SOFT X-RAY OBSERVATIONS OF CATACLYSMIC VARIABLE STARS

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HEAO-1 observations of a large number of cataclysmic variable stars demonstrated that most of these objects are not bright X-ray sources, even during their eruptive phases.

HEAO-1 scanned about 20 dwarf novae while they were undergoing optical outbursts, yet soft X-ray emission (0.18-0.43 keV) was detected only from SS Cyg and U Gem. The 3σ upper limits to the flux from the nondetected objects, several of which were observed by HEAO-1 during more than one outburst, range from 1 to 10% of U Gem's mean flux of $\sim 1 \times 10^{-10}$ erg cm^{-2} s^{-1}. SS Cyg itself was detected during outburst at an intensity 20% of this value.

A preliminary survey of the soft X-ray emission from ~ 65 dwarf novae during quiescence and ~ 65 other cataclysmic variables using the HEAO-1 data base, revealed very few X-ray emitters. In the energy range 0.7-2 keV, X-rays were detected only from EX Hya and possibly SS Aur, while in the 1/4 keV band X-rays were detected only at positions coincident with those of AY Lyr and MV Lyr. The average 3σ upper limits to the flux from the remaining stars were $\sim 7 \times 10^{-12}$ erg cm^{-2} s^{-1} in the energy interval 0.18-0.43 keV, and $\sim 3 \times 10^{-11}$ erg cm^{-2} s^{-1} in the interval 0.74-2 keV. These upper limits were only two or three times less than the observed intensities of AY Lyr and EX Hya; thus it was entirely possible that a more sensitive survey might produce more detections.

HEAO-B is able to do a deeper survey for soft X-ray emission than its predecessor, and its first results show that most cataclysmics are indeed X-ray sources, but at an extremely low level. Recent HEAO-B observations of nine cataclysmic variables produced six positive detections: the ex-nova GK Per, the recurrent nova T CrB, the nova-like variable CD-42°14462, and three dwarf novae (AH Her, VW Hyi, and YZ Cnc). The brightest among these is GK Per at 0.3 IPC ct s^{-1}; the faintest is T CrB at 0.012 ct s^{-1}. (One IPC ct $s^{-1} \approx 2 \times 10^{-11}$ erg cm^{-2} s^{-1}.) The objects not detected as X-ray emitters were the dwarf nova EQ Mon and two ex-novae, V533 Her and DQ Her. The upper limit to the X-ray emission from DQ Her was < 0.0037 ct s^{-1}, a factor of 800 less than the X-ray emission from the quiescent EX Hya.

The soft X-ray intensities of all cataclysmic variables observed to date are presented, and possible reasons for the wide range of X-ray behavior among the cataclysmic variables are discussed.

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