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X-RAY/OPTICAL FLARES ON RS CVn STARS

Previous observers (e.g. Chambliss et al., 1978) have noted the lack of a corresponding optical flare for quite large ultraviolet and micro-wave flares on RS CVn stars. This has been generally interpreted as a contrast effect, since the non-flare continuum is more intense in these stars than, for instance, in the dMe or flare stars where optical flares are common. An alternative explanation may be that the flare loop lengths and electron densities on RS CVn stars are much larger than those on either the sun or dMe stars, resulting in an increased column density along the loop. Assuming, as in the sun, that we have a flare model where we have an instability at the loop apex leading to the generation of a high energy beam of hard X-ray electrons which move down the loop legs to the chromosphere, theoretical calculations from Emslie (1983) imply that all electrons with energy less than 50 keV are stopped before they reach the chromosphere. Hence in this model, most of the heating from this beam goes to heating the transition region/corona with a substantially less amount going to heat the lower atmosphere than in solar-type stars and dMe stars.

Simultaneous optical (covering the high Balmer lines) and X-ray data should help in distinguishing between these two suggestions, i.e. contrast effect or increased loop length and density, since the X-ray observations will give an estimate for the flare size and density. Simultaneous ultraviolet data will provide (through line ratio techniques), an estimate of the electron density in the transition region. A good target for such a campaign is II Peg (=HD 224085). This star has a very high X-ray luminosity, e.g. $4 \cdot 10^{31}$ erg/s was observed by Walter et al. (1980) in the 0.2 - 4 keV range and $5 \cdot 10^{30}$ erg/s by Schwarz et al. (1981) in the 2 - 10 keV range. It is a single-line spectroscopic binary of spectral type K2 IV-V with an orbital period of approximately 6.7 days with photometric variations, of the type usually interpreted as due to cool surface spots. This star has a very high rate of flaring in the ultraviolet region, e.g. see Doyle et al. (1988). Ultraviolet

flares so-far observed have had typical decay times of 10 to 15 hours with a total radiative power output of 10^{36} erg. These long flare decay times will mean that a high resolution (compared to the flare life-time) is possible. Two 24 hr. shifts on the Japanese X-ray satellite GINGA has been awarded. An application for ESA and NASA I IUE shifts have been submitted, in addition, we have requested spectroscopy and photometric coverage from La Palma and Mauna Kea (Hawaii). The requested dates of observations are the 15 and 16 August 1989. Involved in this international corroborative project is Armagh Observatory, the Institute for Astronomy at the University of Catania, Goddard Space Flight Center, the Joint Institute for Laboratory Astrophysics of the University of Colorado, the Rutherford-Appleton Laboratory, the Laboratoire de Physique Stellaire et Planetaire du CNRS and the University of Leicester.

We welcome the participation of any observer who can contribute either photometric or spectroscopic observations. Interested observers are requested to contact the undersigned and to notify us of their telephone and telex numbers and/or their electronic mail address.

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References:

- Chambliss, C.R., Hall, D.S., Landis, H.J., Louth, H., Olson, E.C., Renner, T.R., Skillman, D.R., 1978, *Astron. J.* 83, 1514.
 Doyle, J.G., Byrne, P.B., van den Oord, G.H.J., 1988, *Astron. Astrophys.* (in press).
 Emslie, A.G., 1983, *Solar Phys.* 86, 133.
 Schwartz, D.A., Garcia, M., Ralph, E., Doxsey, R.E., Johnson, M.D., Lawrence, A., McHardy, I.M., Pye, J.P., 1981, *MNRAS*, 196, 95.
 Walter, F.M., Cash, W., Charles, P.A., Bowyer, C.S., 1980 *Ap. J.* 236, 212.