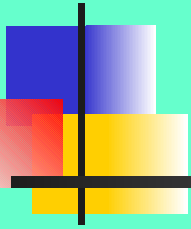
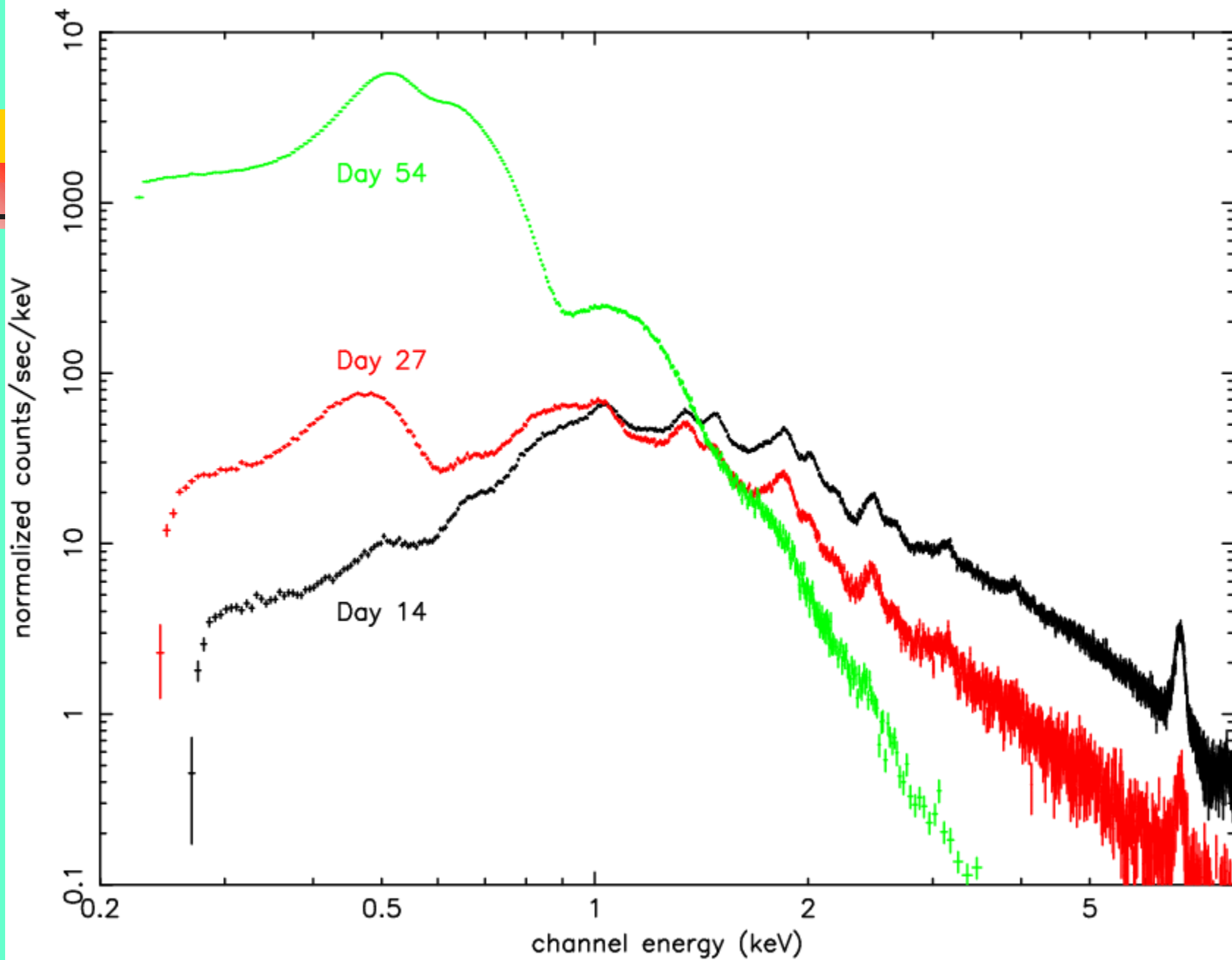


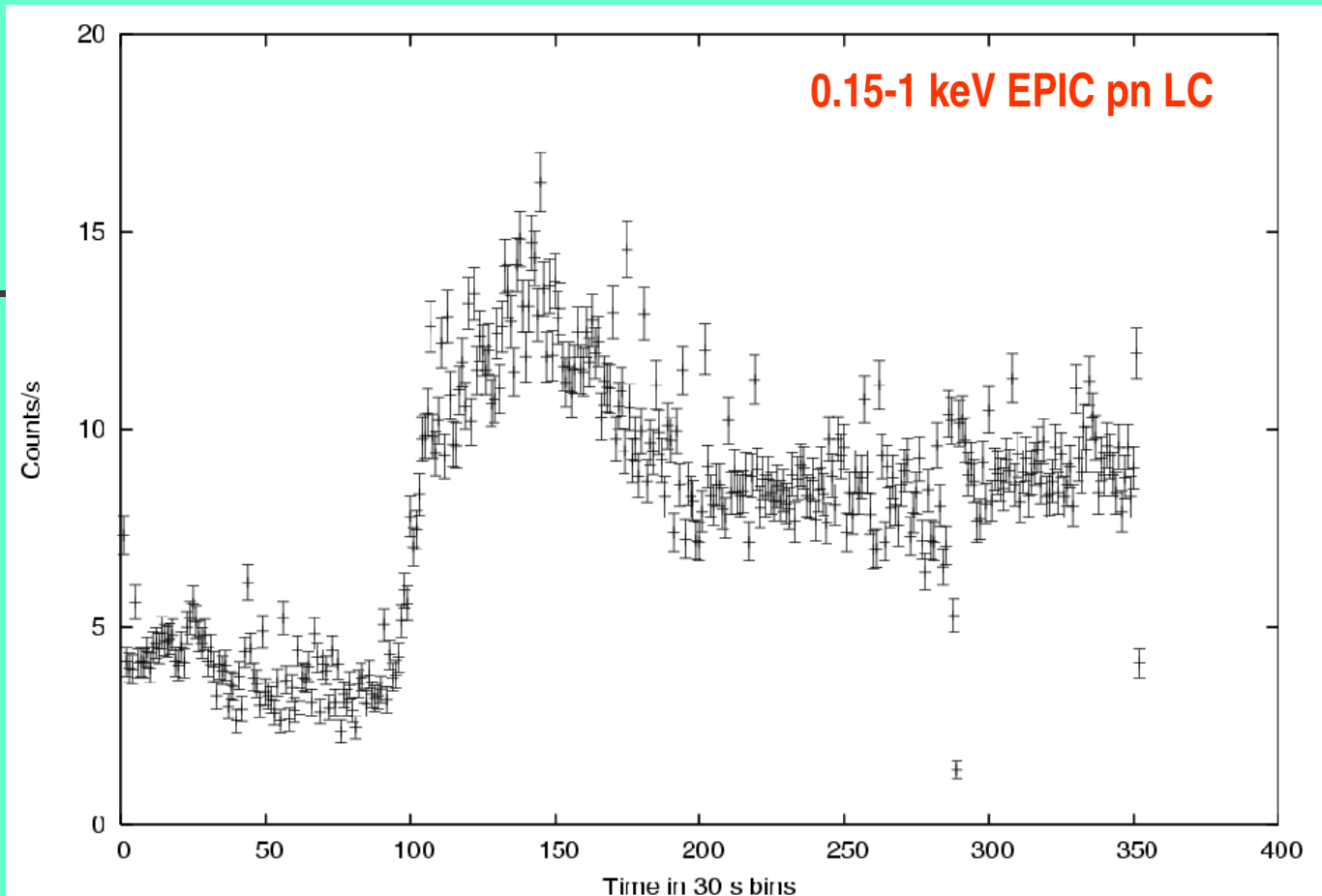
The ~35 sec period(s) in the X-ray light curves of RS Oph: March and April with XMM-Newton and Chandra



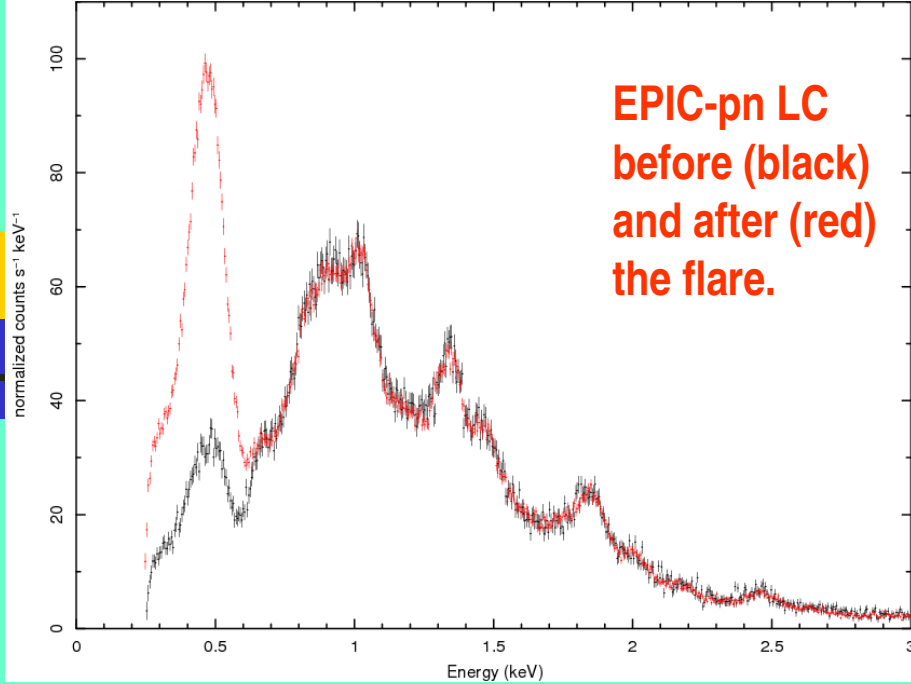
Marina Orio, Elia Leibowitz, Thomas Nelson, Dina Prialnik and Ofer Yaron

RS Oph XMM-Newton EPIC-pn spectra



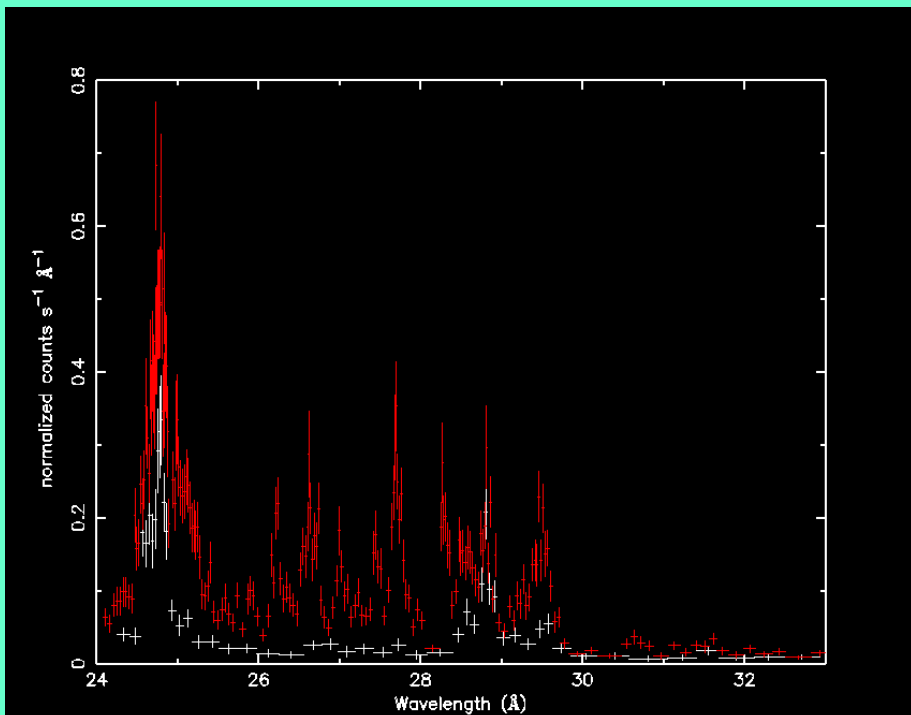


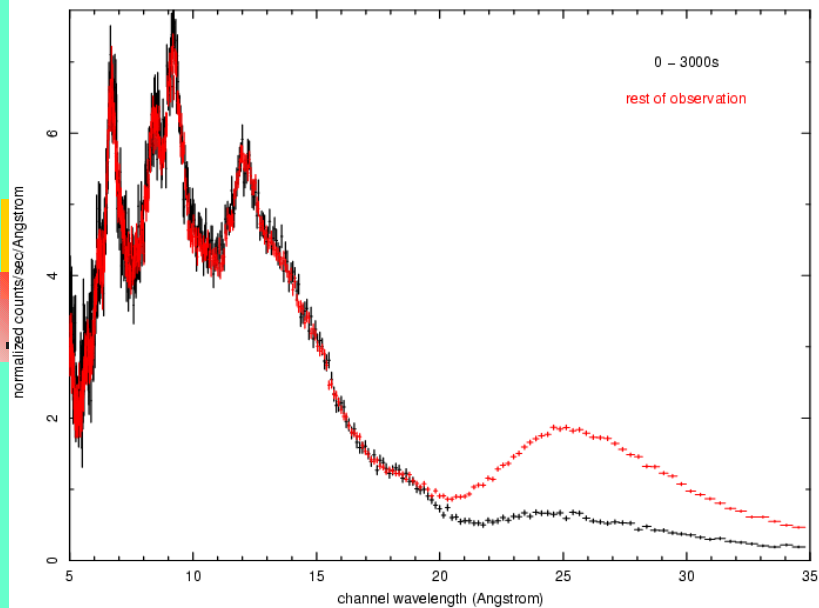
On March 10 (day 26) the period is detected for the first time during a “soft X-rays flare”. A 35.56 s oscillation clearly measured for ~43 min at onset of flare.



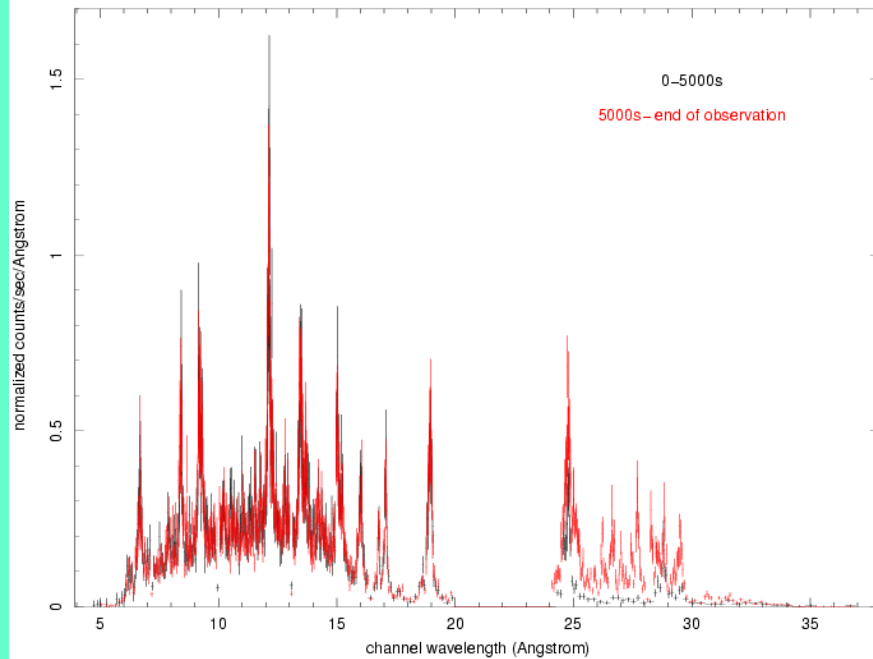
No period is detected before or after the flare.

The nature of the RGS spectrum during the flare shows additional, cooler material being ejected.



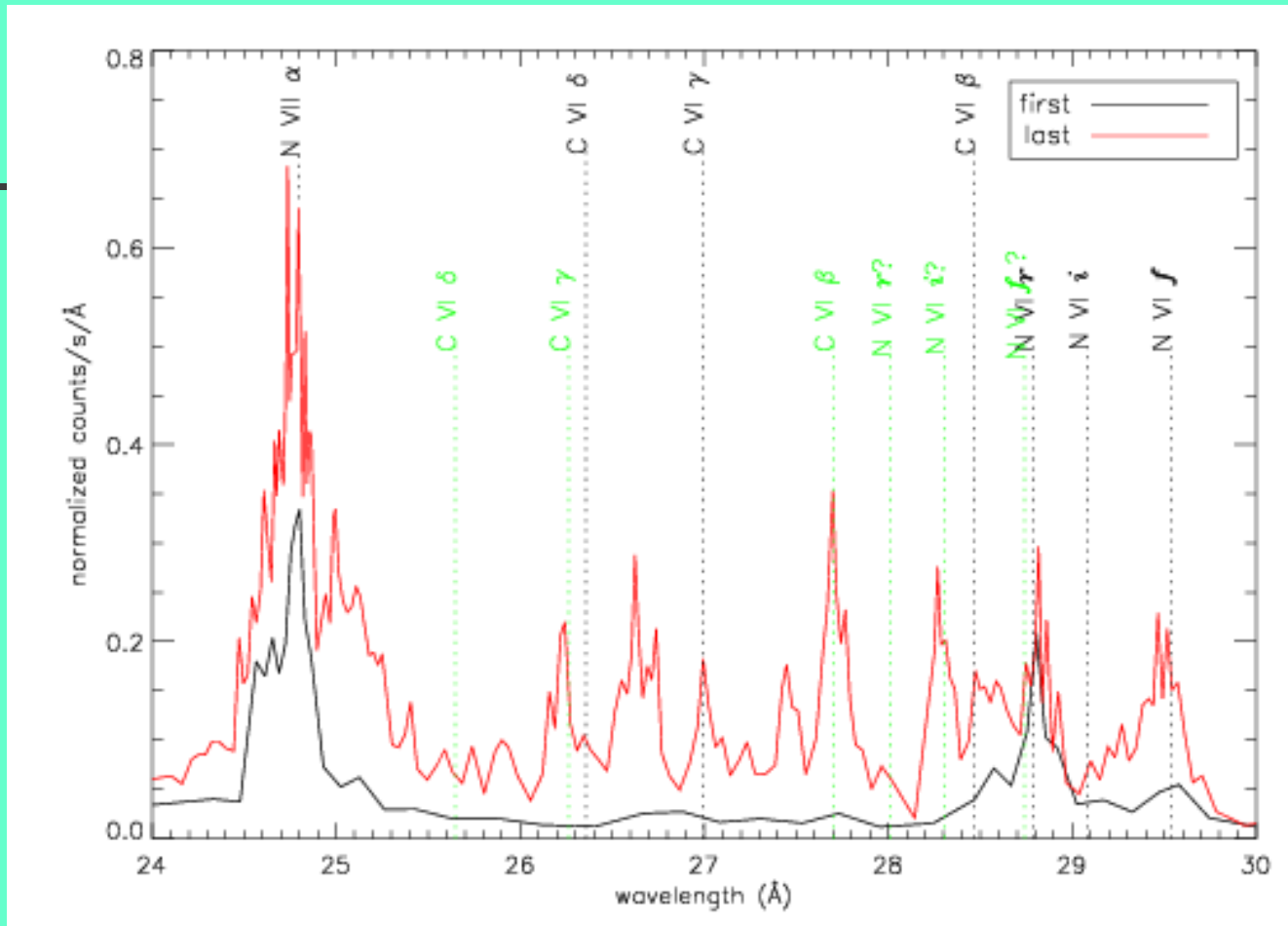


netson 21-Feb-2007 10:42



netson 25-Apr-2007 11:32

The additional component appearing during the observation is due mainly to emission lines, therefore it is difficult to associate it directly with the WD itself.



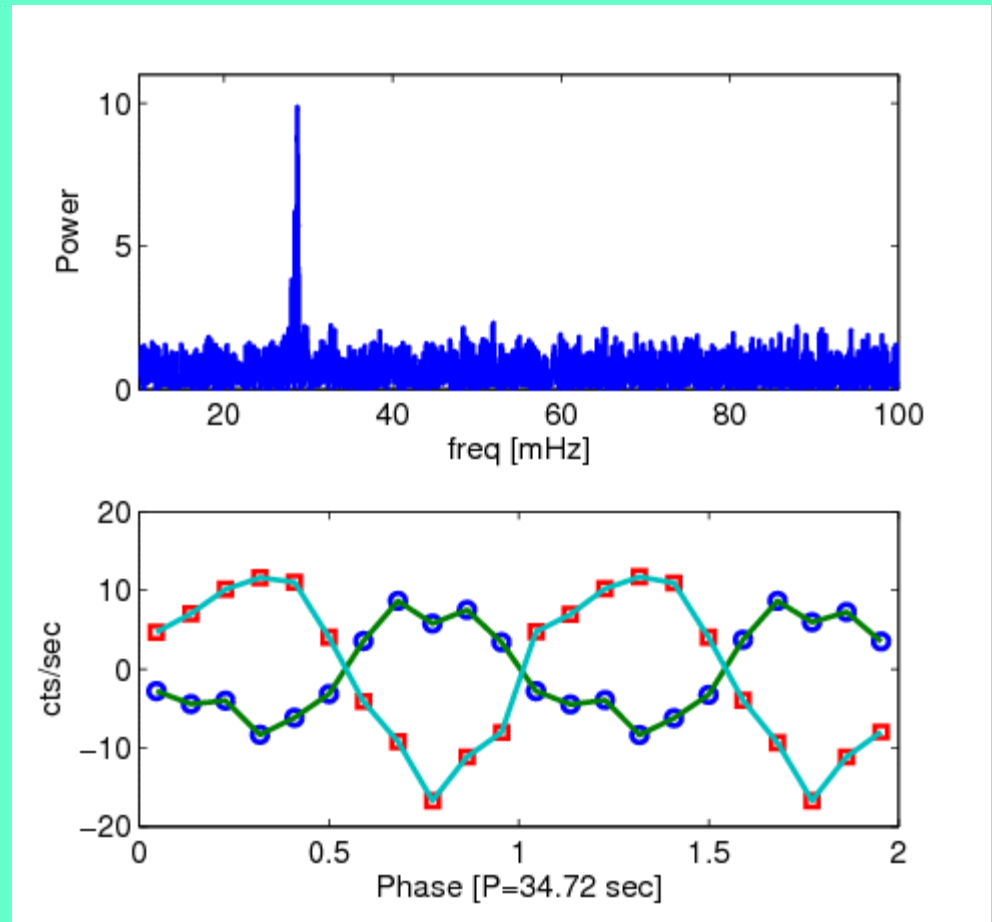
What are these lines?

Possible identification with $< \sim 8000$ km/s blue shift

Is the oscillation due to a phenomenon happening first at only one, then at both poles?

A Chandra LETG observation on day 40 (March 24): there is a clear period at about twice as high frequency ($P=34.93/2$ s) in the LC at $E<0.6$ keV.

In a new XMM observation on day 54 (April 6) there is a very clear 34.72 s period, which however is in anti-phase at $E\leq 0.4$ keV and $E>0.6$ keV.



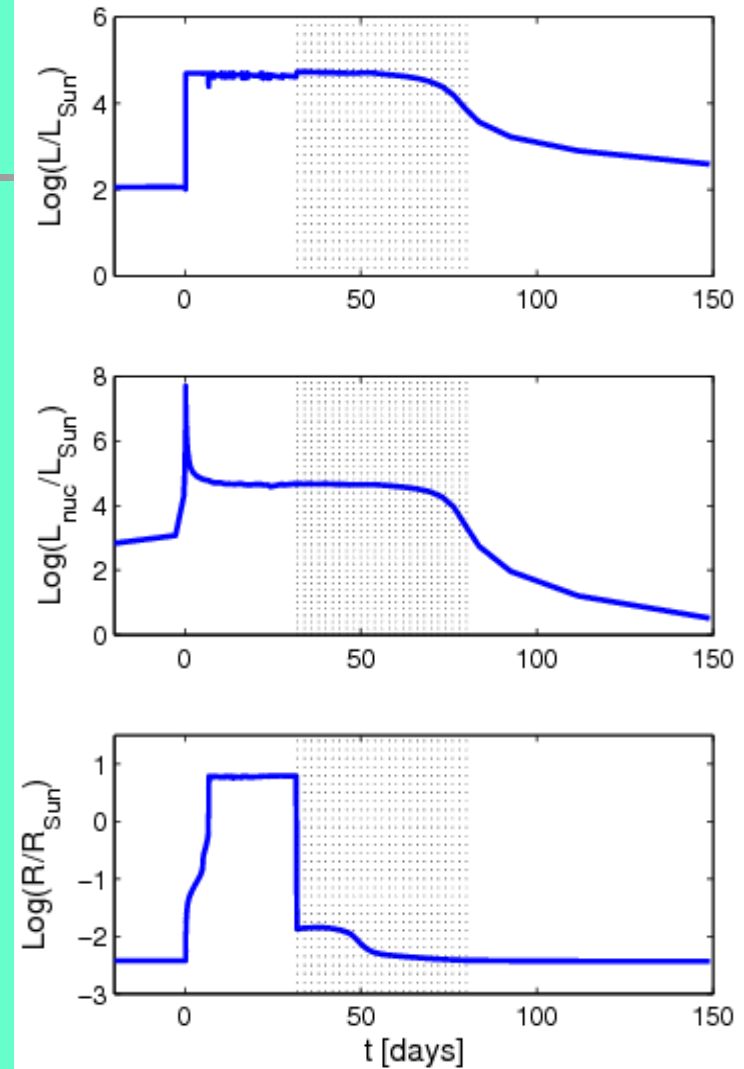
Day 26 => 35.56 s

Day 40 => 34.93 s

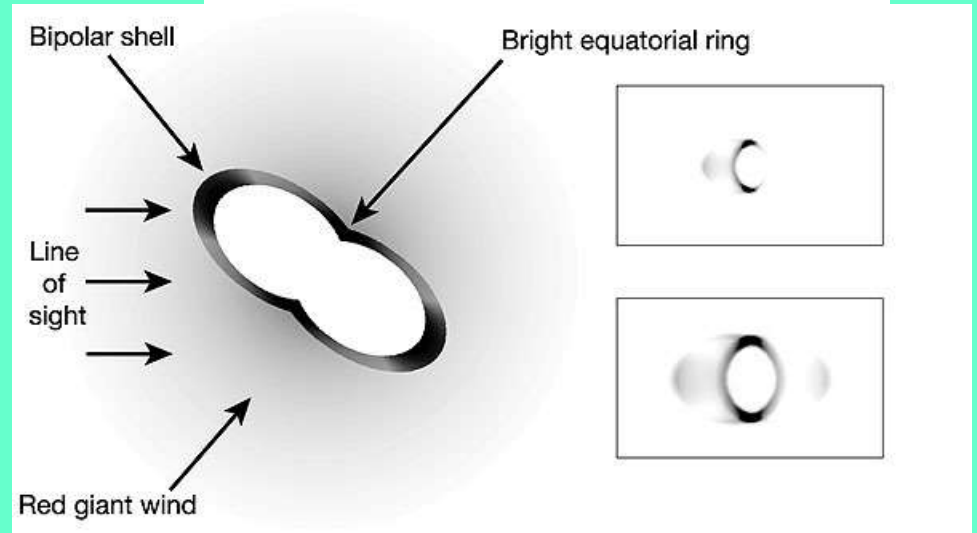
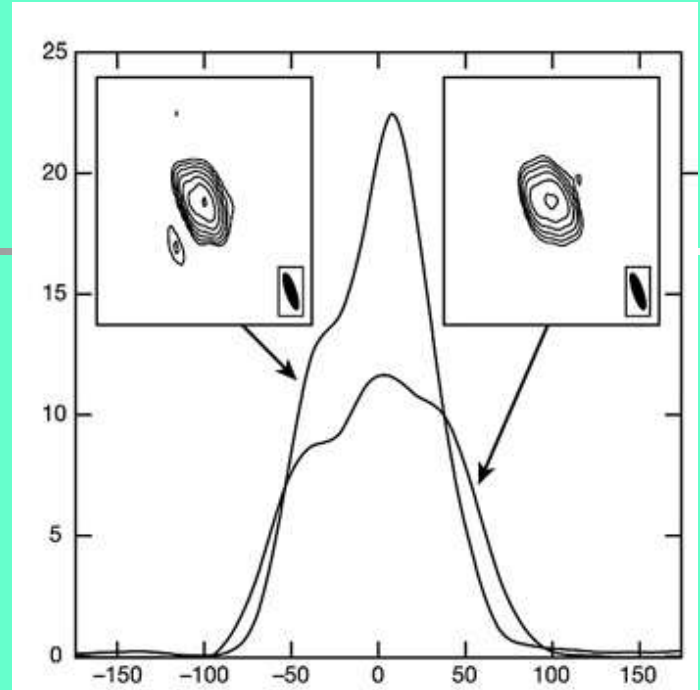
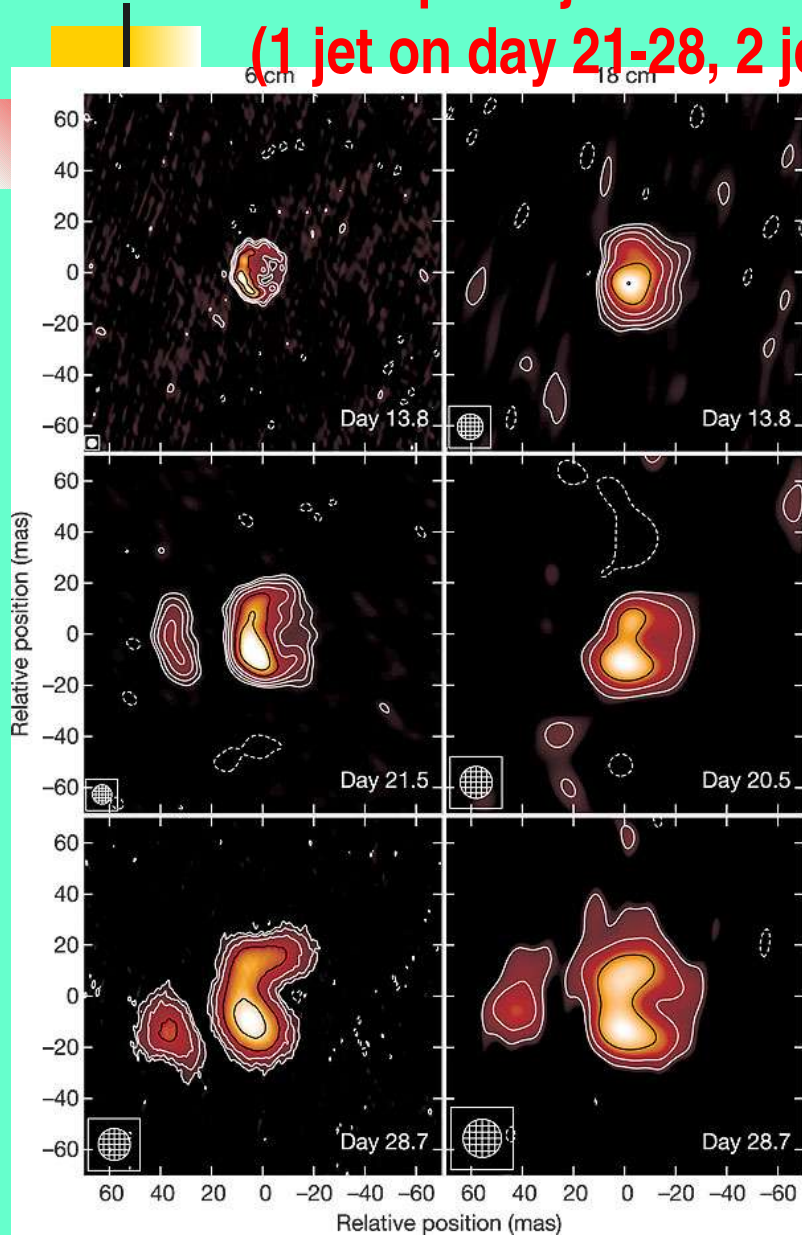
Day 54 => 34.72 s

New models by Yaron & Prialnik.
Rapidly rotating WD (Livio & Pringle 1995, Yoon & Langer 2005, Cumming & Bildsten 2000) has differentially rotating envelope, which is spun up at increasing rate as the photosphere shrinks (SSS phase).

The envelope radius would shrink corresponding to a ~ 1 sec shorter spin period in almost 4 weeks.



Is the period associated with bipolar jet-like emission? (1 jet on day 21-28, 2 jets after day 49)





Possible origin of the period:

- If the Swift observation rule out shrinking beyond uncertainties, it is not necessarily associated with a phenomenon happening on, or near the surface of a rapidly rotating WD.
- However, a “uni-polar” and then “bi-polar” nature appears likely in the Chandra and XMM observations.
- The grating spectrum indicates additional mass ejection of cooler material at the first onset of the period.