

Chandra Monitoring of Nova V4743 Sgr

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I. The nova outburst

- **Third strongest explosion** of stellar object.
- A nova outburst is a **thermonuclear explosion** on top of a white dwarf in a cataclysmic binary system.

II. Sources of X-rays from novae in outburst

- Early very hot („fireball“) phase ($T \gg 10^5$ K)
⇒ **hot stellar atmosphere** (**super-soft spectrum**).
- Ongoing hydrostatic hydrogen burning on top of the white dwarf. Phase of **constant bolometric luminosity** ($T \gg 10^5$ K)
⇒ **hot stellar atmosphere** (**super-soft spectrum**).
- Interaction of expanding envelope with CS material
⇒ shocks ⇒ **bremsstrahlung** (harder SED)

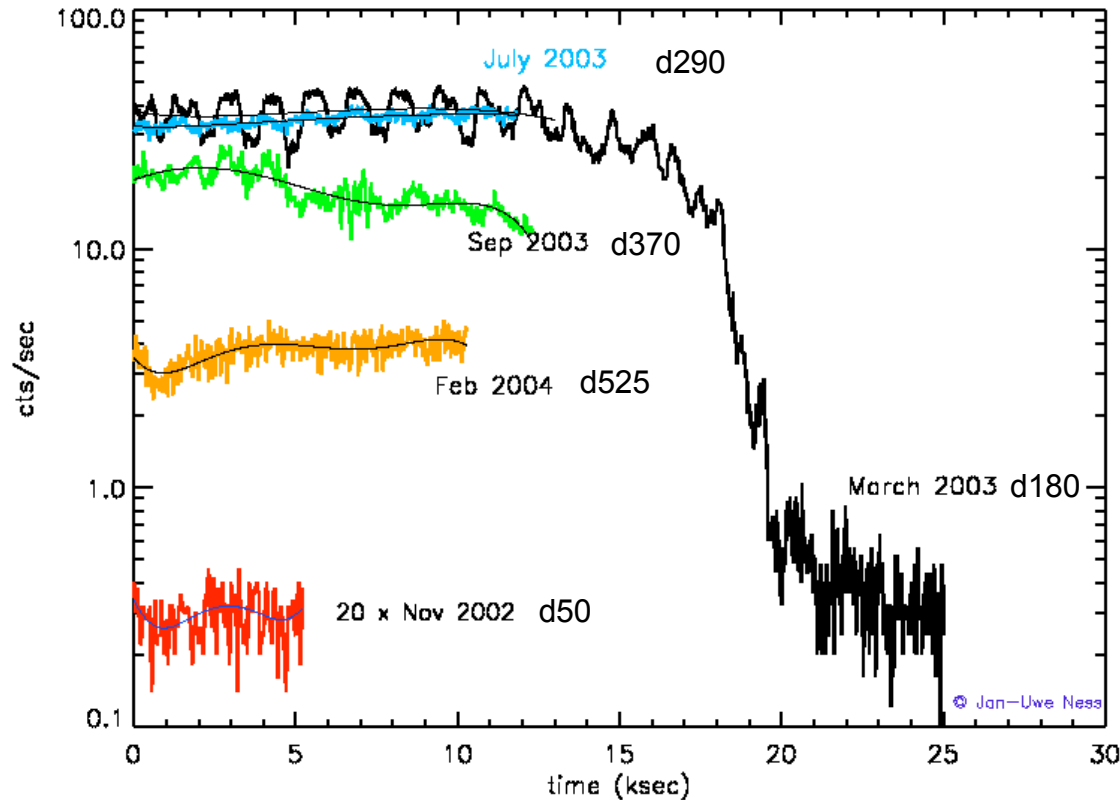
III. V4743 Sgr

- Detected on Sep 20, 2002
- $m_{\max} \sim 5$ mag
- $t_3 < 15$ days (very fast nova)
- $v_{\text{exp}} \sim 1200 \text{ km s}^{-1}$
- **X-ray observations with**
 - CHANDRA LETGS
ACIS-S
 - XMM-Newton RGS (Orio et al.)

Chandra observations

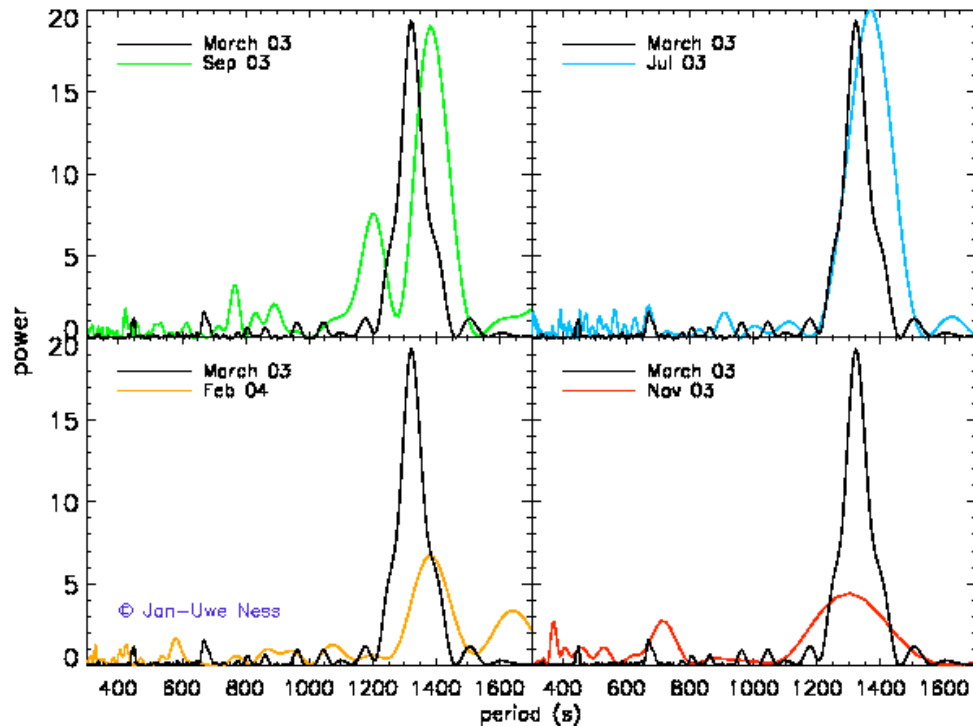
Date	Day	Exp. t [ksec]	Instrument
Nov 9, 2002	50	5.3	ACIS-S
Mar 19, 2003	180	25.0	LETGS
Jul 07, 2003	290	11.7	LETGS
Sep 25, 2003	370	11.9	LETGS
Feb 28, 2004	525	10.3	LETGS

X-ray lightcurve



- Strong increase of **count rate** from day 50 to 180; decrease from day 290 to 525
- Strong **variability**
 - **periodic variations**
 - **sudden decrease** of count rate (day 180; **Ness et al. 2003**).
- Amplitude of periodic variations decreases.

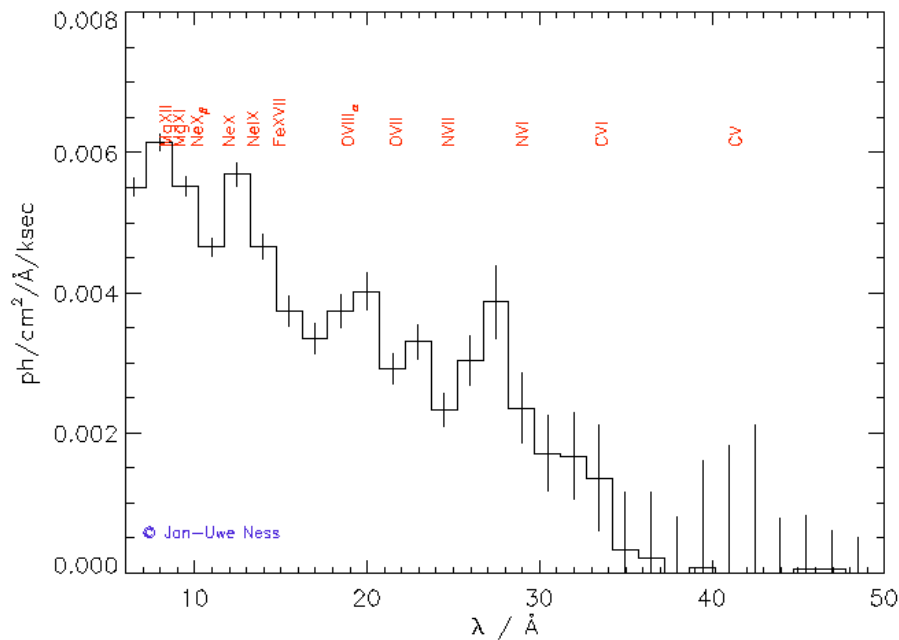
Periodic variations



Periodograms for light curves
of V4743 Sgr.

- **Periodograms** similar for all epochs.
- Peak around **1300 sec**
- Day 370: two peaks
- **Overtones** at 600 and 400 sec.
- Explanation: **Rotation** period of WD?
- Overtones] **non-radial pulsations?**
(e.g. V1494 Aql, **Drake et al. 2003**)

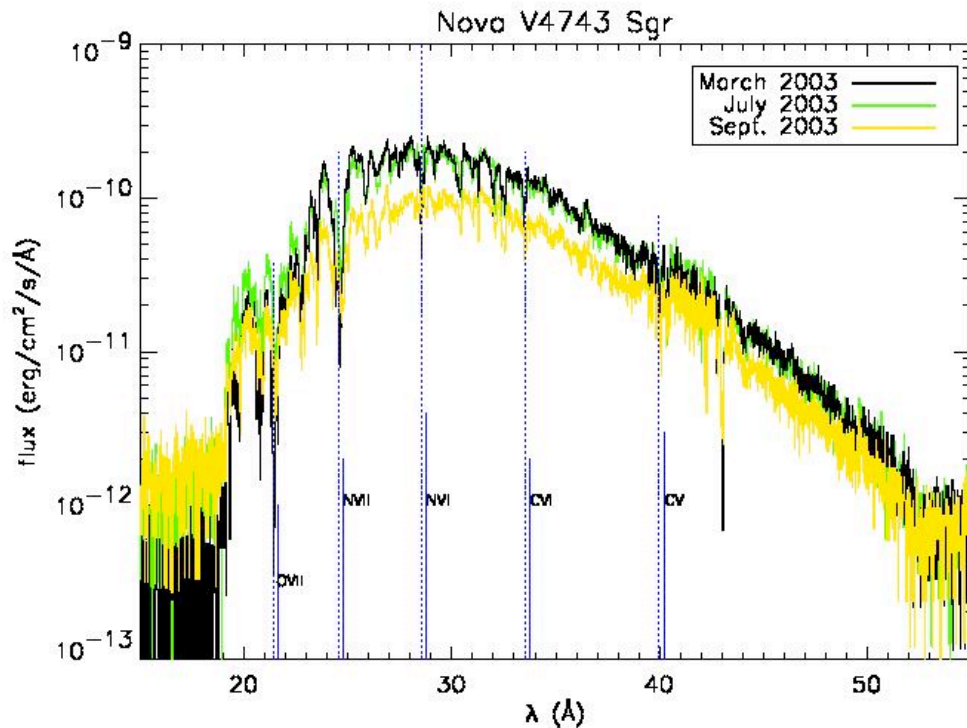
Spectroscopic evolution



ACIS-S spectrum on day 50

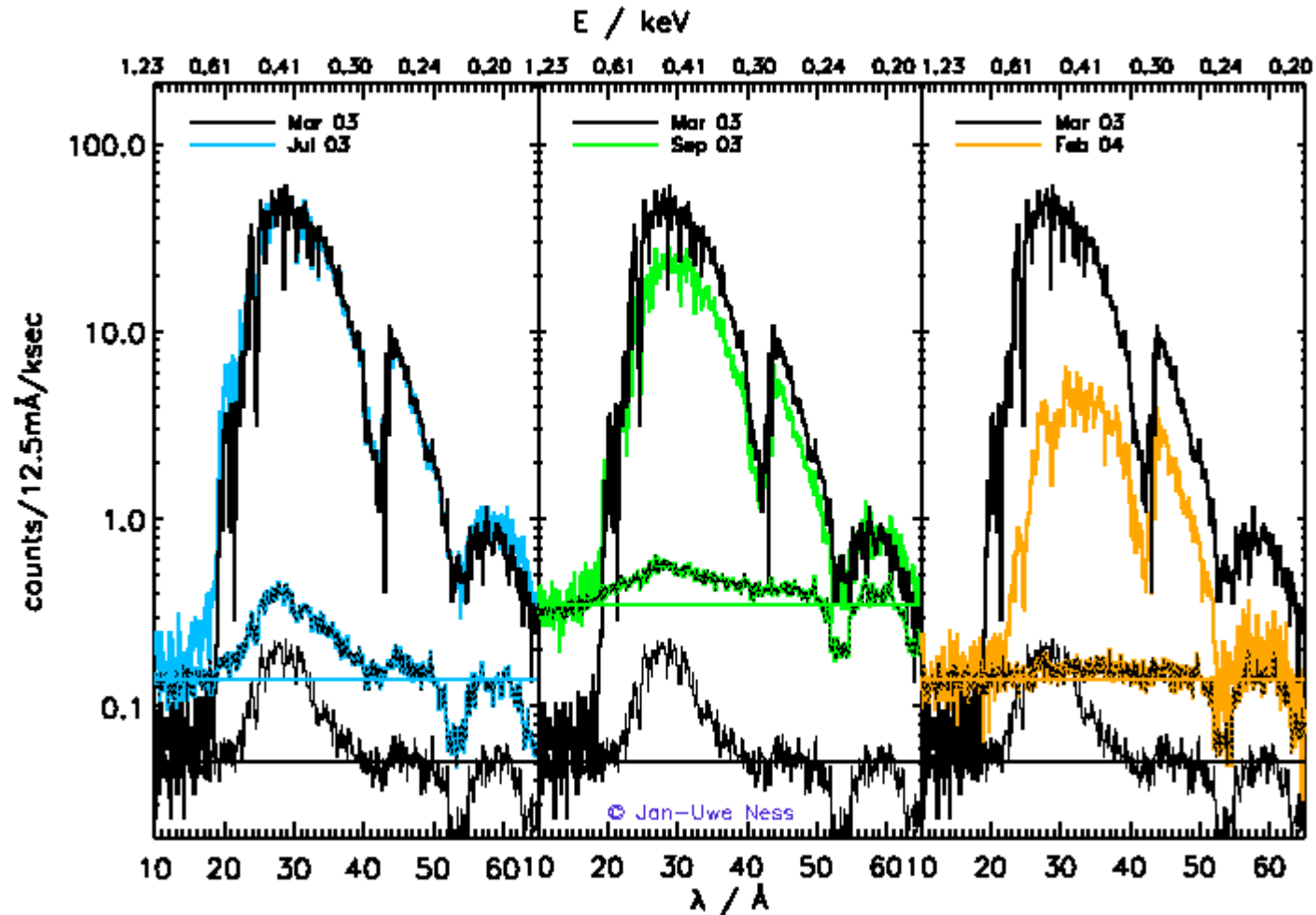
- **Day 50: Hard spectrum**, no soft component.
- soft radiation absorbed by H in expanding envelope.

Spectroscopy



- Strong **continuum emission** of thermal origin.
- **Super-soft spectrum**
- Strong **absorption features**; can be identified with resonance lines of highly ionized ions.
- Absorption lines **blueshifted** by **~ 2400 km s⁻¹** (due to expanding envelope)

Evolution of soft component



count rate spectra of V4743 Sgr

- Spectrum gets softer in February 2004 (day 525)
] **switch-off** of hydrogen burning?
- **spectral analysis** requires full non-LTE treatment, done so far only for day 180 (with PHOENIX, **Petz et al. 2005**).
 - $T_{\text{eff}} = 5.8 \cdot 10^5 \text{ K}$,
 - $v_{\text{exp}} = 2500 \text{ km s}^{-1}$,
 - $L_{\text{bol}} = 2 \cdot 10^{38} \text{ erg s}^{-1}$

Conclusions

- X-ray observations allow to study those areas where **essential physical processes** are going on.
- Several **unusual features** found:
 - non-radial pulsations
 - disappearance of X-ray flux

Results will be published by **Ness et al.** (to be submitted).