X-ray emission from PTT stars

Giulio Del Zanna

Department of Applied Mathematics and Theoretical Physics
University of Cambridge

Summary

- Coordinated XMM-Newton and ground-based spectroscopic + photometric observations of two Post T Tauri stars.
- The observations were done in February $\rightarrow$ results are only preliminary !

Acknowledgements

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I would like to acknowledge the participation, contribution/support from:

- Gordon Bromage and Hannah Leigh Worters, UCLAN, UK
- Helen Mason, University of Cambridge UK
- Carl Foley, Hilary McKay, MSSL, UK
- Alan Whiting group (CTIO, Chile), in particular Melissa Rice.
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- Federico Gonzalez (CASLEO), Argentina
- Massimo Landini, Univ. of Florence Italy
- PPARC

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- dK7e and dM3e fast rotating stars (v sin i=12, 70 km/s). Southern star is Li-rich.

Pushing to the limits

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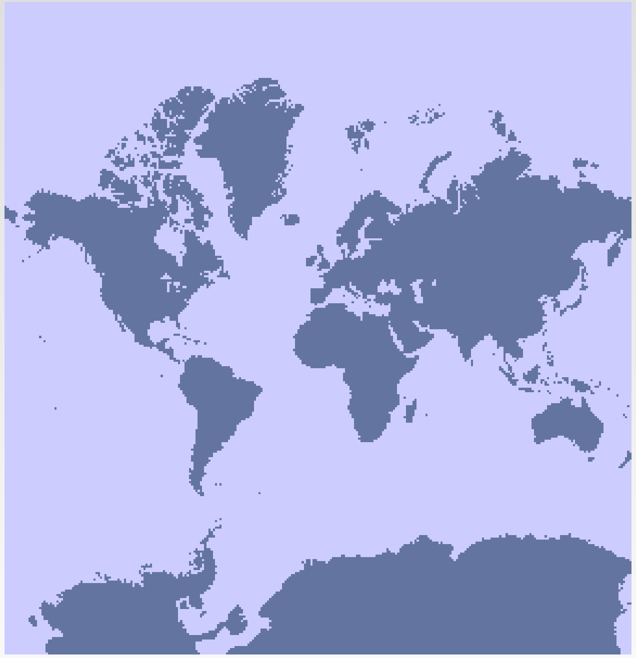
- Problems in coordinating multi-wavelength observations
- XMM OM fast mode windows
- angular separation of 22” – roll angle
- multi-continent, multi-cultural experience
- we need an observatory on Easter Island!



Ground-based

Two-weeks observing in South Africa.
Spectroscopy

- SAAO 1.9m grating spectrograph with 1 Å resolution and $\simeq$90 s exposures.
- Wavelength range: 3700 - 4360 Å
- 6 consecutive nights

Photometry

- UBV aperture photometry with the SAAO 0.5-m telescope
- 3 nights

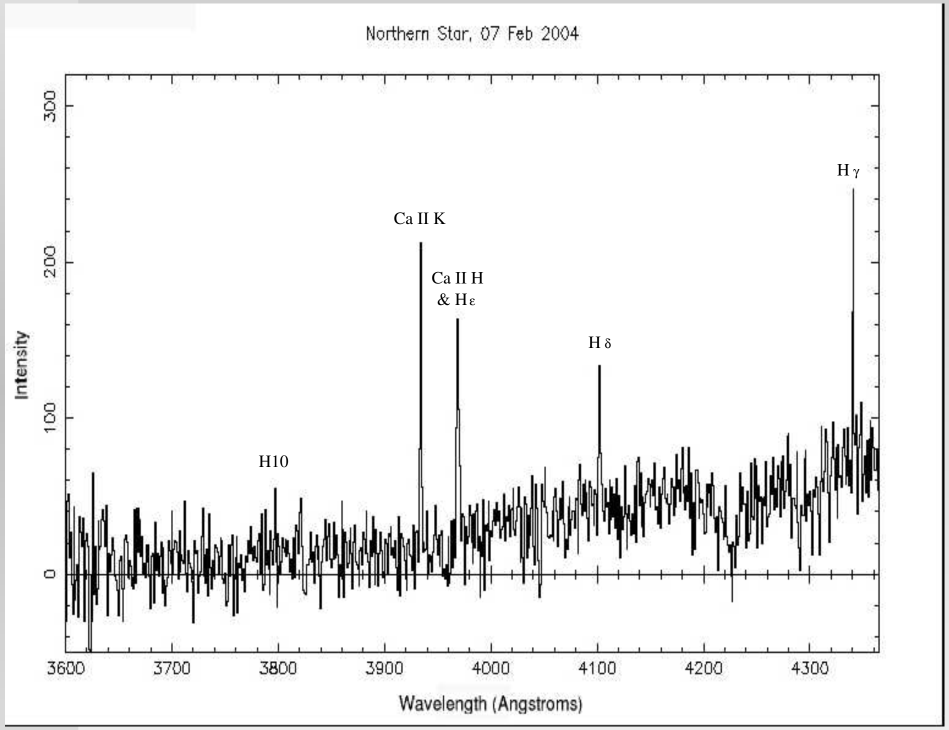
On the XMM night (19-20 Feb 2004)

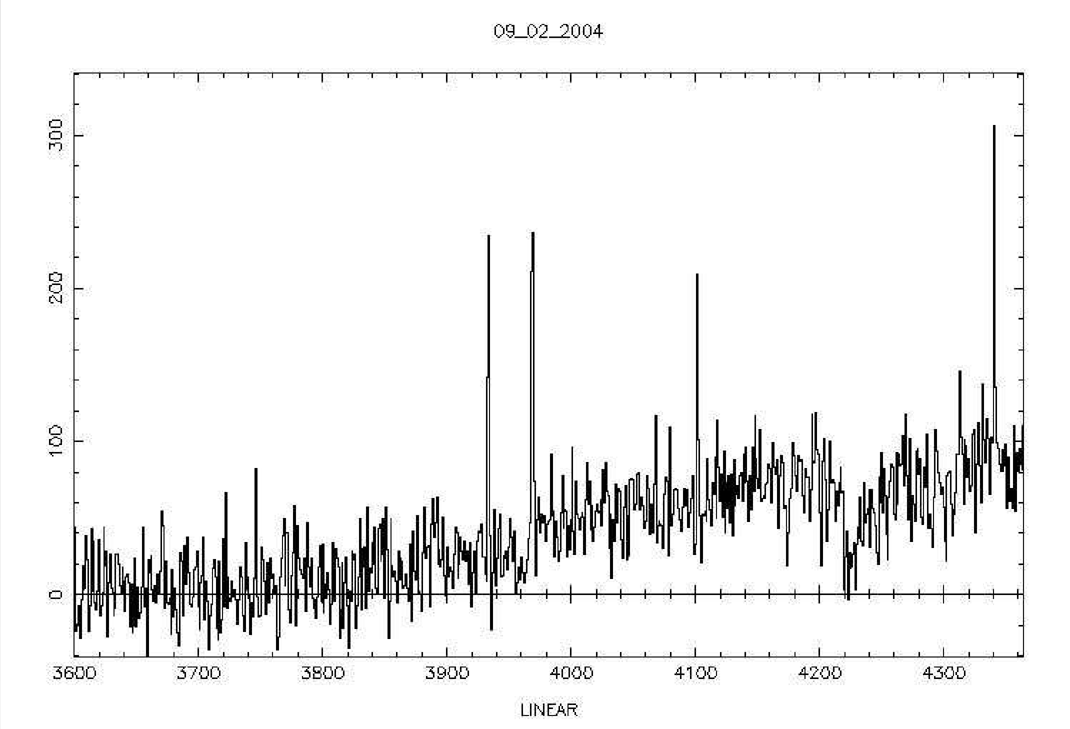
- Argentina – CASLEO: cloudy !
- Brasil: B-band monitoring 23:00 – 00:30 UT then cloudy.
- Chile:
  - CTIO low-resolution (17.2 Å FWHM) spectra at the 1.5m
  - CTIO CCD B and U band photometry with the 0.9m 01:17 04:40 UT
- South Africa:
  - SAAO 1.9m spectra 18:32 UT – 00:04 UT
  - SAAO U-band monitoring

→ ground-based only covered part of the XMM observation

SAAO spectra - northern star

Two spectra on the 7th and 9th Feb 2004:





Filters - CTIO

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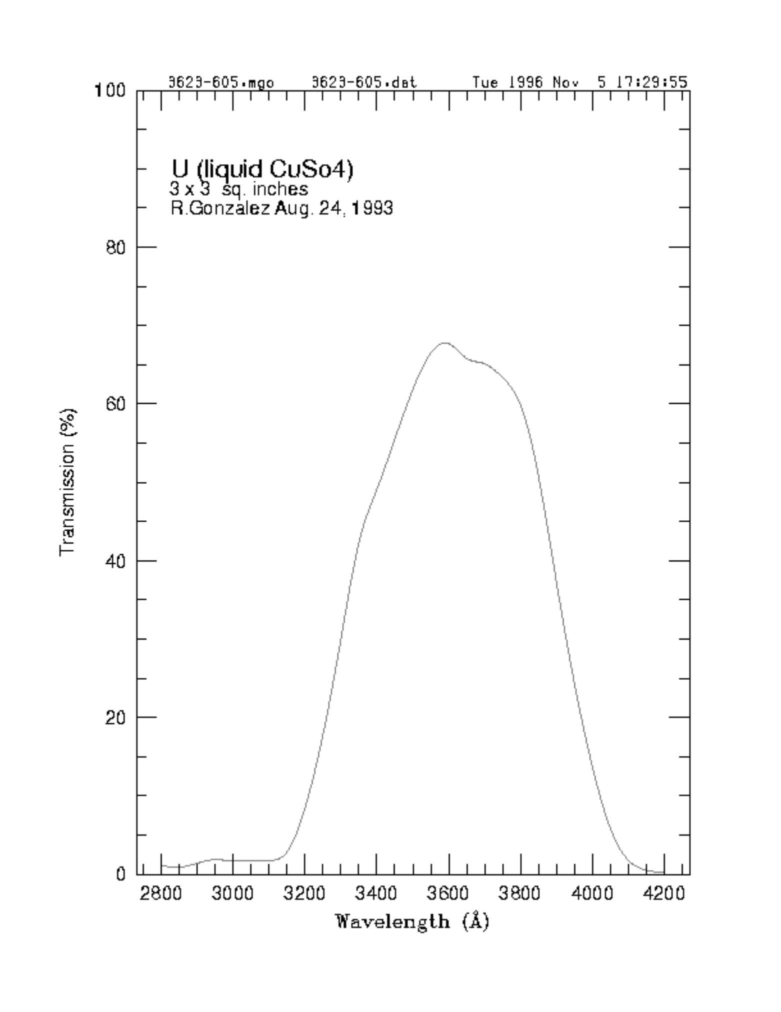

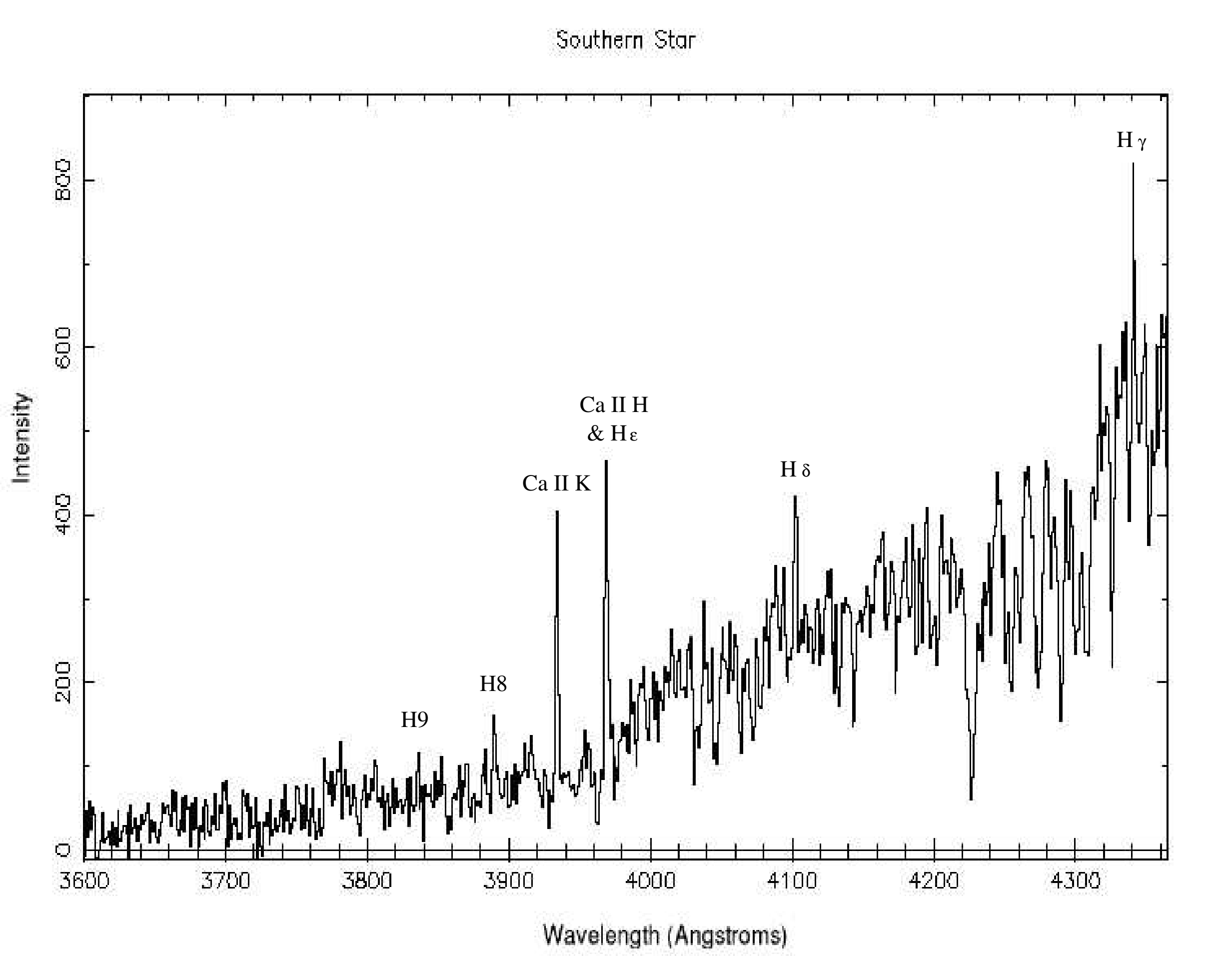

Filters - OM

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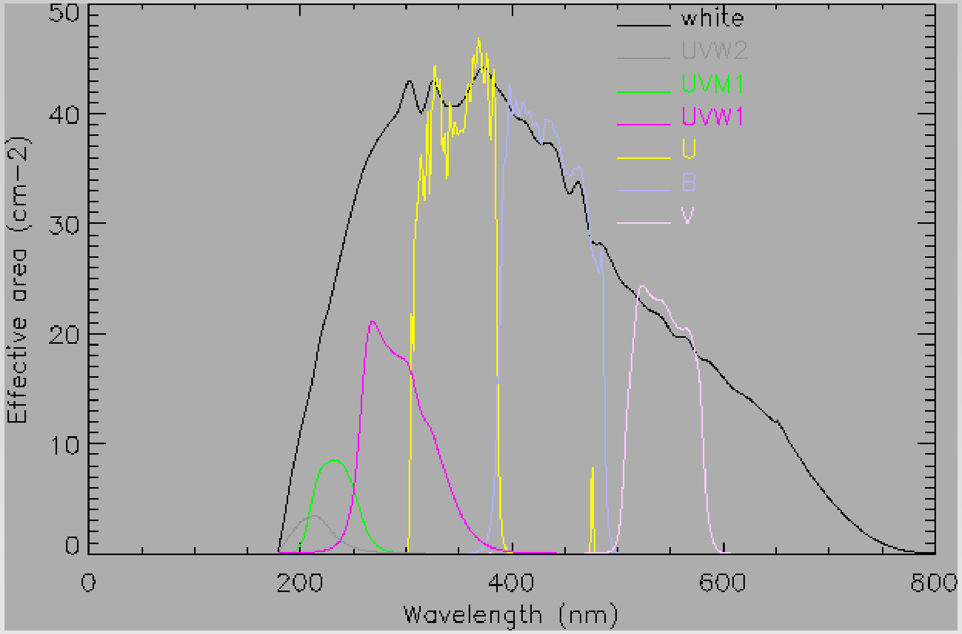
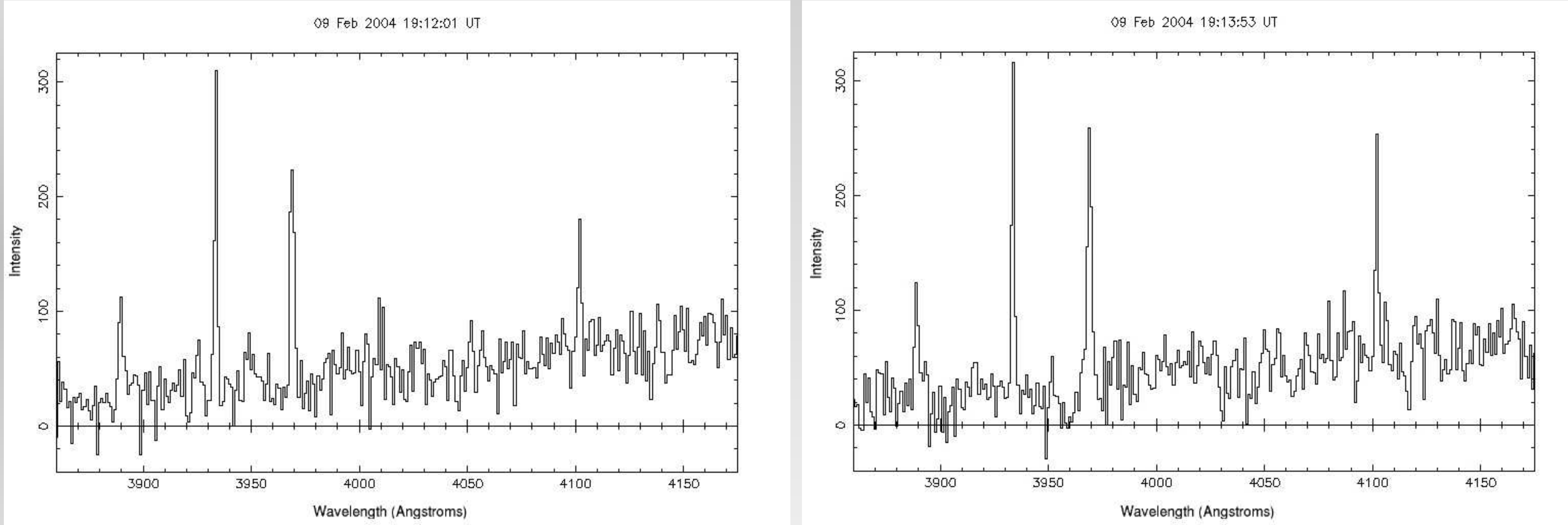
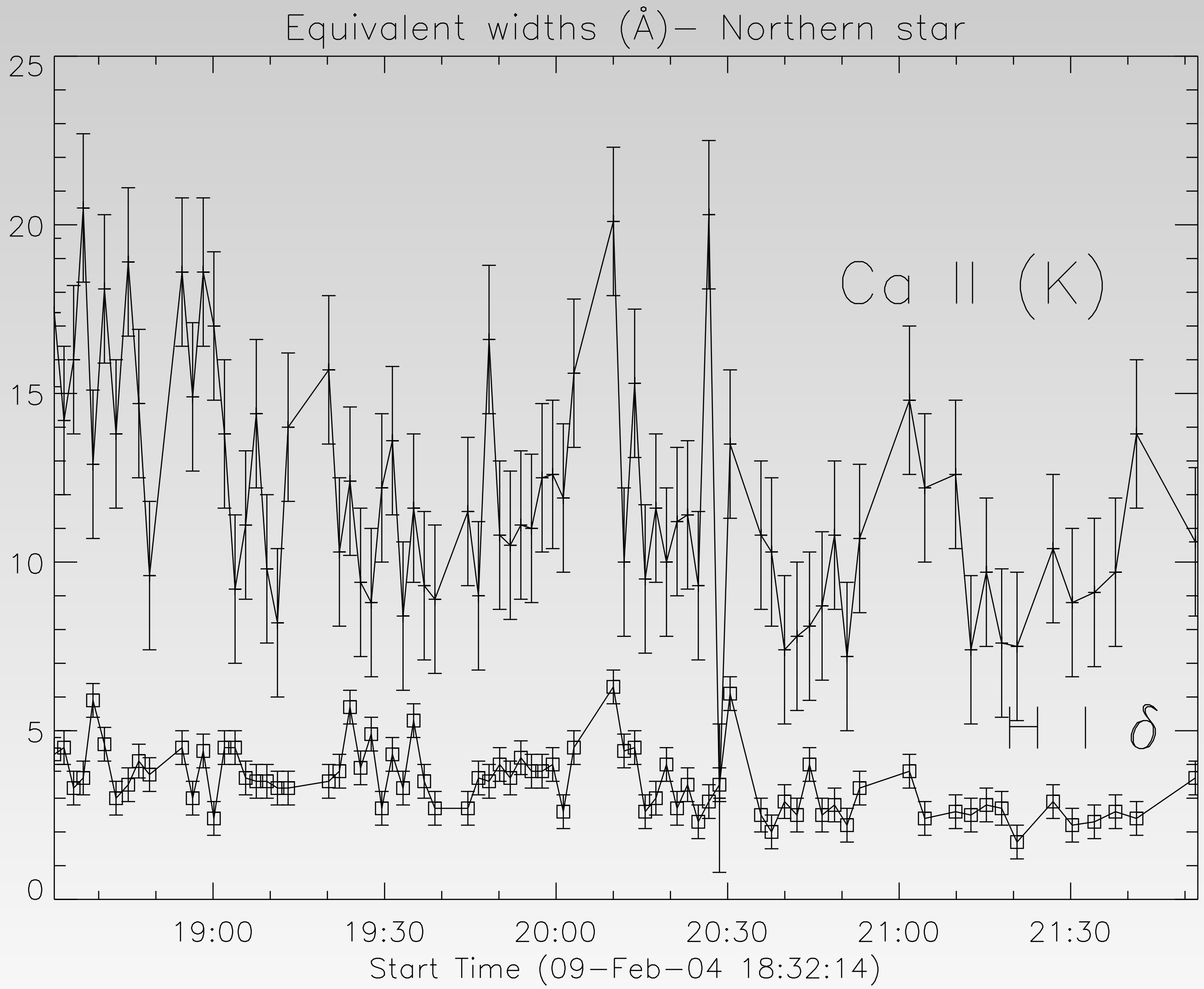


Chromospheric variability

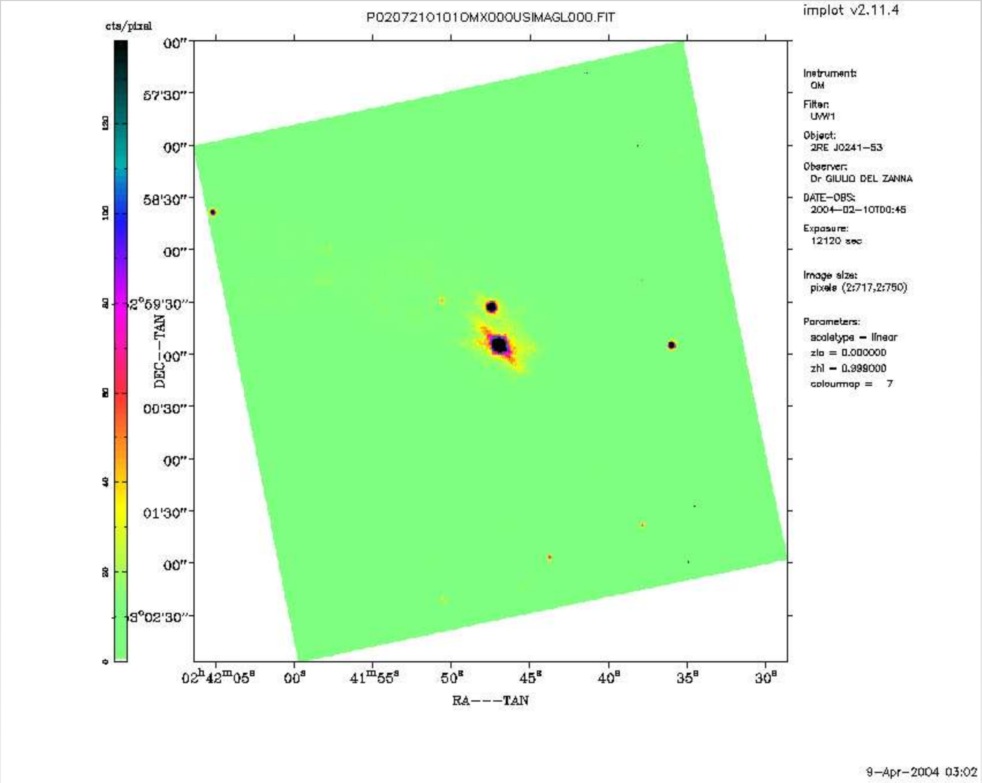
Consecutive 90s exposures from XMM night (19:12,19:14 UT). Notice the variation in the Ca II (H and K) and H δ.



EW for the Northern star



XMM OM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Filter:
UVW1
Object:
2RE J0241-53
Observer:
Dr GIULIO DEL ZANNA
DATE-OBS:
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Exposure:
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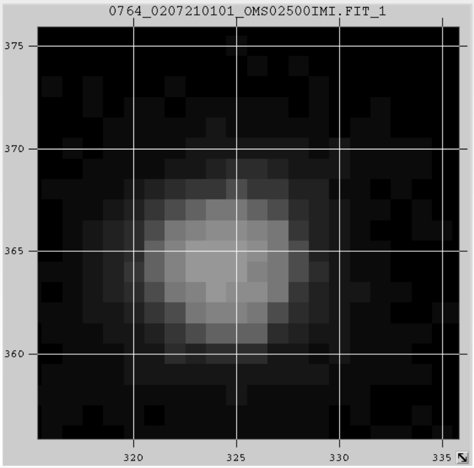
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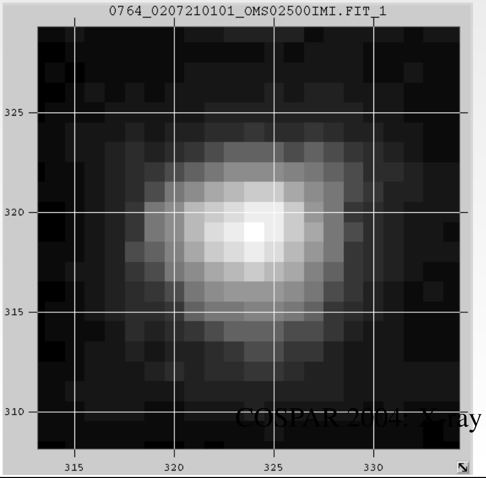
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OM light curves

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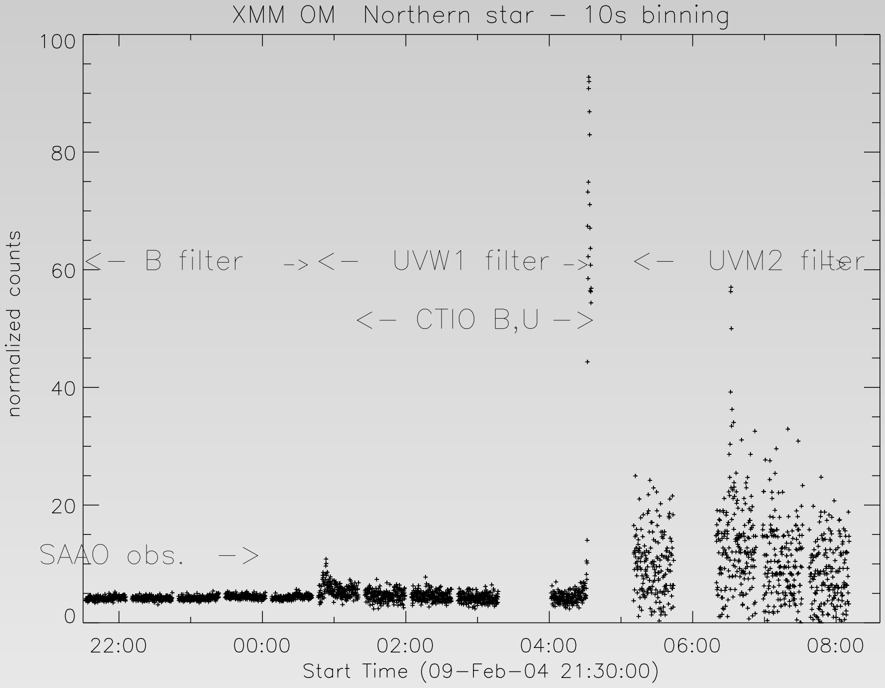

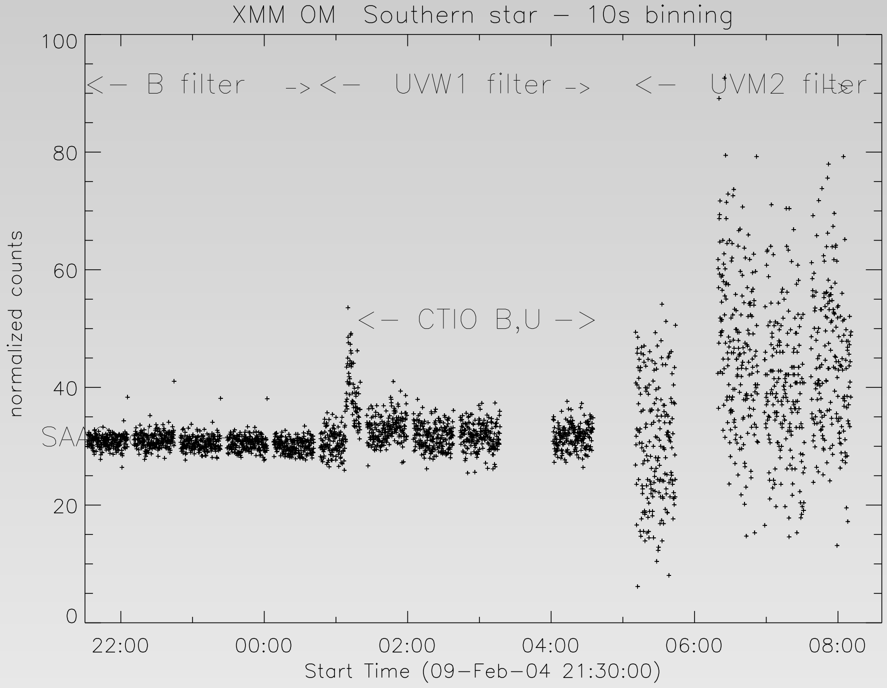

EPIC MOS 1 image

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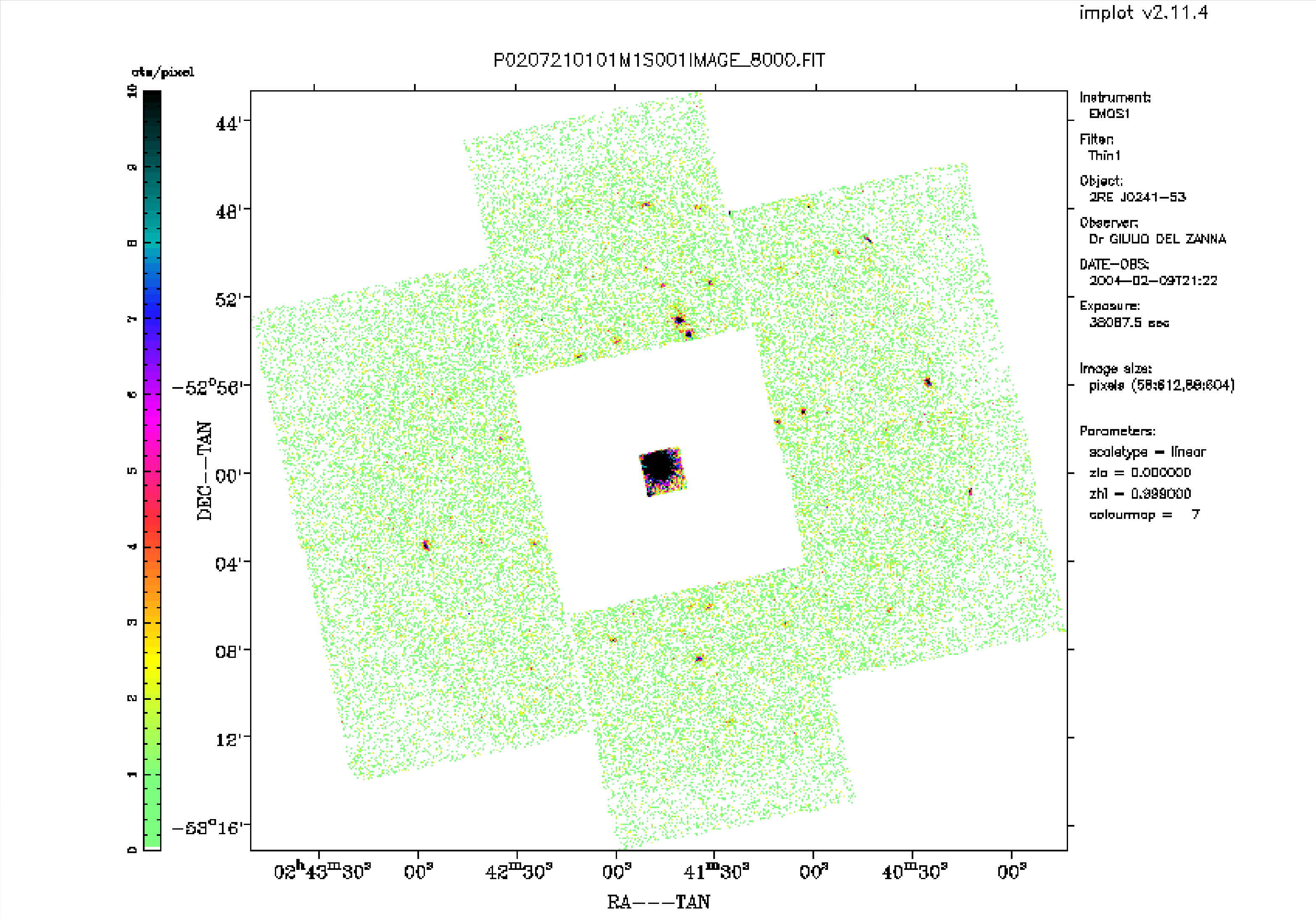
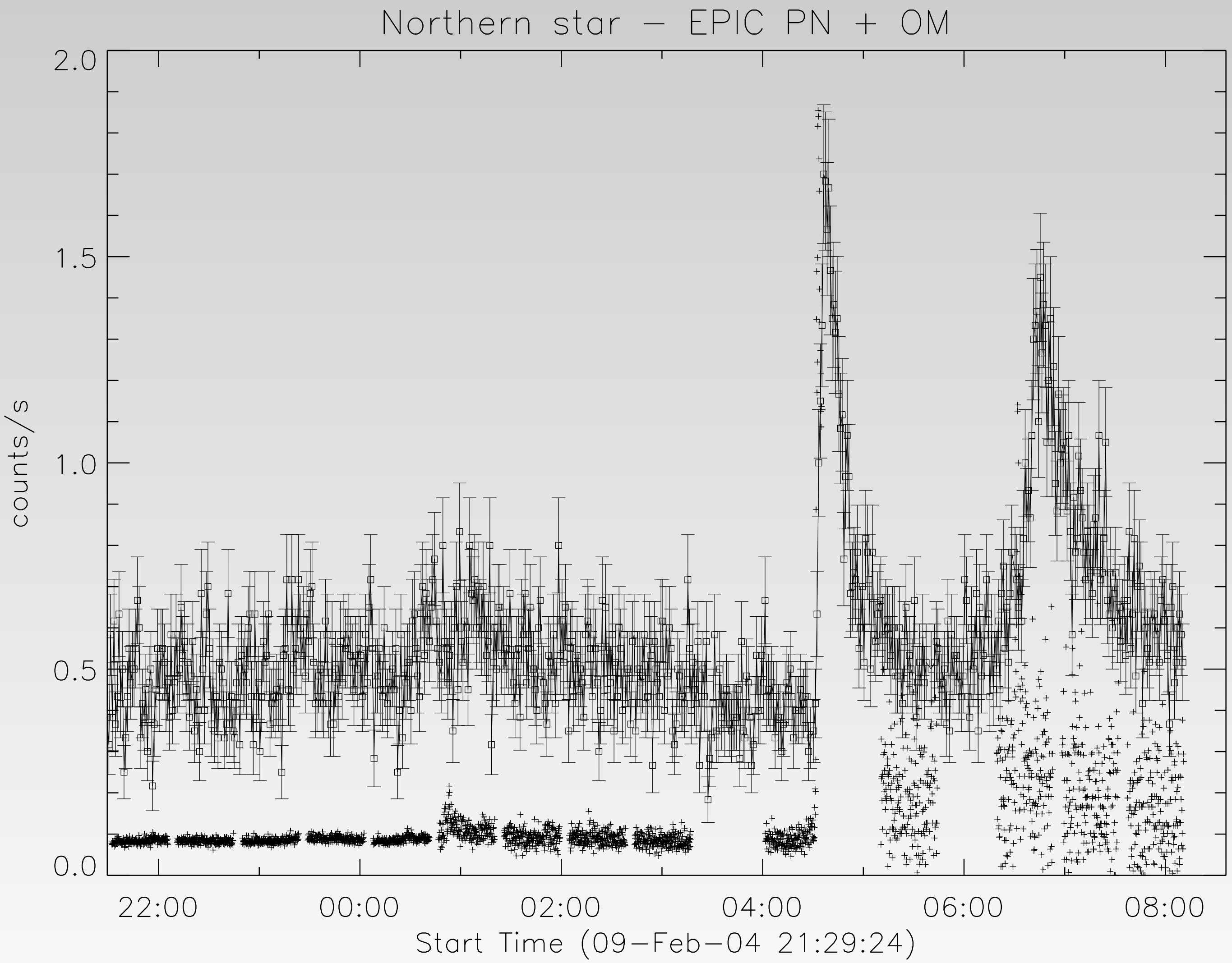


EPIC PN light curves



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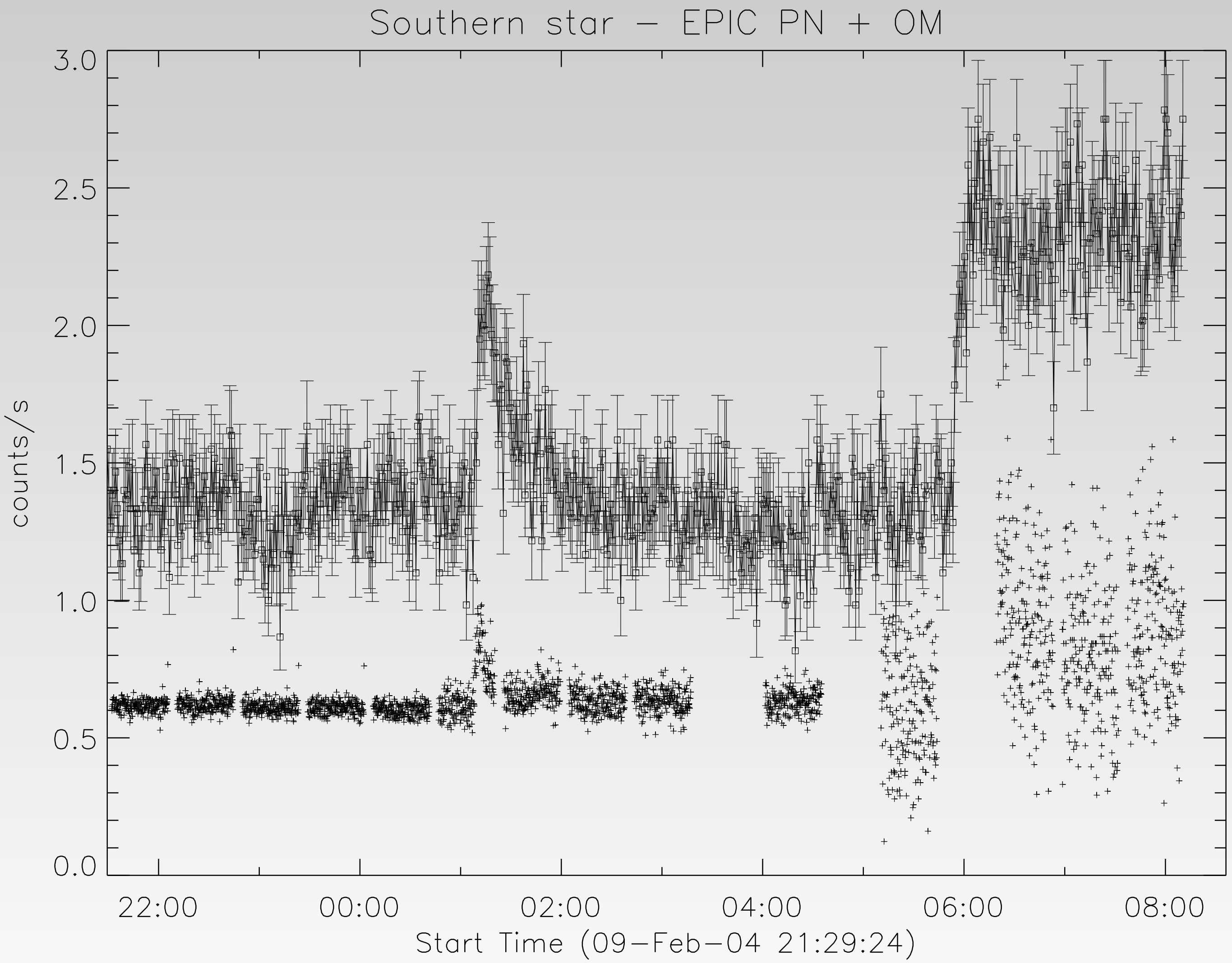
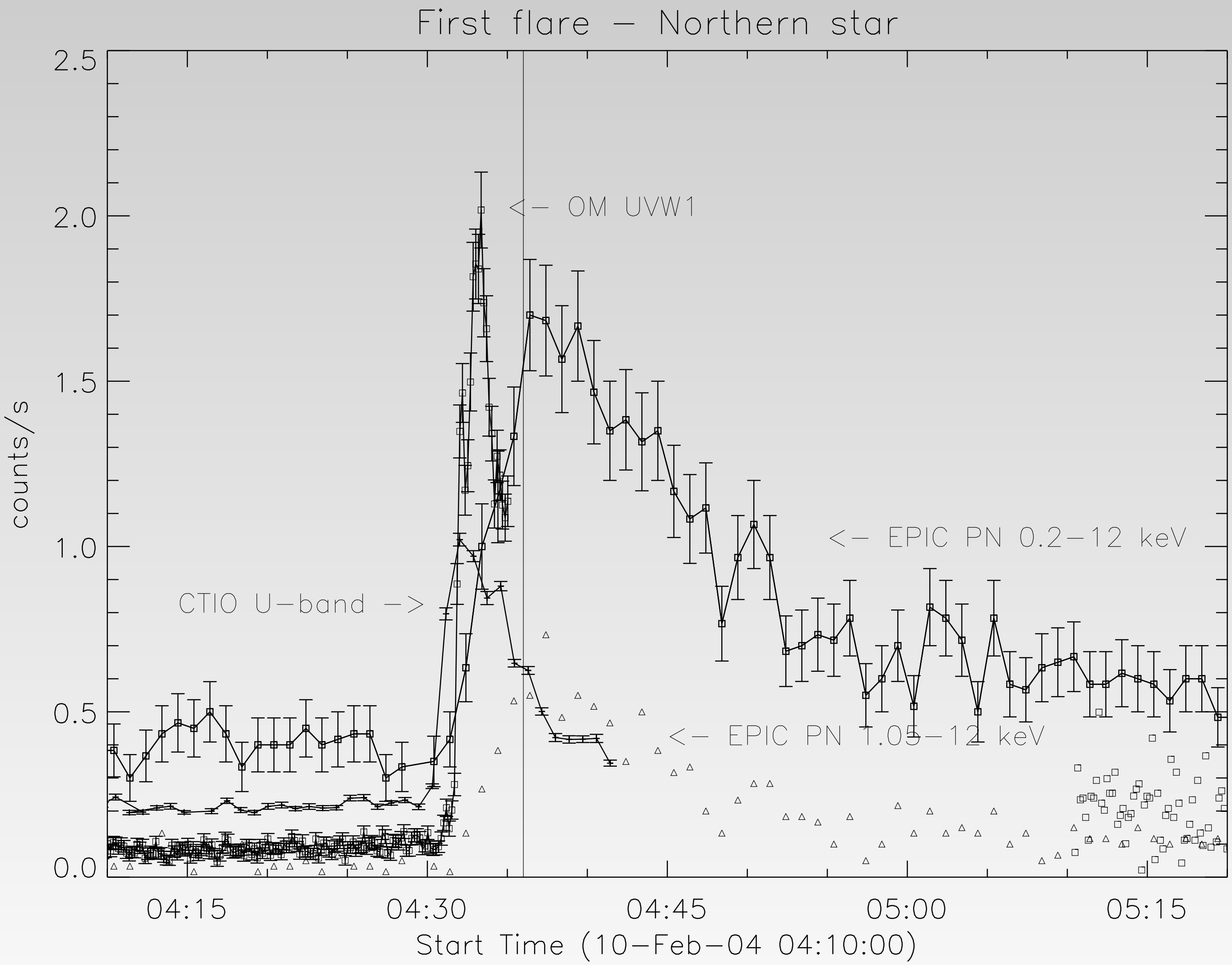


Flares on Northern star



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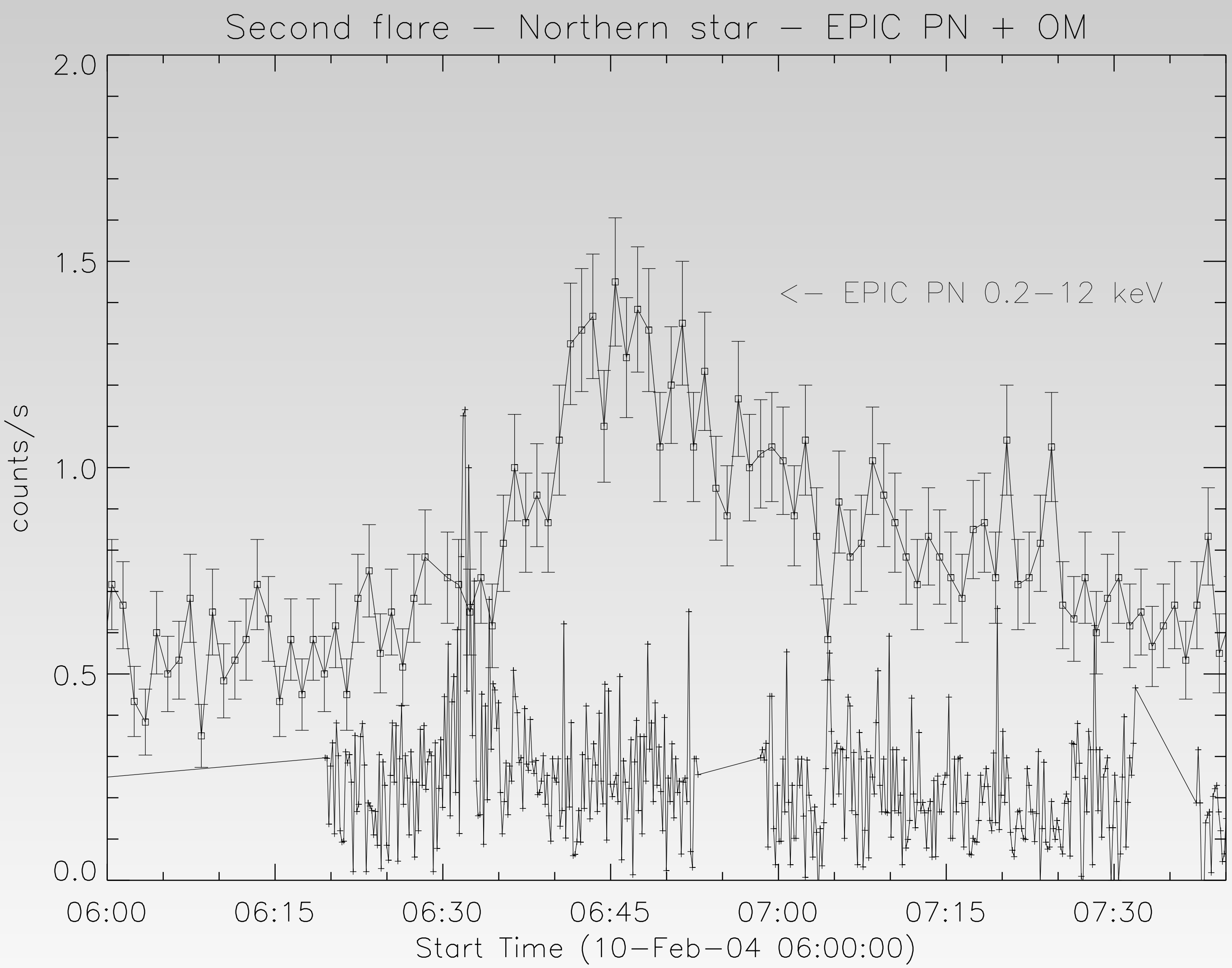

Flares on the Southern star.

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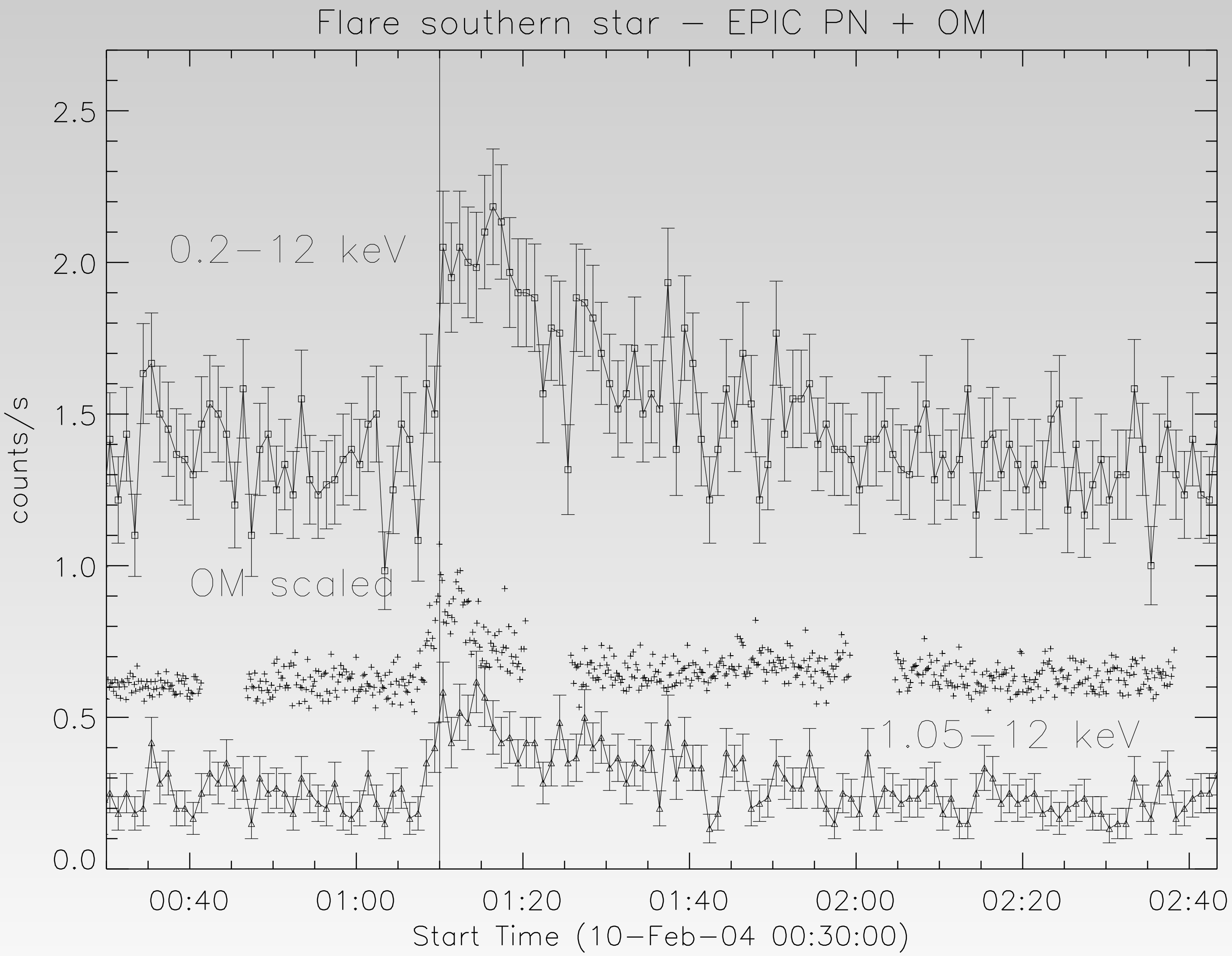

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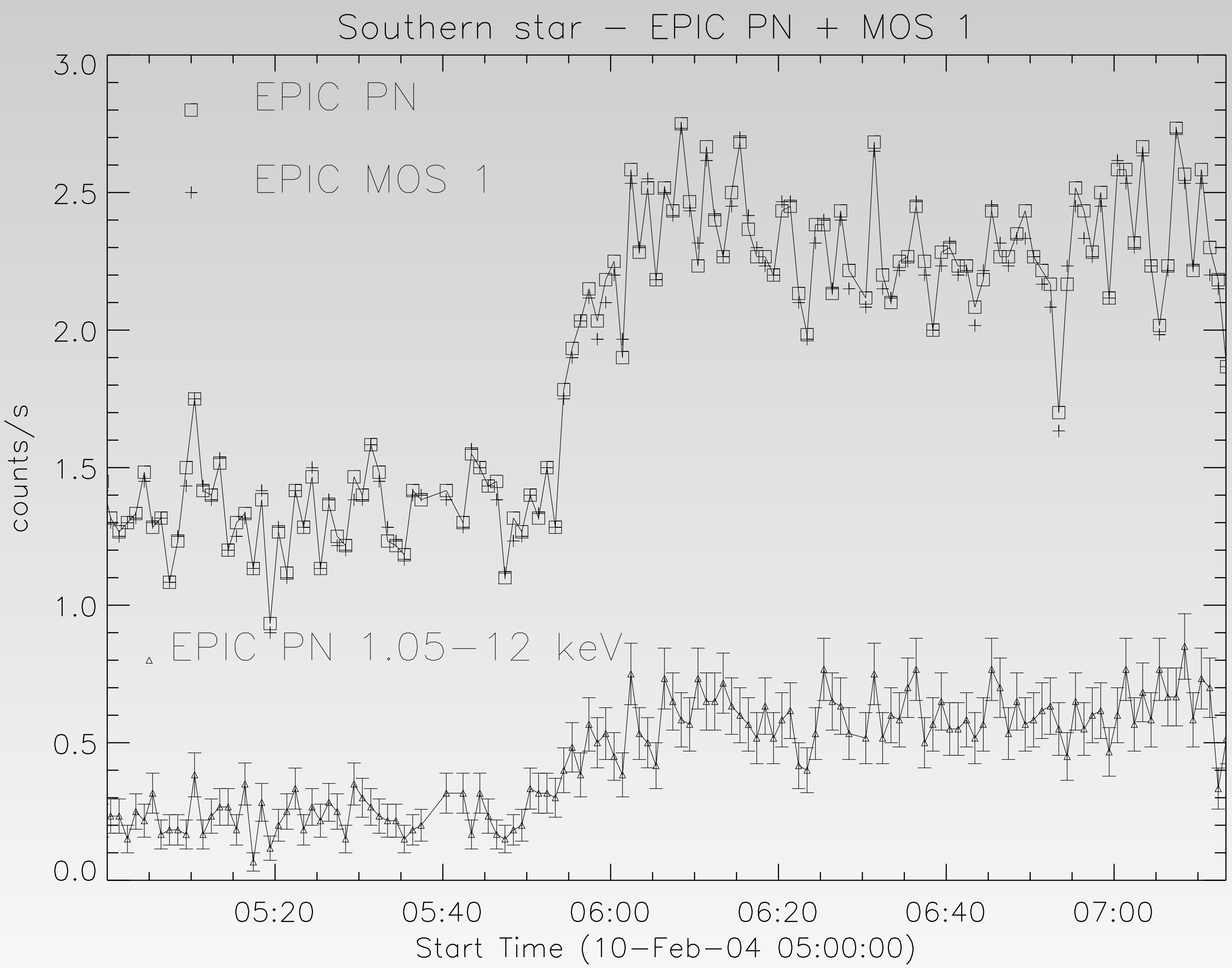

EPIC MOS 1 spectrum of the Southern star

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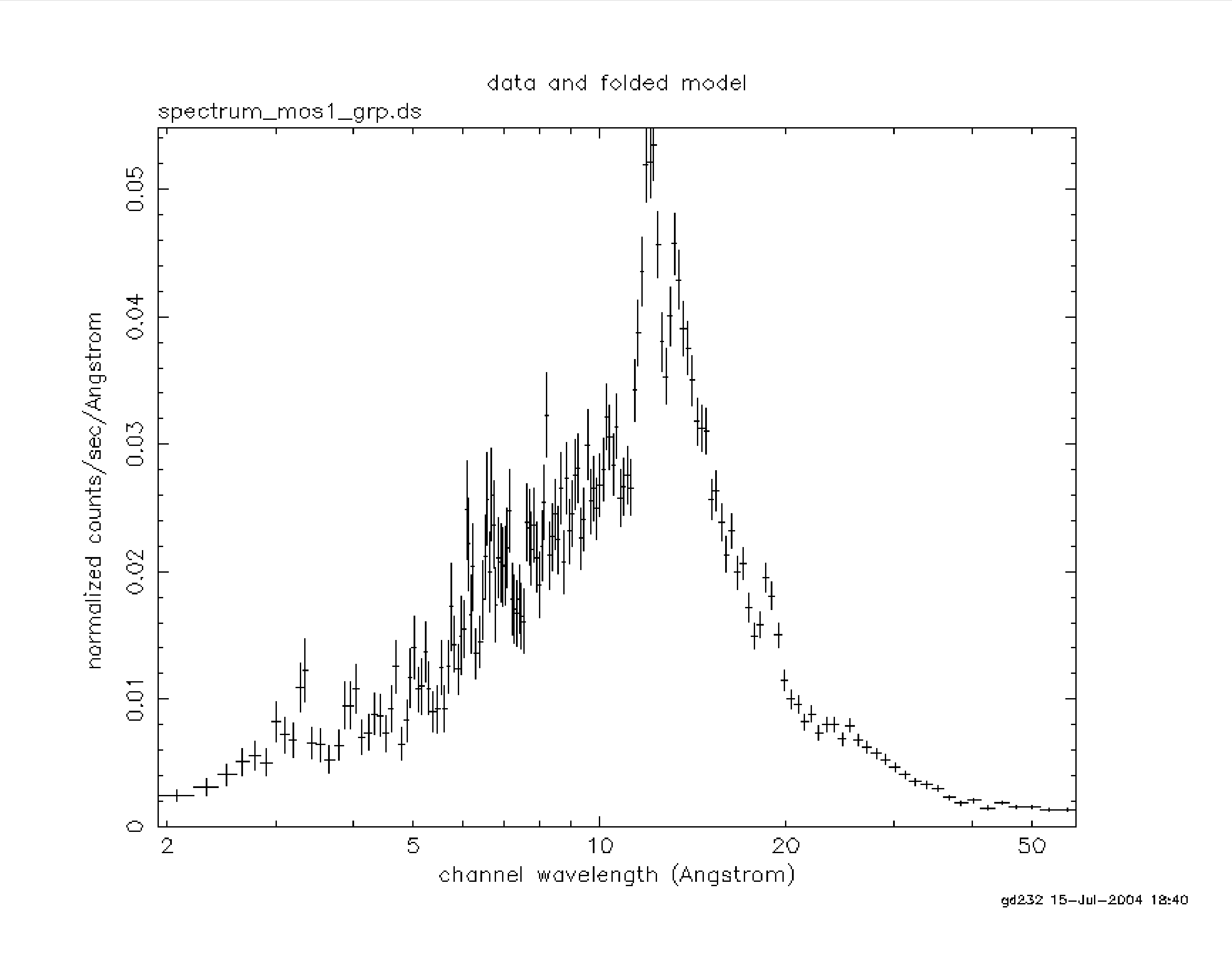
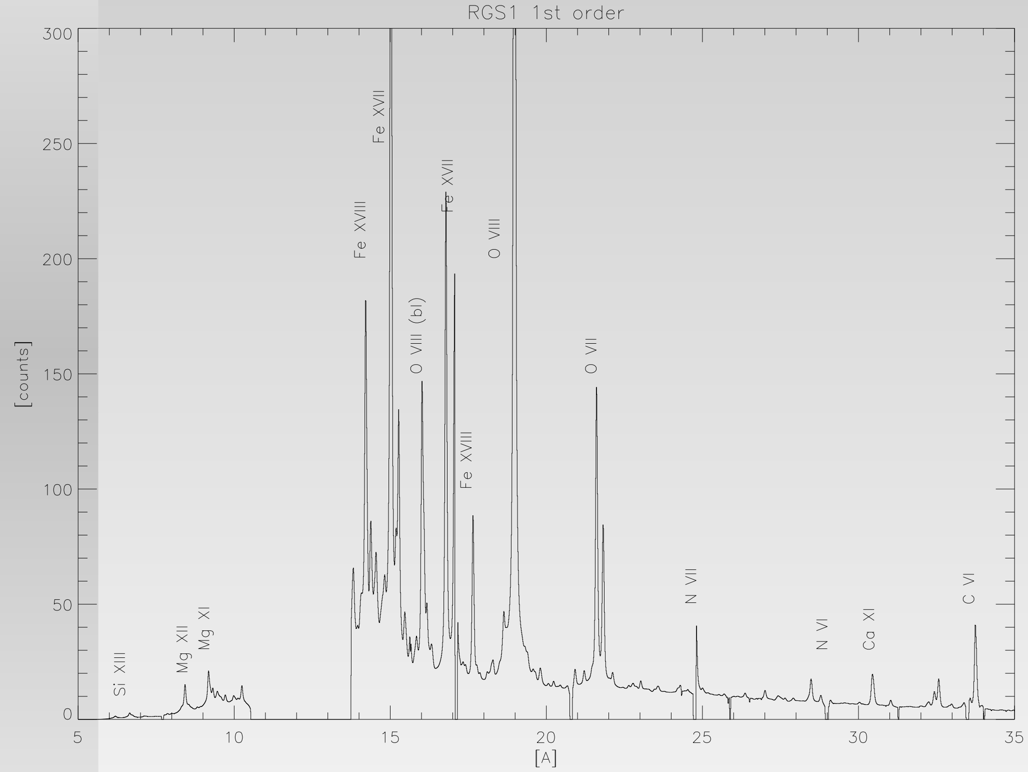
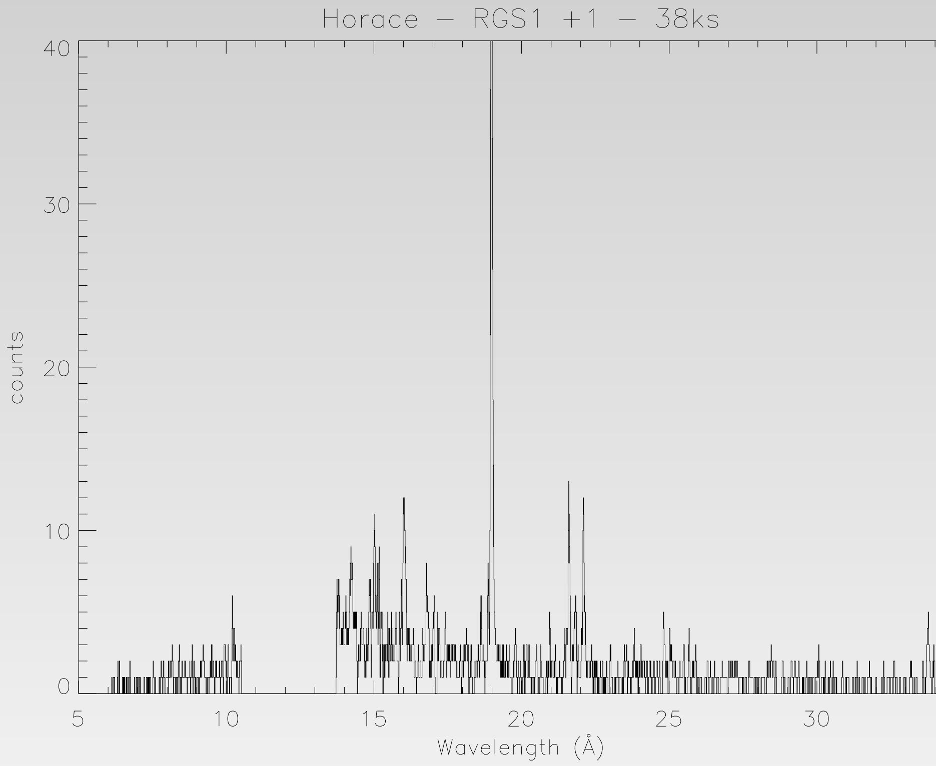


RGS - here is why we need spectroscopy

Where is all the Iron gone ?





Gallery - (from Huenemoerder, 2002)

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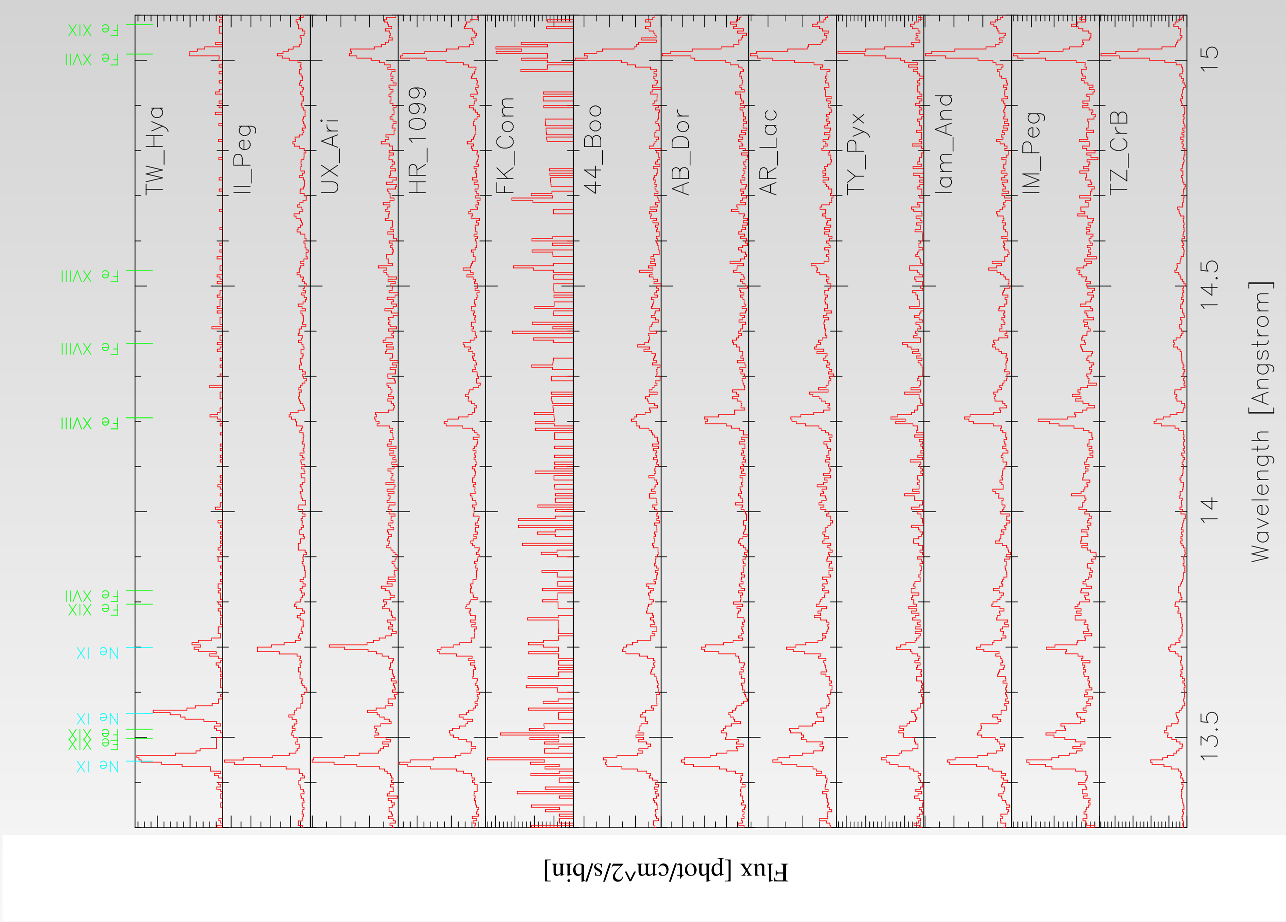
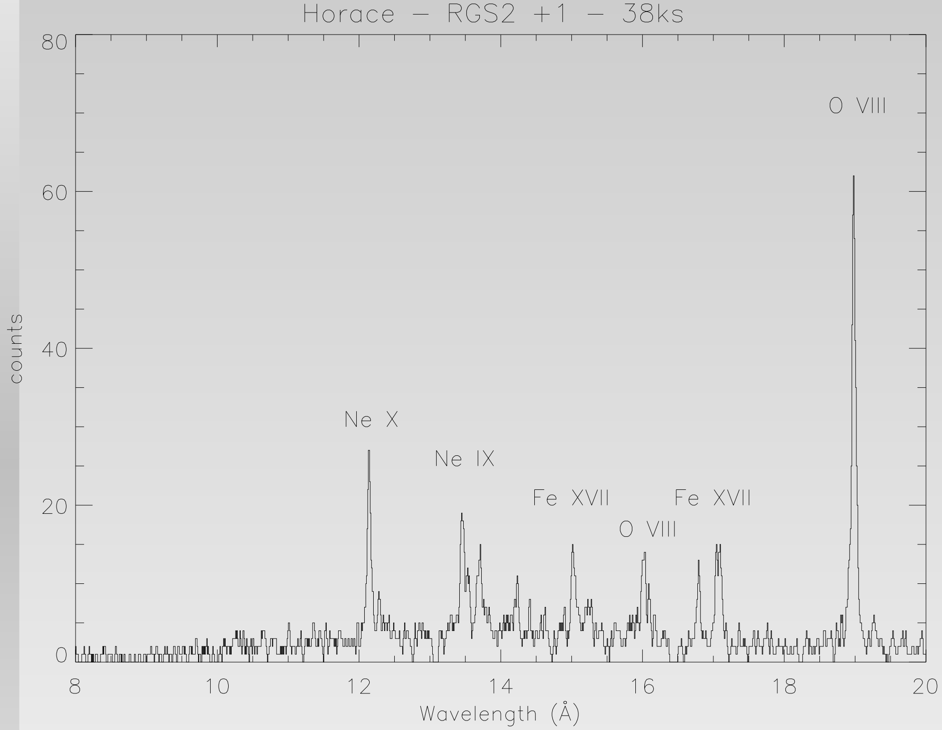
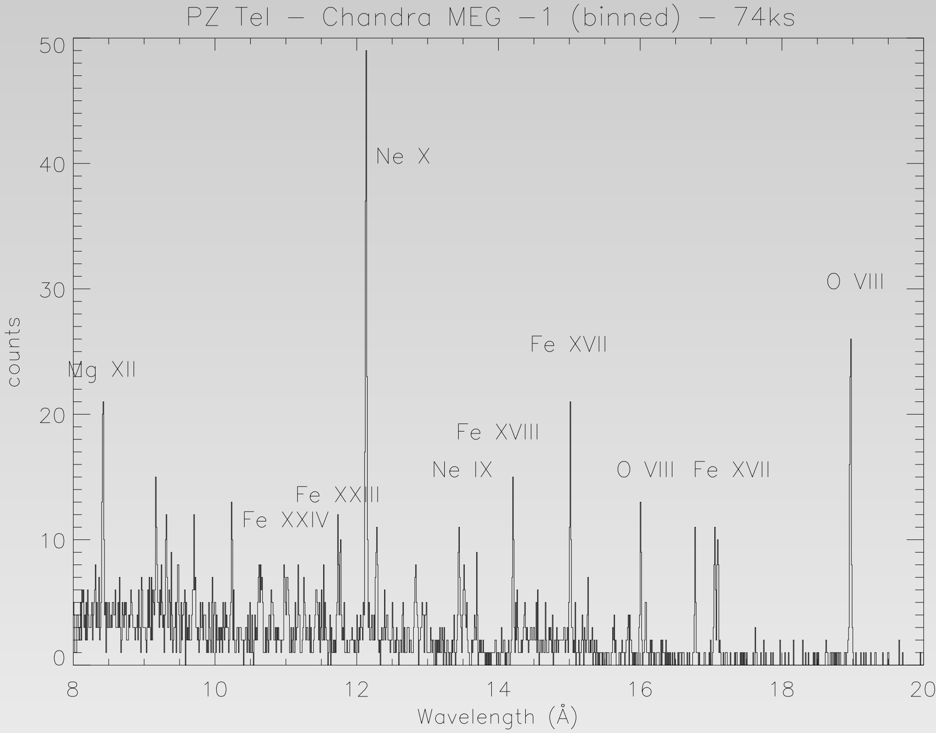


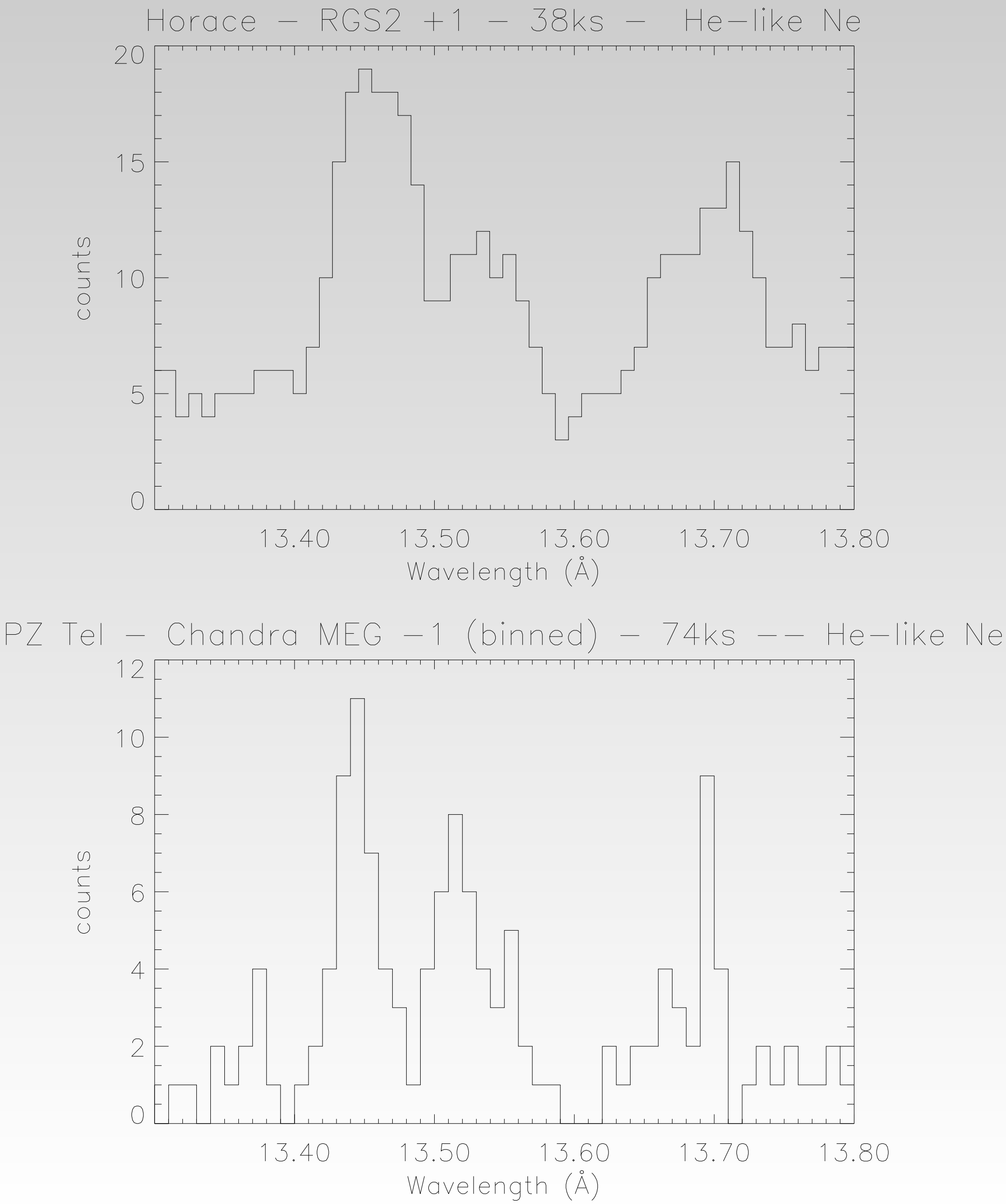
Figure 4. Gallery of spectra, for a very diverse collection of cool stars. The Ne IX triplet lines (13.44, 13.55, 13.70 Å) are at the left, and Fe XVII, which has a similar emissivity distribution with temperature, is at the right (15.02 Å). Spectra have been ordered by relative strength of Ne IX to Fe XVII, a mainly abundance-dependent ratio.

Horace vs. PZ Tel

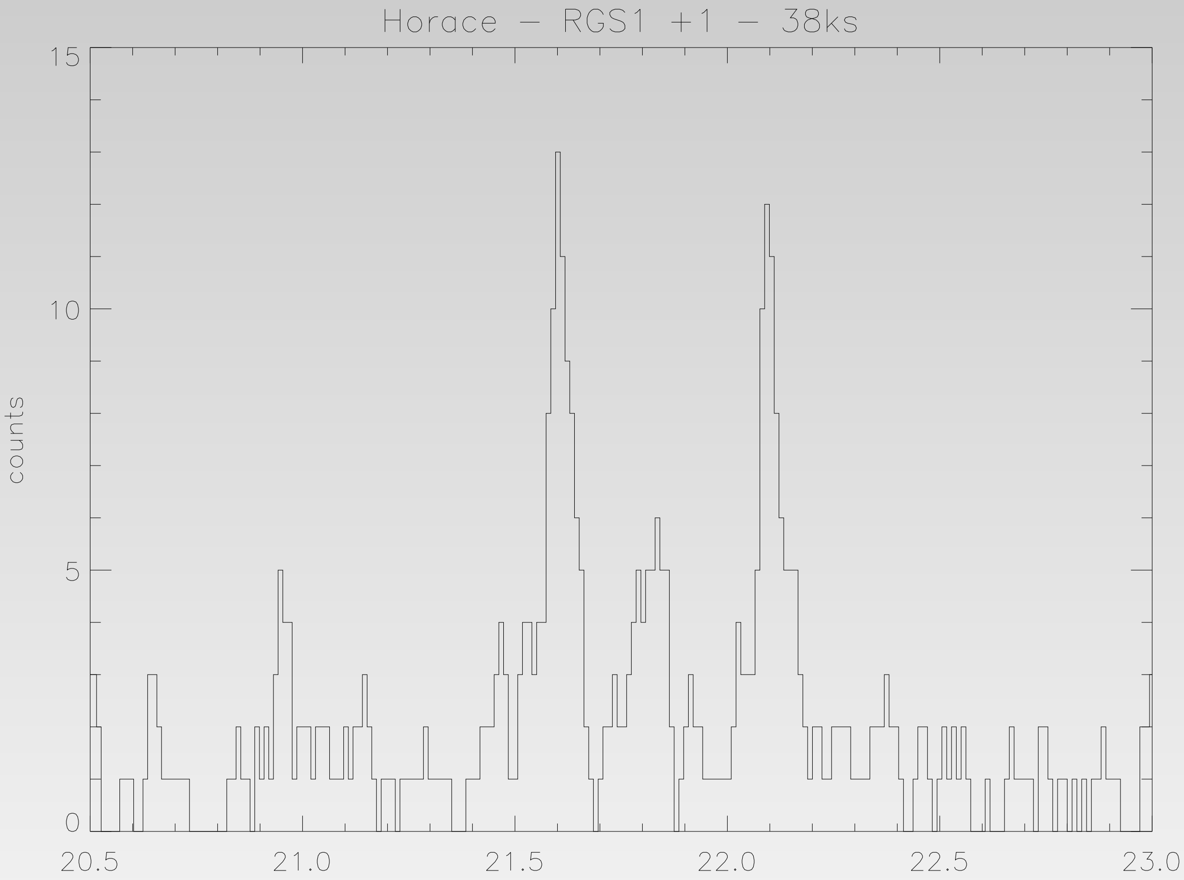




Densities - Ne IX



Densities - O VII



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- We confirm Linsky’s law (the most interesting events occurr at the end of the observation).