X-RAY VARIABILITY OF THE AM HER STAR CW1103+254

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ABSTRACT. The AM Her star CW1103+254 was observed with the low-energy and the medium-energy instruments of EXOSAT on 3 occasions for a total of 10.5 orbital cycles. Both, soft and hard X-rays from CW1103+254 were detected. We report preliminary results on the time variability of the X-ray emission on time scales from 1 minute to 1 month.

1. INTRODUCTION

We report the detection of soft and hard X-ray emission from the AM Her star CW1103+254. Results of a spectral analysis were presented by Beuermann et al. (1984). We comment here on the time variability of the X-ray emission. The geometry of this system is particularly simple with a single accreting pole being visible for ~ 40% of the orbital period. The inclination of the system is 69° ± 2° and the magnetic colatitude 146° ± 2° (Schmidt et al., 1983).

2. OBSERVATIONS

CW1103+254 was observed with the low-energy (LE) and medium-energy (ME) instruments of EXOSAT on December 9/10, 1983, January 6/7, 1984, and January 9, 1984 for a total of 20 hours or an equivalent of 10.5 orbital cycles (P = 114 min). Simultaneous UBV photometry was scheduled in January 1984 but clouds prevented meaningful observations for most of the time.

3. RESULTS AND DISCUSSION

Both, hard and soft X-rays were observed only during those ~ 40% of the binary period when the active pole was in view (on-phase). Spectral analysis revealed a hard bremsstrahlung source with kT > 12 keV and a soft blackbody-like component with kT in the range of 18-40 eV (Beuermann et al., 1984). If we adopt a black-body spectrum with kT = 30 eV and a
Figure 1. Mean soft- and hard X-ray light curves of CW1103+254 obtained with the low-energy (LE) and medium-energy (ME) experiment on board EXOSAT. The LE-count rate is corrected for background, the ME-count rate is not. The ME background is 11.0 c/s on Dec. 9, 1983 and 11.5 c/s in Jan. 1984. The number of bins per orbit is 57 with one bin corresponding to about 2 minutes. Abscissa is orbital phase with $\phi = 0$ referring to the end of the bright phase. Add 0.06 to obtain linear polarization phase.

distance of 150 pc (Beuermann et al., 1984) then the emitting area is $\approx 10^{15}$ cm$^2$, corresponding to a fraction $f = 3 \times 10^{-4}$ of the surface of a standard 1 M$_\odot$ white dwarf. This value is lower by about an order of magnitude than the spot size estimated by Stockman et al. (1983) from the optical light curves.

CW1103+254 shows X-ray variability on all time scales from $\sim 20$ sec to months: The short-term variability is best seen in the soft X-ray light curves obtained with the low-energy instrument with CMA and 3000 $\mu$m Lexan filter where the count rate reaches a maximum of $\sim 1.5$ c/s. The soft X-ray intensity shows flaring on a time scale of minutes but the coherence of these fluctuations is small. An autocorrelation analysis shows that there is significant correlation, however, on a time scale of 40-60 sec. The X-ray variability on time scales of minutes and less seems to be similar to fluctuations seen by Larsson (1984) in high-speed white-light photometry of CW1103+254.

On Dec. 9/10, 1983, and in January 1984, we covered 2 and 5 complete on-phases, respectively, with the CMA and 3000 $\mu$m Lexan filter. The integrated countrate of the individual on-phases varied between 1070 cts. and 1800 cts. in January, the mean integrated countrate in December was 805 cts. Between December and January the mean ME count-rate also varied by a factor of $\sim 2.5$ which is similar to the variation of the soft X-ray intensity (see Fig. 1). The probable origin of these differences, therefore, seems to be time variability of the accretion rate $\dot{M}$. 