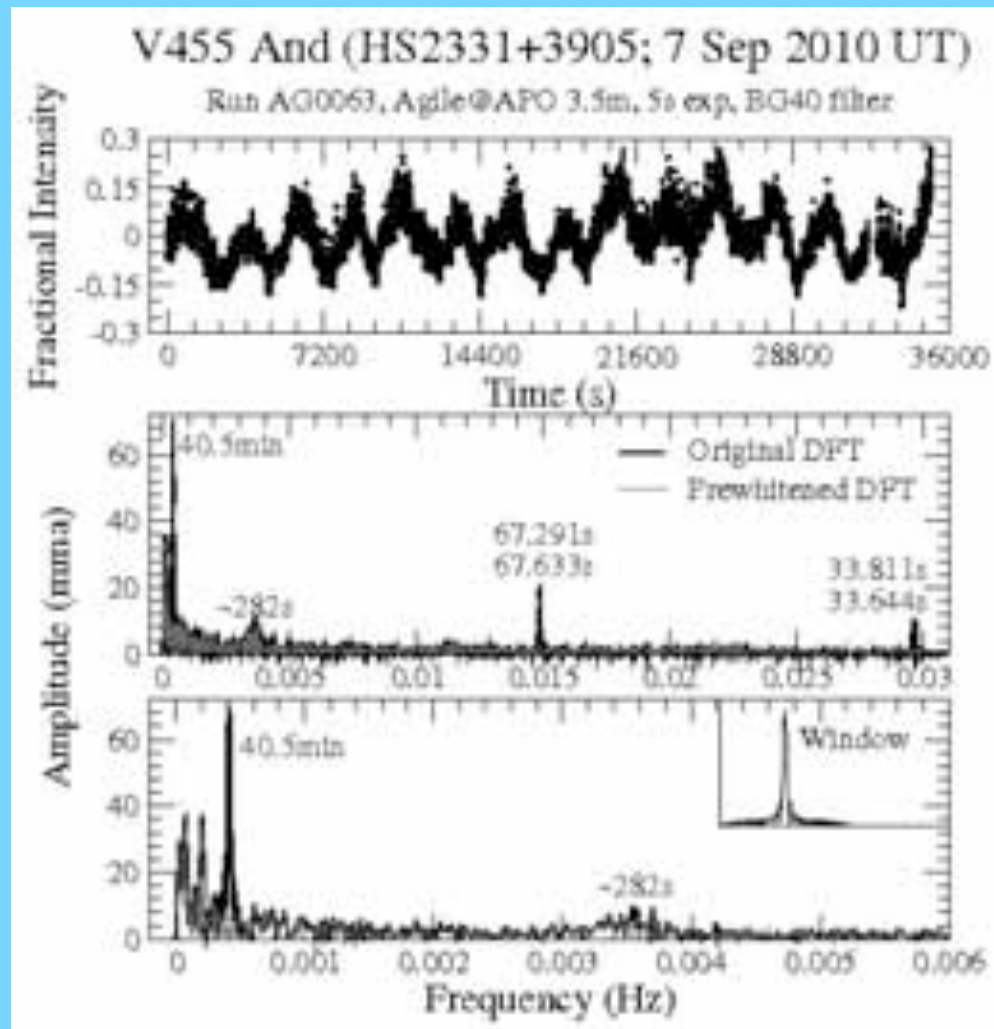
AAVSO data plotted by Matt Templeton

1 yr past outburst:

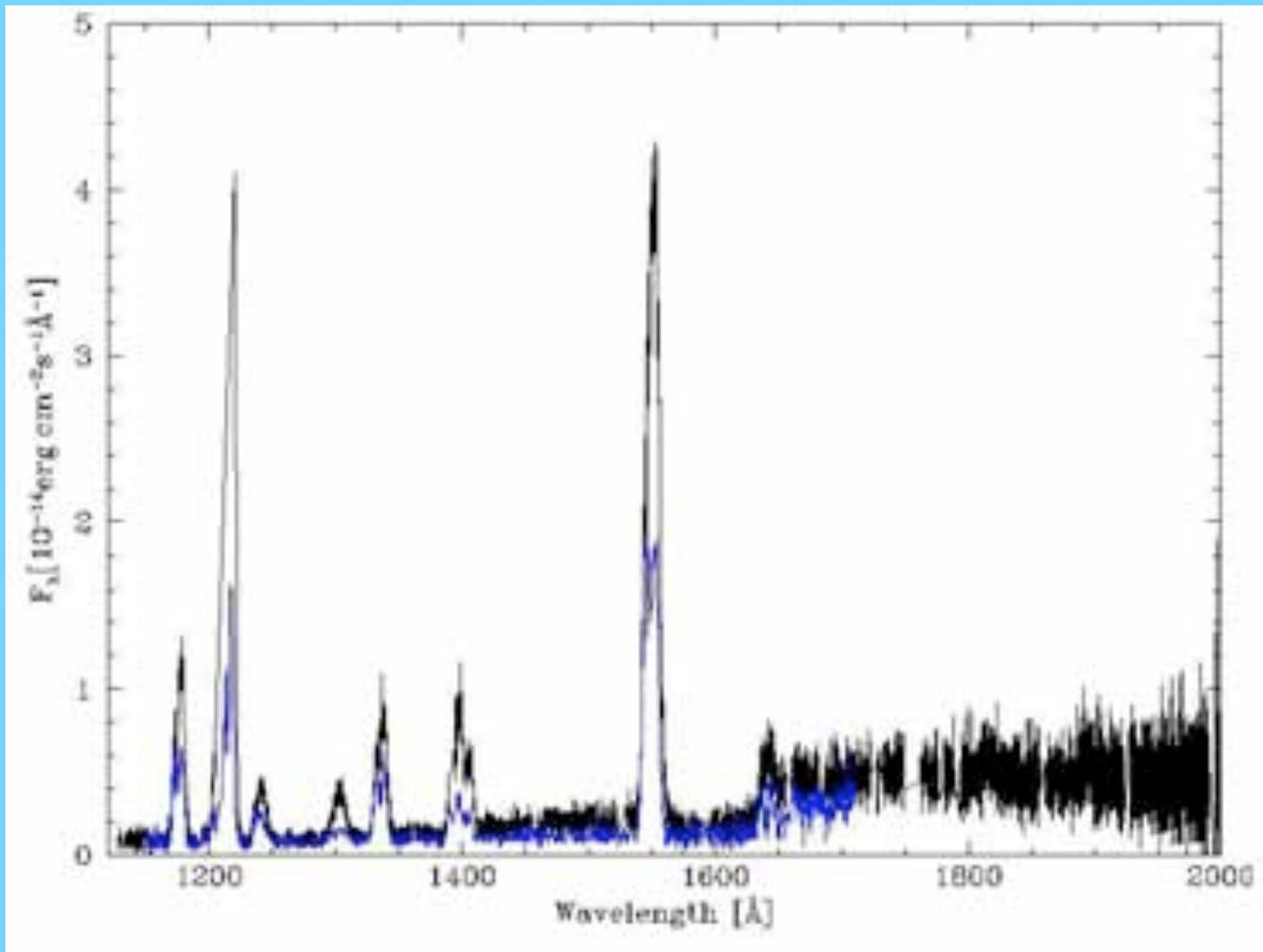


Spin present but
not pulsations

V455 And Sept 2010; pulsations at ~282 sec pre-outburst was at 336 sec



V455 And HST Oct 14 2010 compared
to STIS pre-outburst- (not much hotter)



SDSS0745+45 outburst CSS October 2006

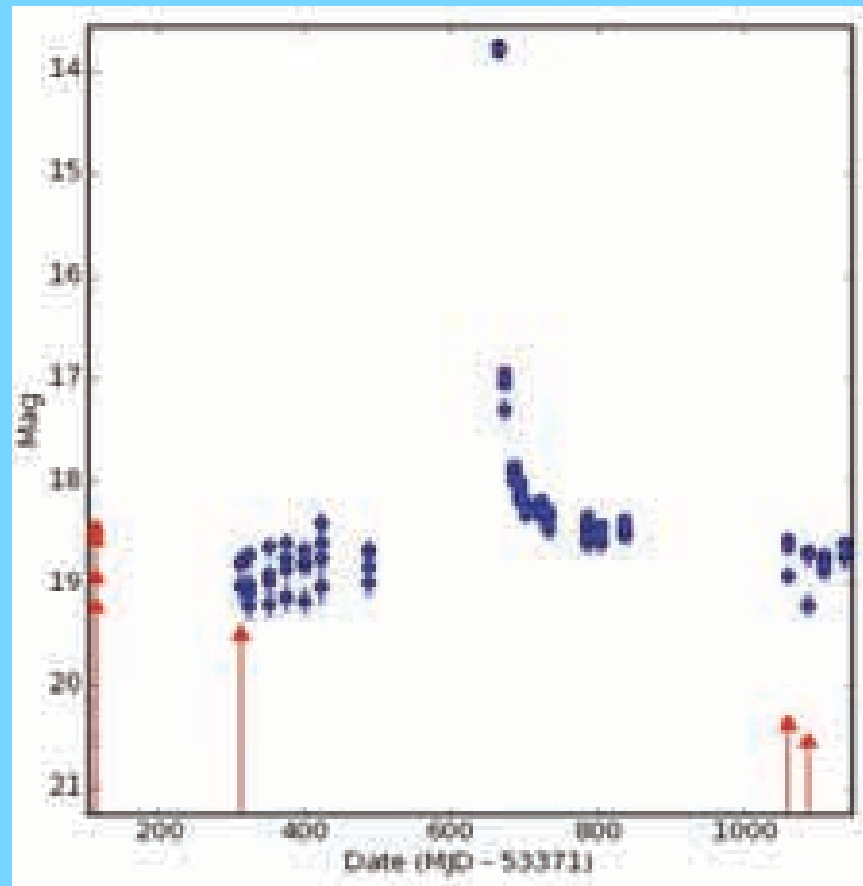
$P_{\text{phot}} = 87 \text{ min (SH?)}$

$P_{\text{pulse}} = 1230 \text{ s}$

$P_{\text{spec}} = 78 \text{ min?}$

T_{wd} (HST) Nov 2007
= 17,000K

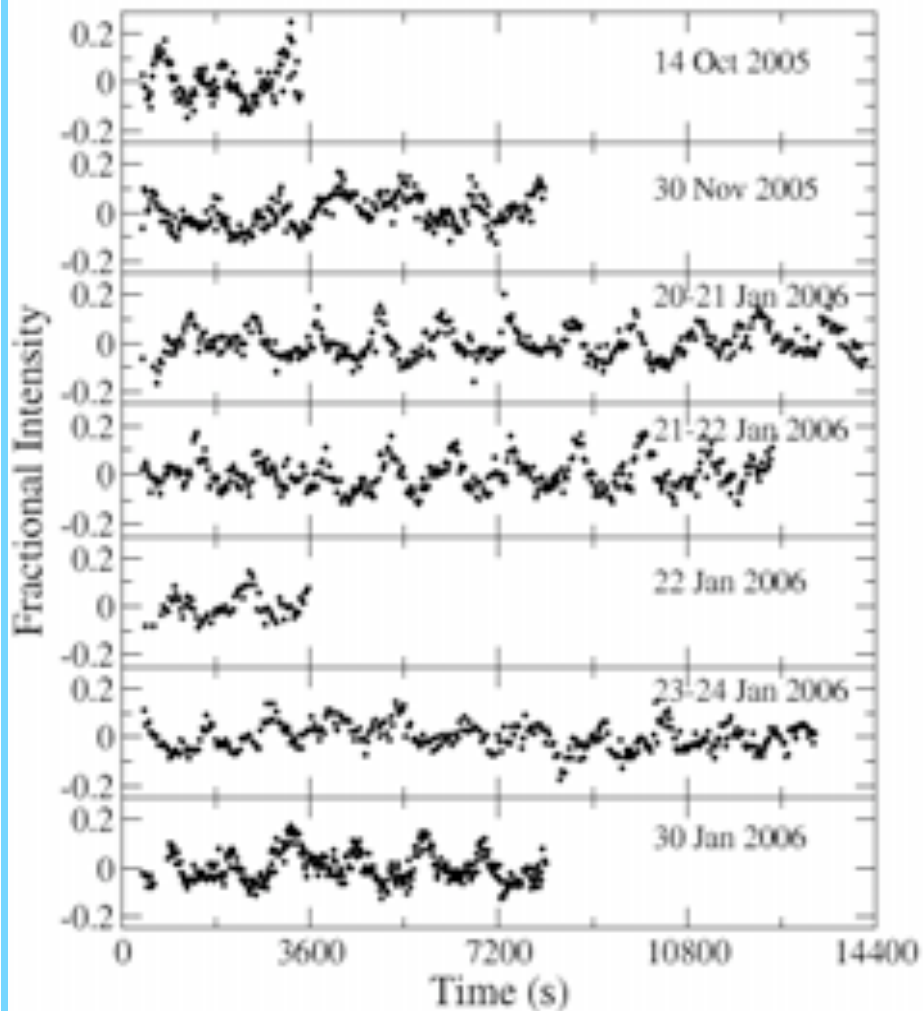
(don't know pre
-outburst T)



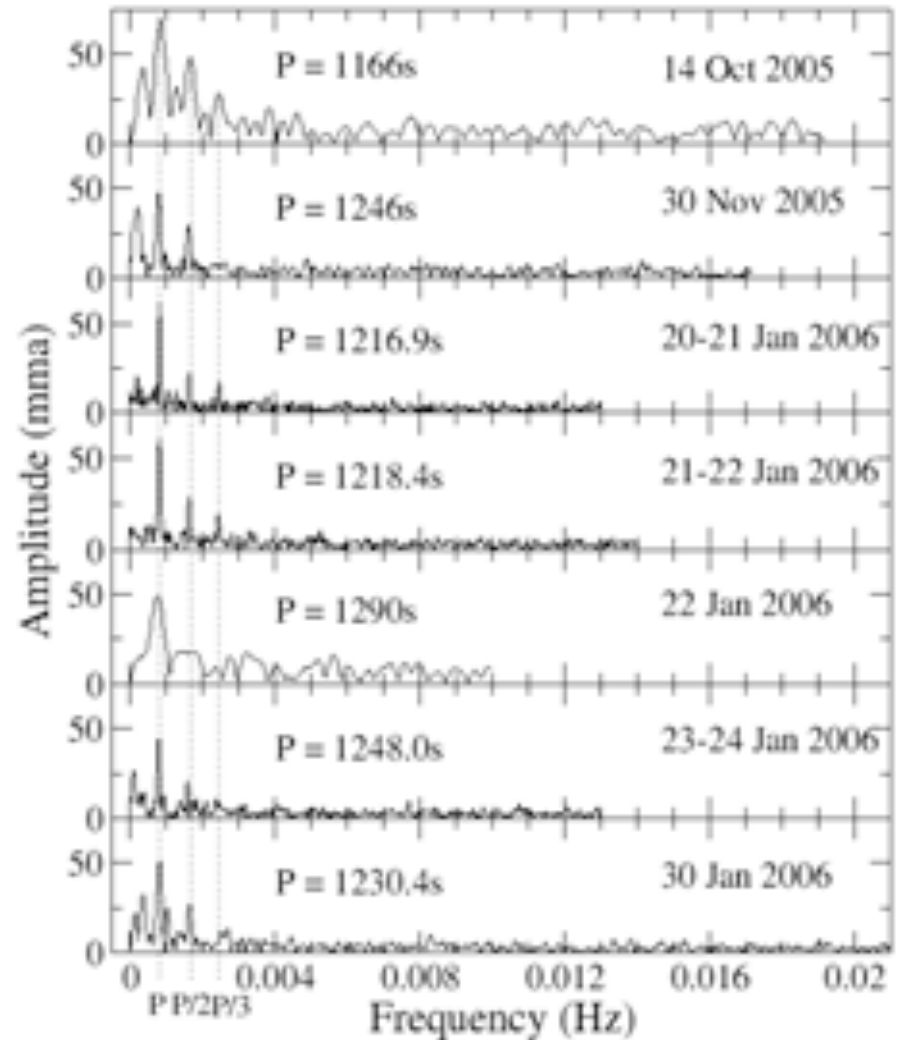
Amplitude
> 5 mags

2005-2006 Data on SDSS0745+45 Pre-outburst

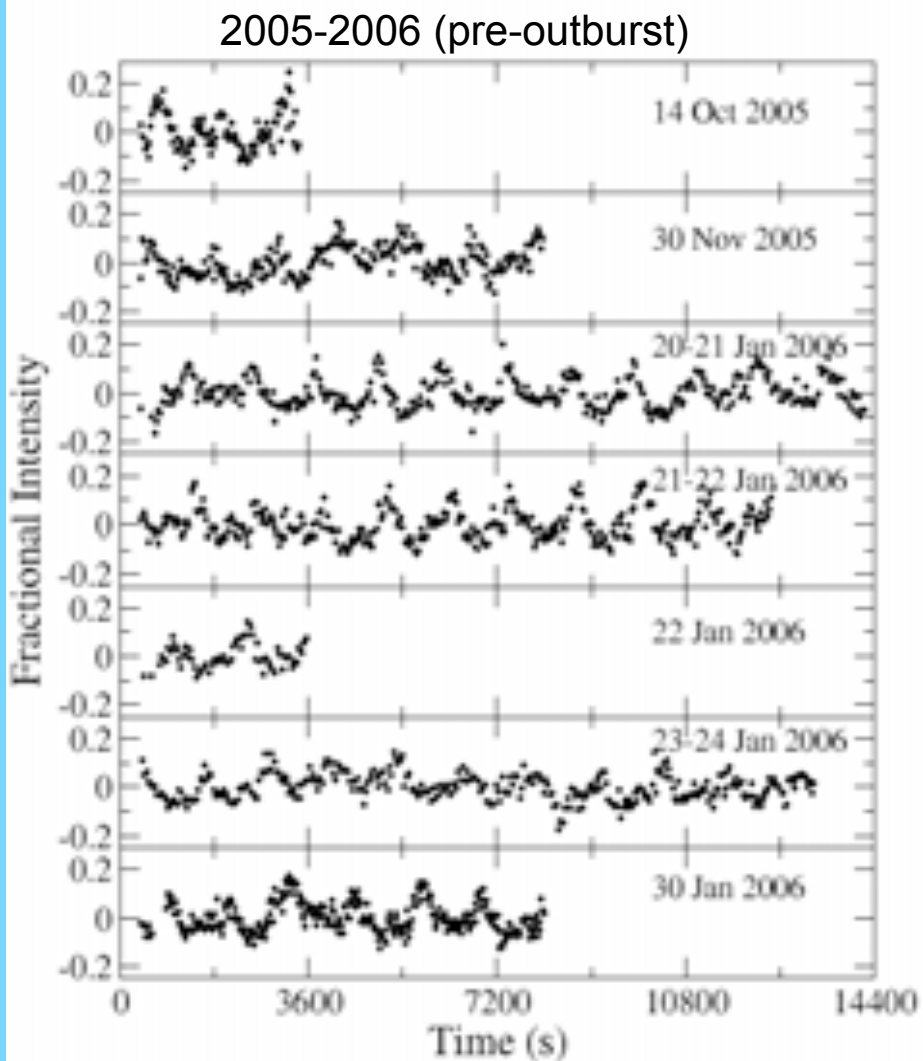
Light curves



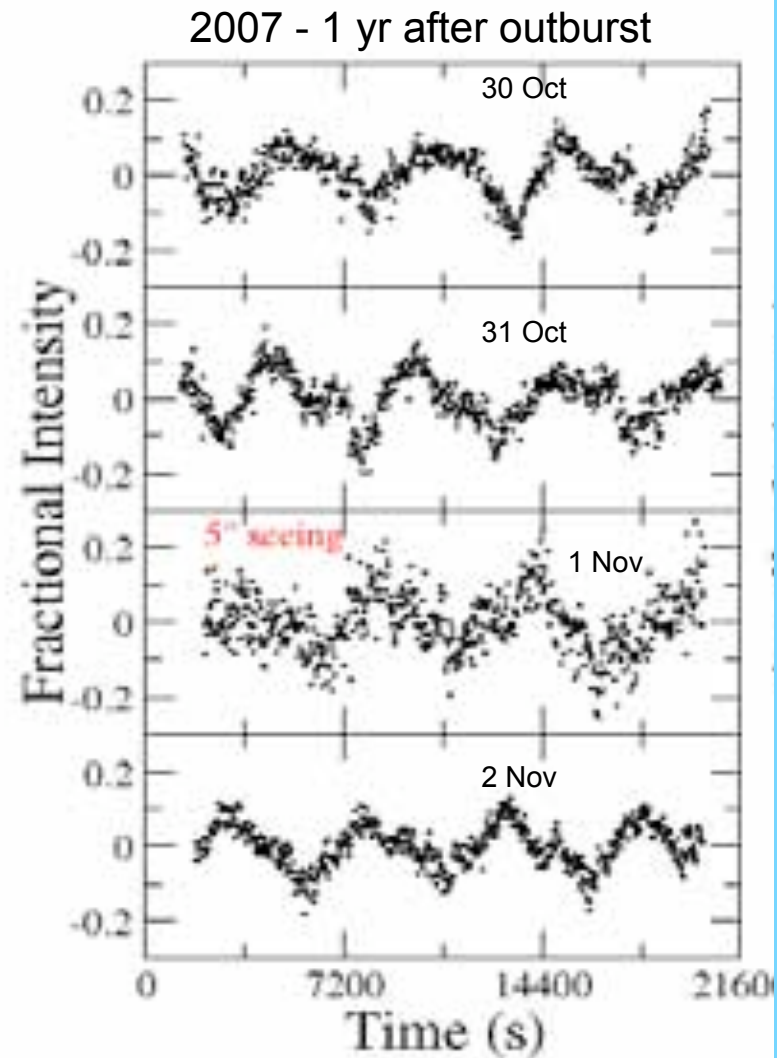
Fourier transforms



SDSS0745+4538



6 peaks/ 7200 sec = pulsation



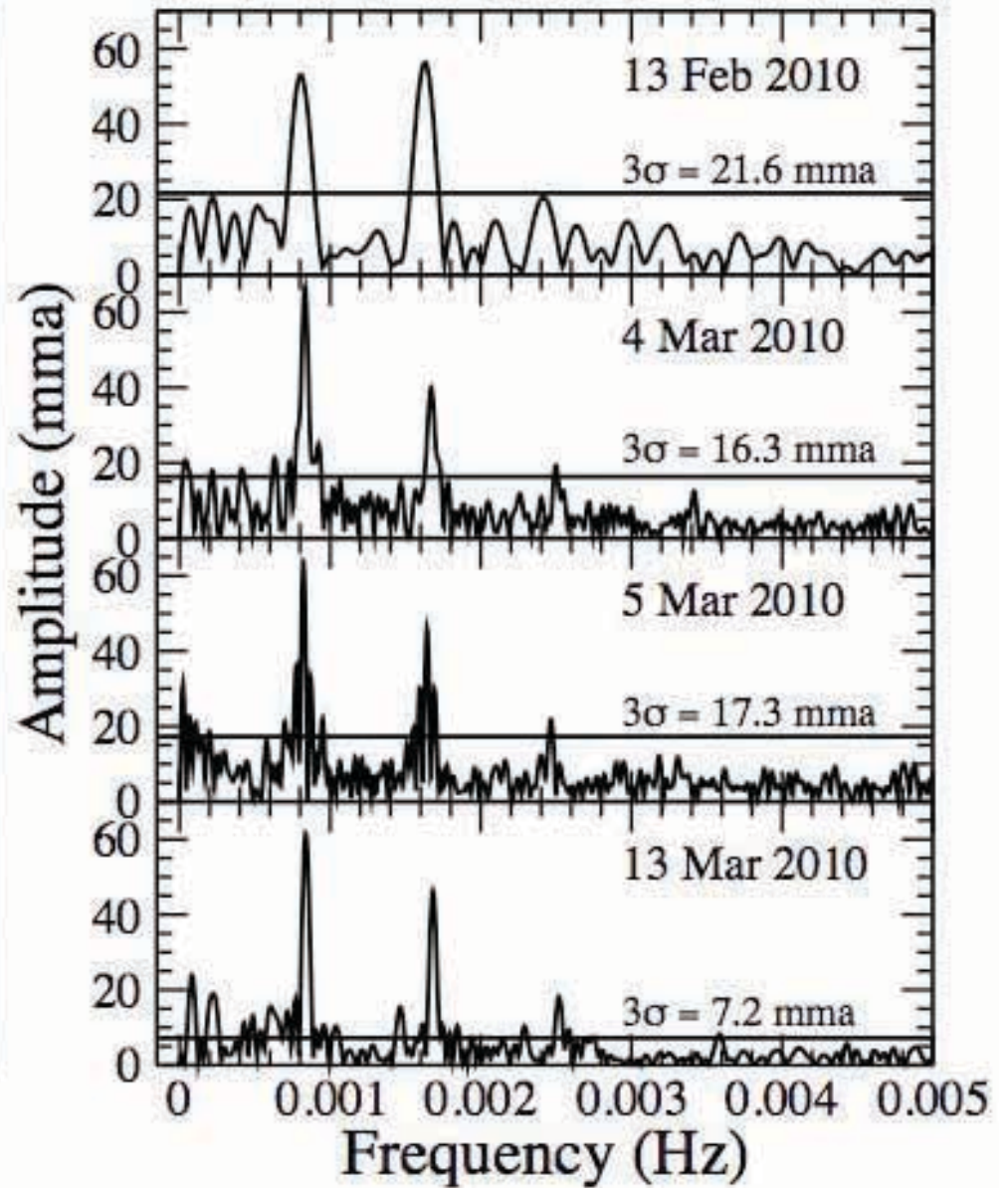
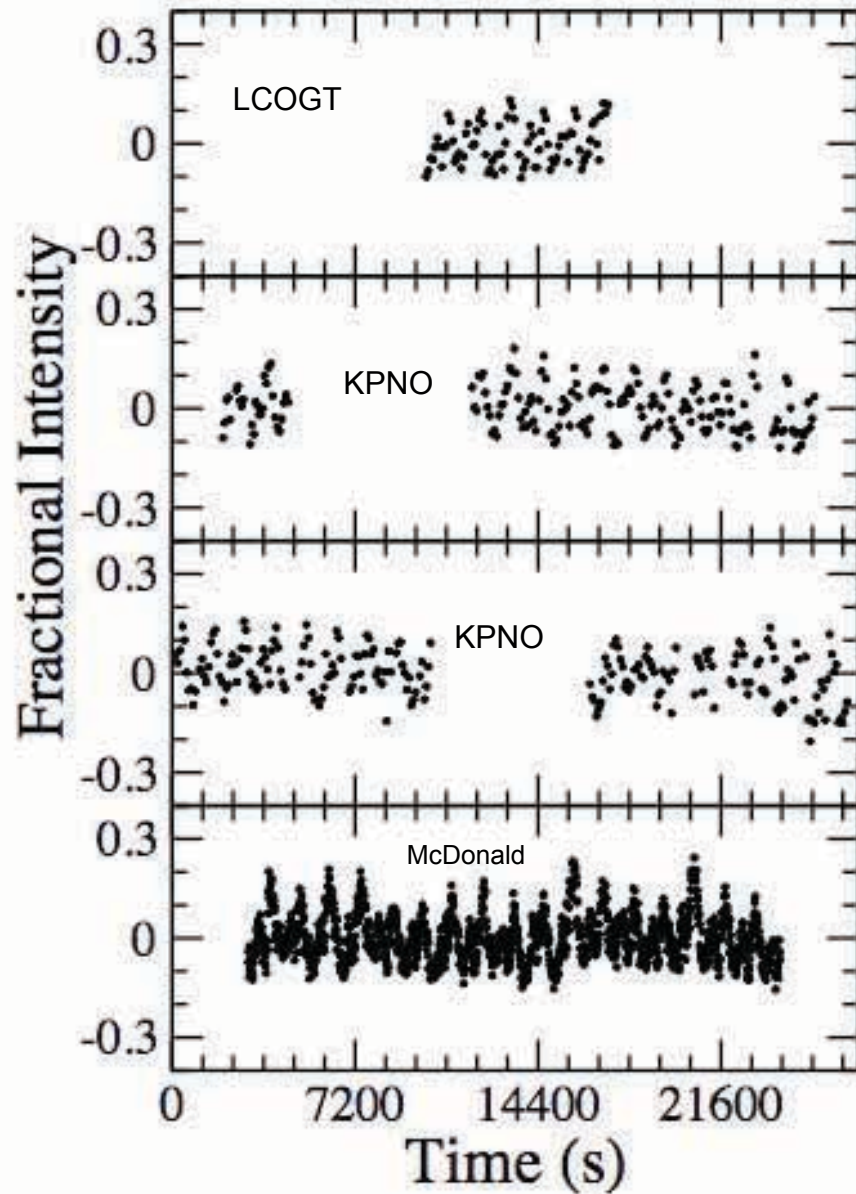
1.5 peaks/ 7200s = orb/SH

2010 data: 3.3 yrs past outburst

Pulsations are back!

Pre-outburst: 1228.6 ± 1.8 s

Post outburst: 1232.1 ± 2.2 s



Summary

- GW Lib: WD at 18,500K 3 yrs past outburst; no pulsations yet; 4 hr modulation opt+UV
- V455 And: pulsations back 2 yrs past outburst at shorter P?
- SDSS0745: WD at 17,000K 1 yr past outburst; pulsations back < 3.3 yrs past outburst at same period

One oddity in common:

None showed echo outbursts on decline

Are the different return timescales related to:

- amplitude of SOB
- mass of WD
- lack of echo outbursts

????

Our thanks to the
many observers
from AAVSO that
helped make the
HST observations
possible!