A NEW VIEW OF THE SUPERSOFT X-RAY SOURCE CAL 87 OBSERVED WITH XMM-NEWTON

M. Orio, 1,2 K. Ebisawa, 3 J. Heise, 5 and W. Hartmann 4

RESUMEN

El resumen será traducido al español por los editores. Cal 87 was observed with with XMM-Newton in April of 2003. The source shows a rich emission spectrum, where lines can be identified if they are red-shifted by 700-1200 km s⁻¹. These lines seem to have been emitted in a wind from the system. The eclipse is observed to be shifted in phase by 0.03 $\phi_{\rm orb}$, where $\phi_{\rm orb}$ is the phase of the optical light curve.

ABSTRACT

Cal 87 was observed with with XMM-Newton in April of 2003. The source shows a rich emission spectrum, where lines can be identified if they are red-shifted by 700-1200 km s⁻¹. These lines seem to have been emitted in a wind from the system. The eclipse is observed to be shifted in phase by 0.03 $\phi_{\rm orb}$, where $\phi_{\rm orb}$ is the phase of the optical light curve.

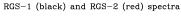
Key Words: STARS: BINARIES, WHITE DWARFS — X-RAYS: STARS

1. THE OBSERVED X-RAY SPECTRUM

Cal 87 was observed with XMM Newton on April 18-19 2003, for 21.8 hours (two full orbital cycles). The background corrected count rate measured in the two RGS-1 and RGS-2 instruments in the 0.33-2.5 Å range is 0.0764 ± 0.0012 and 0.0653 ± 0.0011 cts s⁻¹, respectively. The spectrum clearly appears to be an emission line one. There is an obvious similarity with the X-ray grating spectra of this source, (Motch et al. 2002, Bearda et al. 2002), however Cal 87 displays a much softer spectrum. Tentative line identification for the emission features in the RGSspectra indicates a red shift of several identifiable lines with velocities in the 700-1200 km s^{-1} range. We conclude that these lines must be originated in a wind. The EPIC spectra, despite pile-up effects that cannot be completely corrected for, offer a broader energy range (0.2-10 keV), and allow us to conclude that the central white dwarf is not visible at any time, even outside of eclipse.

2. THE LIGHT CURVE

The eclipse already observed in X-rays is observed again with *XMM-Newton*. It is more definite and deeper in the *EPIC* in the *RGS* light curve, not only because of the better S/N, but also because the



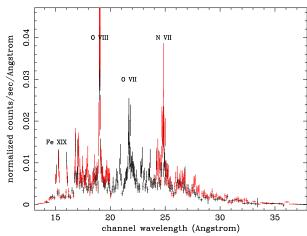


Fig. 1. The spectrum observed with the two RGS gratings. The RGS-1 spectrum is shown in black, the RGS-2 spectrum is in red. Some line identifications are labelled. No significant signal above the background is detected at wavelengths below 15 Å.

depth of the eclipse is greater at lower energy. It is shifted by $\Delta\phi_{\rm orb}{=}0.03$ with respect to the eclipse observed at optical wavelengths. We speculate that this may be so because the X-rays are emitted by the Accretion Disk Corona, while the optical radiation originates instead from the disk.

REFERENCES

Bearda, H., et al. 2002, A&A, 385, 511 Motch, C., Bearda H., and Neiner C. 2002, 385, 91

¹INAF – Turin Astronomical Observatory, Italy.

²Department of Astronomy, U Wisconsin at Madison, USA

³INTEGRAL Science Data Centre, Versoix, Switzerland.

 $^{^4 {\}rm SRON}$ National Institute for Space Research, Utrecht, The Netherlands.

 $^{^{5}4}$

Ken Ebisawa: INTEGRAL Science Data Centre, Chemin d'Ecogia, 16 CH-1290 Versoix, Switzerland (ebisawa@obs.unige.ch).

John Heise and Wouter Hartmann:SRON National Institute for Space Research, Sorbonnelaan 2, 3584 CA Utrecht, Netherlands. (jheise@purple.sron.nl, W.Hartmann@sron.nl.).

Marina Orio: INAF – Turin Astronomical Observatory, Strada Osservatorio 20, I-10025 Pino Torinese (TO), Italy and Department of Astronomy, 475 N. Charter Str., Madison WI 53706, USA. (orio@astro.wisc.edu)