

# CORONAL VARIABILITY AND FLARING OF THE RS CVN BINARIES $\sigma^2$ CRB AND HR1099

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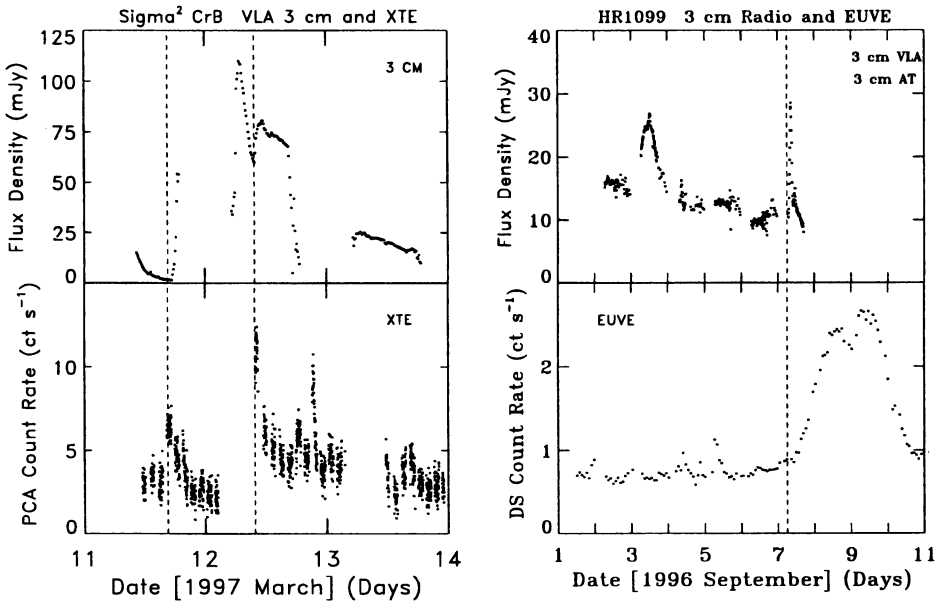
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We present new X-ray, EUV, and radio observations of the coronal emission from the RS CVn binaries HR1099 (V711 Tau) and  $\sigma^2$  CrB. RS CVn systems possess coronae that display extreme activity levels and frequent flaring. Our observations provide multiwavelength records of coronal variability and flaring over more than two binary orbits for each system. While the EUV and X-ray spectra show the flare response of the thermal plasma, the radio data give the corresponding information for the nonthermal electron population. The HR1099 data contain one of the most energetic flare outbursts observed from HR1099 that lasts for over 3 days. Coronal flaring is common in these systems and, in fact, is the normal condition.

$\sigma^2$  CrB was observed with the XTE and ASCA X-ray satellites and the VLA radio array on 1997 March 11-13. The radio observations show large variations at 3, 6 and 20 cm; including a flare rise seen on March 11 and a complex flare outburst that lasted for most of March 12. Polarised 20 cm bursts were seen associated with flare rises; those associated with the flares at March 11.7 and 12.3 were **left** circularly polarised, while that at March 12.6 was **right** circularly polarised. A weak excess of right CP was seen during the March 12.5 subflare at 6 cm. The rapid radio decay at 3 and 6 cm suggests that the flare region was expanding rapidly. Outside the flares CP was absent at all three frequencies. At least three flares were detected by XTE, with two of them having radio counterparts.



*Figure 1.* Left Coronal flaring from  $\sigma^2$  CrB in the X-ray and radio. Right Variations of HR1099 in the radio and EUV spectral regions. The vertical dashed lines mark the onset of large flares.

Over the period 1996 September 1-11 we observed HR1099 with the EUVE and XTE satellites, and the VLA and the AT radio arrays. While the EUVE Deep Survey (DS) photometer shows a mildly varying signal between September 1 and 7, the 3cm flux density is steadily falling with a modest flare lasting 16 hours seen on September 3 without any obvious EUV counterpart. At about 6 UT on September 7 a sharp radio flare indicates the initiation of an extremely large coronal flare outburst. The EUV flare lasted over 86 hours with an integrated energy (80-180 Å) of  $4.1 \times 10^{34}$  ergs. The e-folding times of the rise and decay were 23.5 and 25 hours respectively. XTE detected a small flare at 20 UT on September 4, which corresponds to a weak enhancement in the EUV and a gap in the radio coverage.

Our extensive multi-spectral-region studies of HR1099 over the last five years have demonstrated in a systematic way the ubiquitousness of coronal flaring and the extremely transitory coronal conditions present at any instant.

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