A FLARE-LIKE EVENT FROM THE SHORT-PERIOD SYSTEM XY UMa

M. Zeilik, R. Elston, G. Henson and P. Smith
Capilla Peak Observatory, The University of
New Mexico, Albuquerque, New Mexico USA

XY UMa (+55°1317, SAO27143) is a short-period (P 0.48 d) cousin of the RS CVn stars. The primary star is G2-G5V; the secondary K5 (Geyer, quoted by Lorenzi and Scaltriti, 1977). Geyer (1977) has done the bulk of the observational work to date, including the first photoelectric observations. The rapid, annual changes in XY UMa's light curve, and the fact that the last published light curves was from the 1977 season convinced us to reobserve this active system.

We did all observations with the 61-cm telescope at the University of New Mexico's Capilla Peak Observatory, located at an altitude of 2.84 km. The telescope has a single-channel, photon-counting photometer with a cooled (-20°C) EMR 641A phototube. The statistical error in each observation is no more than 0.01 mag. The star +54°1278 (F5) was used as the comparison star for all observations. The magnitudes of the comparison star +54°1278 are: U=9.90, B=9.94, V=9.56. Phases were calculated from HJD = 2435216.5086 + 0.478995E (Wood et al., 1980) and range from 0.41 to 0.20 on 31 January 1982 (UT) and 0.12 to 0.62 on 20 February 1982 (UT).

We detected a flare-like episode on 31 January 1982 (UT), which began at 5:14 UT at phase 0.54 (Figures 1-3). The flare peaked at 5:29 UT at phase 0.57; its total duration was about 30 minutes. At peak, the system magnitude was U=10.59, B=10.33, V=9.55, and R=8.88. Relative to the average light curve of the system, the apparent magnitude increase was 0.33 at U, 0.13 at B, and 0.09 at V.

To look at the event in its intensity profile, we converted magnitudes to fluxes and integrated over its duration (Table 1). From the spectral types of the stars, we estimated a distance of 84 pc to the system and calculated the mean and integrated energies (Table 1). Note that, although the flare was strongest relative to the system at U, most of the energy was released at B and V.

Similar flare-like episodes have been reported by Patkós (1981) from the very similar system SV Cam (period = 0.59 d, spectral types

P. B. Byrne and M. Rodonò (eds.), Activity in Red-Dwarf Stars, 411–413.

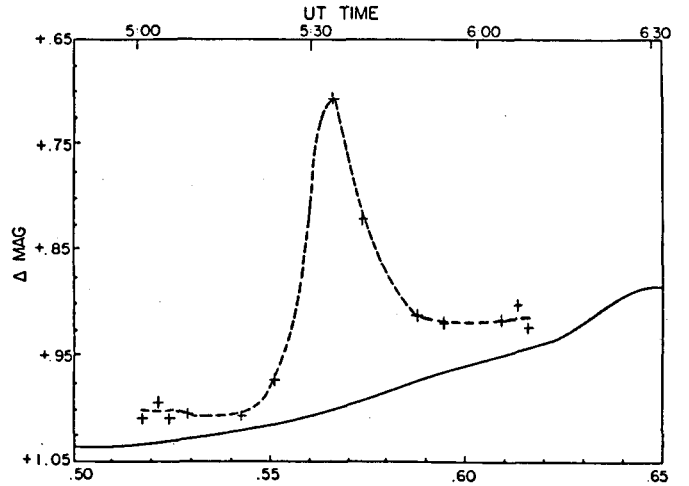

Fig. 1
XY Uma Flare like event on 1/31/82. In U band crosses are actual data points; dashed line is an interpolated fit to the data. The solid line is the average system brightness as observed on 2/20/82.

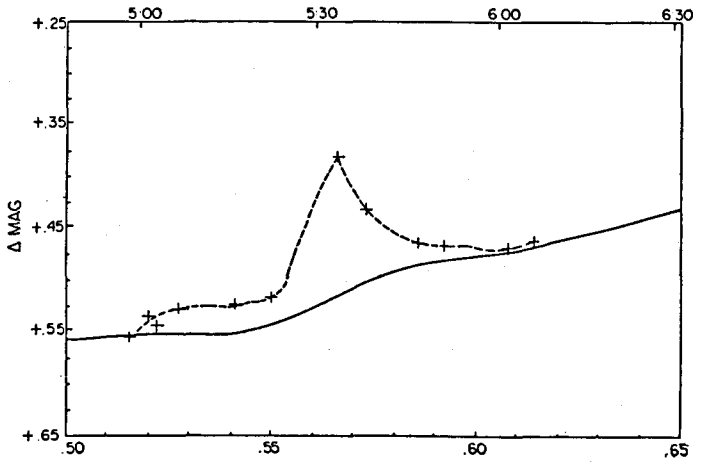

Fig. 2
Same as Figure 1, but for B band, note that UT runs along the top, phase along the bottom.

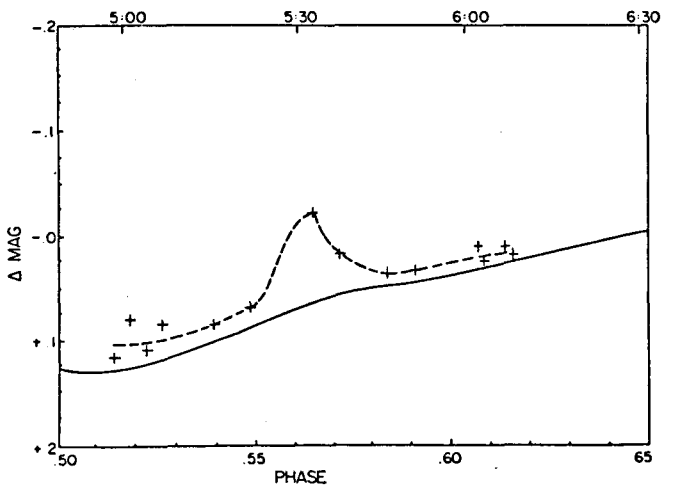

Fig. 3
Same as Figure 2, but for V band.

https://doi.org/10.1017/S025292110009641X Published online by Cambridge University Press

G3 and K4). The strongest of these (Flare 1 on 8/9 December 1980) took place at phase 0.61; its duration was 43 minutes, its peak reached 0.12 mag. above the system at U (or about 5%) of system's total intensity at U). Patkós positions the flare-active region as a sector 40° wide on the spotted half of the secondary star. If the primary star really is the active one in XY UMa, then our event also occured on the spotted hemisphere.

We can also compare our event to those of flare stars (Kunkel, 1975), which are typically spectral type dMe or dKe. Some of those, such as BY Dra, show distortion waves that can be attributed to starspot activity (Bopp and Evans, 1973). Flares from UV Ceti have B-band powers of 10^{29} to 10^{31} ergs/sec, whereas those from BY Dra cluster near 10^{33} ergs/sec. Solar white-light flares are typically a few times 10^{27} ergs/sec at B. Our event was not only more energetic than these, but also redder in color; our U-B ≅ -.66 in contrast to U-B ≅ -1 for solar and dMe flares

Geyer (1982) has reported brightness spikes from XY UMa, similar to, be less intense than our event. In February, March, and April 1982, Geyer (1982) observed a brightness spike at phase 0.63 with magnitude increases about 1/3 the amplitude of ours. Rather than an actual flare our event may be the appearance of an active, spot-enhanced chromosphere of the primary star.

We thank the Research Corporation for providing partial funding for the computer control system at Capilla Peak.

Table 1. Flux Densities and Integrated Energies

Filter	Integrated Flux (mJy.sec)	Flare/System	Mean Energy (erg/Hz)	Integrated Energy (ergs)
U	2.4×10^4	0.10	2.0×10^{20}	3.2×10^{34}
B	4.6×10^4	0.05	3.8×10^{20}	5.9×10^{34}
V	8.0×10^4	0.05	6.7×10^{20}	5.9×10^{34}

REFERENCES

Bopp, B. W. and Evans D. S. (1973), Mon. Not. Roy. Astro. Soc., 164, 343
Geyer, E. H. (1977), In IAU Colloquium No. 42, p. 292; (1982), private communication.
Kunkel, W. E. (1975), In Variable Stars and Stellar Evolution, edited by Sherwood and Plant, p. 15.
Lorenzi, L. and Scaltriti, F. (1977), Acta Astronomica, 27, 273.
Patkós, L. (1981), Astrophys. Lett., 22, 131.
Wood, F. B., Oliver, J. P. Florkowski, D. R. and Koch, R. H. (1980), A Finding List for Observers of Interesting Binary Stars (Univ. of Pennsylvania Press).