EXOSAT OBSERVATIONS OF OMEGA CENTAURI

Lydie Koch-Miramond

Centre d'Etudes Nucléaires de Saclay

Michel Aurière

European Southern Observatory

1. THE OBSERVATIONS

We have undertaken an EXOSAT study of Omega Cen to tackle the two aspects of its X-ray emission revealed by the Einstein satellite (Hartwick et al, 1982) : i) diffuse emission which could be due to the interaction between the gas lost by the evolving cluster stars and the interstellar medium ; ii) dim point sources, the major part of them being white-dwarf binaries (Hertz and Grindlay 1983a,b) ; their nature is discussed by Verbunt et al (1984) and Hertz and Wood (1985). EXOSAT made two observations about 6 months apart : i) 1984, day 42 useful exposure time 39468s with Lexan 3000 filter and the Channel Multiplier Array (CMA) and exposure time 2744s with Polypropylene filter (PPL) ii) 1984, day 213, a useful exposure time of 48276s with the Lexan 3000 filter was obtained by Verbunt et al (1986). The two filters have a similar X-ray bandpass 0.062 keV and different UV leaks (Chiappetti and Giommi, 1985) : around 1900Å for the PPL filter, around 1500 Å for the Lexan filter.

2. THE UV EMISSION FROM OMEGA CEN

The emission at 1500Å and shorter seen by OAO2 and ANS is mainly due to blue horizontal-branch (BHB) stars but some "UV bright" stars are also present (Norris, 1974, Cacciari et al, 1984, Van Albada et al, 1981). The UV sensitivity of the CMA has enabled us to observe the two components of the UV emission of Omega Cen: diffuse emission due to faint unresolved BHB stars; point sources due to UV bright stars. We found that the radial variation of the UV diffuse emission agrees well with the King (1966) model proposed by DaCosta (1979; r_c = 2'63 ; r_t = 43'65) to give the best fit of the Omega Cen brightness in the B band.

Four UV stars are detected on days 42 and 213: ROA1, ROA2, ROA4 and ROA5701 (numbered according to the Woolley (1966)'s catalogue). The flux obtained for ROA2 and ROA5701 are in good agreement with the expected ones from ANS (Van Albada et al, 1981) and IUE (Cacciari et al, 1984).

3. X-RAY EMISSION OF OMEGA CEN

The extended hot gas emission discovered by Hartwick et al (1982) is not detected but our upper limit ($f_x < 8\ 10^{-13}$ erg.cm^{-2}.s^{-1} in aperture 5 by

J. E. Grindlay and A. G. Davis Philip (eds.),
The Harlow-Shapley Symposium on Globular Cluster Systems in Galaxies, 687–688.

20 arcmin. assuming a thin thermal bremsstrahlung at 10^6°K) is not inconsistent with the Einstein result.

Three X-ray point sources are detected among 5 known from the Einstein catalogue. Only HGD on day 213 was rediscovered without using the previously known position, the count-rate being $(2.09 \pm .44)10^{-3}s^{-1}$.

3.1. Variability of HGD and HGA

The CMA count-rate ratios (day 213/day42) for HGD and HGA are respectively 3.1 and 4.5, with significance levels of 1.4 σ and 2.6 σ (Koch-Miramond and Aurière, 1986). It follows that HGD at least may be a large amplitude variable object.

3.2. Spectra and Luminosities

Whatever their assumed emitted spectrum (either a very soft black body or a hard thermal bremsstrahlung) we find that HGA and HGD can be as bright as 6 to 9 10^{33} erg.s^{-1} in the 0.2-4 keV range, i.e. brighter than any observed cataclismic variable (CV) in the galactic disc, (Cordova and Mason, 1983). Actually the Einstein IPC recalibrated data show no evidence of very soft spectra for these sources. On the contrary the best fits we have obtained for spectra of dim globular cluster sources exclude kT < 1.0 ; 0.3 ; 0.2 keV at the 90 percent confidence level, respectively for 47 TUC ; M22 (A) ; Omega CEN (HGA) sources.

4. CONCLUSIONS

HGA and HGD can have X-ray luminosities approching 10^{34}erg s^{-1} as exhibited by the central source in 47TUC. The two EXOSAT and Einstein observations require HGD (and may be HGA) to be a highly variable object. It could be a CV, since during outbursts, as observed for U Gem, Lx can increase by a factor 10 (Cordova and Mason, 1983).

REFERENCES

Cacciari, C., Caloi, V., Castellani, V. and Fusi Pecci, F. 1984 Astron. Astrophys. **139**, 285.

Chiappetti, L. and Giammi, P. 1985 Exosat Express 11, 37.

Cordova, F. and Mason, K. 1983 in Accretion Driven Stellar X-Ray Sources, W. Lewin and van den Heuvel, eds., Cambridge Univ. Press, Cambridge.

Hartwick, F., Cowley, A. and Grindlay, J. 1982 Astrophys. J. Letters **254**, L11.

Hertz, P. and Grindlay, J. E. 1983a Astrophys. J. Letters **267**, L83.

Hertz, P. and Grindlay, J. E. 1983b Astrophys. J. **275**, 105.

Hertz, P. and Wood, K. 1985 Astrophys. J. **290**, 171.

Koch-Miramond, L. and Aurière, M. 1986, in preparation.

King, I. 1966 Astron. J. **71**, 276.

Norris, J. 1974 Astrophys. J. **194**, 109.

van Albada, T., de Boer, K. and Dickens, R. 1981 Monthly Notices Roy. Astron. Soc. **195**, 591.

Verbunt, F., van Paradijs, J. and Elson, R. 1984 Monthly Notices Roy. Astron. Soc. **210**, 899.

Verbunt, F., Shafer, R., Jansen, F., Arnaud, K. and van Paradijs, J. 1986 MPE Preprint 60.

Wooley, R. 1966 Roy. Obs. Annals 2.