

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2761

Konkoly Observatory
Budapest
15 July 1985
HU ISSN 0374 - 0676

FLARE LIKE ACTIVITY OF AR LACERTAE IN 1982

Investigations of the eclipsing binary system AR Lacertae have been reported earlier by the author (cf. Srivastava, 1981; 1983a; 1983b; 1984; Goraya and Srivastava, 1984). AR Lac is a well known radio flaring source. Some evidence of spot activity, radio flaring in the system has already been described by the author (cf. Srivastava, 1981; 1984; Goraya and Srivastava 1984). Recently Walter et al. (1983) derived coronal structure of the components of the system from X-ray and UV observations. Kiziloğlu et al. (1983) obtained UV observations of AR Lacertae and found both chromospheric and transition region lines. Very recently, Huenemoerder and Ramsey (1984) spectroscopically monitored the system AR Lacertae and found very weak excess in H α emission on two nights. Doiron and Mutel (1984) obtained dual frequency radio observations of AR Lacertae and found 2% to 8% circular polarization and a helicity reversal between 1485 MHz and 4885 MHz. They inferred the range of magnetic field strength as $5 \leq B \leq 80$ G.

There are some indications that the system may have been active in 1982 and therefore, the author analysed Everen et al.'s (1983) B and V observations to find out the flare characteristics of the flares associated with the system.

Smoothed light curves of six nights of observations show some deviations from the average smoothed light curves drawn through all the observations. The B and V magnitudes of deviating and average smoothed light curves have been read out at phase intervals of 0.002 and their differences are plotted in Figure 1 (a, b, c) and 2 (a, b, c). In these figures, the filled circles represent the flare like activity ascending above the quiescent intensity level while open circles are the points by virtue of O-C calculations, which help in gaining an idea about the start and the end times of various flares. The solid curves in the figures represent the quiescent level of intensity. The characteristics of relevant flares are given in Table I.

The flare pattern of JD 2445131 appears as a combination of two flares.

The flare pattern of JD 2445152 appears incomplete.

The flare pattern of JD 2445164 suggests that it is a combination of three flares. The system does not appear significantly active on this night.

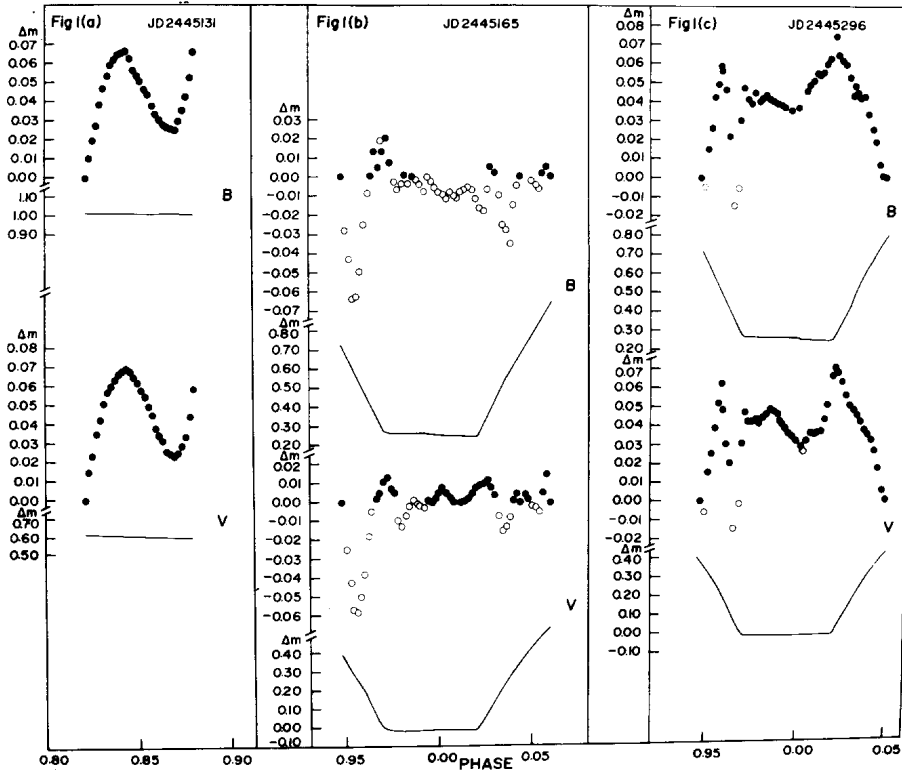


Figure 1(a,b,c): Flares of AR Lacertae around the primary minimum phase.

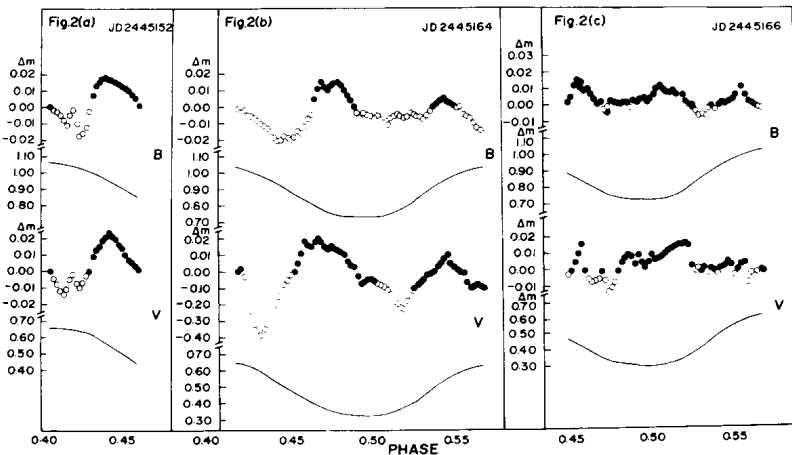


Figure 2(a,b,c): Flares of AR Lacertae around the secondary minimum phase.

Table I
 Characteristics of the flares of AR Lacertae

Min.	JD	Filter phase of flare	Start phase of flare	End phase of flare	Duration of flare in phase	Duration of flare in hours	Phase of the flare maximum	Maximum amplitude of flare
Pr.	2445131	B	0.822	0.870	0.048	02 18	0.844	0.065*
		V	0.822	0.870	0.048	02 18	0.844	0.070*
Sec.	2445152	B	0.870	0.880	0.010	00 29	0.880	0.065**
		V	0.870	0.880	0.010	00 29	0.880	0.059**
Sec.	2445164	B	0.406	0.460	0.054	02 35	0.442	0.024***↑
		V	0.436	0.496	0.060	02 53	0.470	0.020*↑
Pr.	2445165	B	0.955	0.978	0.023	01 06	0.972	0.021*↑
		V	0.950	0.965	0.015	00 43	0.959	0.058***
Pr.	2445296	B	0.950	0.965	0.015	00 43	0.959	0.062***
		V	0.968	0.000	0.032	01 31	0.980	0.046*
Sec.	2445296	B	0.968	0.004	0.036	01 42	0.986	0.048*
		V	0.000	0.050	0.050	02 24	0.022	0.075*
Sec.	2445296	B	0.004	0.050	0.046	02 13	0.022	0.070*
		V	0.004	0.050	0.046	02 13	0.022	0.070*

* The flare has emerged with the other flare and is incomplete.

** Incomplete flare

*** Complete flare ↑ Very weak and doubtful flare.

On JD 2445165 at least two flares are visible. Perhaps the first flare was observed in the declining phase (between the phases 0.948 and 0.955).

On JD 2445166, some fluctuations above the quiescent intensity level are seen, however, it is difficult to say whether these represent the real flares or not.

The flare pattern of JD 2445296 shows that there are three distinct peaks which may represent three flares.

The presence of gas streaming, pulsation, existence of the extended atmosphere around the components, and the presence of spot or flare activity can change the depth and/or light levels. The humps and asymmetries in the branches of minima are not seen, hence gas streaming cannot account for these features. The duration of totality is not changing from night to night, as is apparent from the present figures, hence the possibility of pulsation is also ruled out. The dips are not seen before first and after fourth contacts of the eclipses, hence the presence of extended atmosphere around the components of the system is not possible either. Thus, the spot or flare activity remains the only possibility which can account for the changing light patterns of the system. The presence of spot activity in 1982 was established by polarization measurements of Doiron and Mutel (1984).

We may say that the flare like activity is strongly visible on JD 2445131 and JD 2445296, while on the remaining nights, the system was not very active. Since the flares originate both within and outside the totality region of the system, hence both the components of the system are active. The amplitudes of various flares indicate that their activity is varying.

R.K. SRIVASTAVA
U.P. State Observatory,
Manora Peak, 263 129
Naini Tal
India

References:

- Doiron, D.J. and Mutel, R.L., 1984, *Astron. J.* 89, 430.
 Everen, S., Ibanoglu, C., Tümer, O., Tunca, Z. and Ertan, A.Y., 1983, *Astrophys. Space Sci.* 95, 401.
 Goraya, P.S. and Srivastava, R.K., 1984, *Inf. Bull. Variable Stars* No. 2579.
 Huenemoerder, D.P. and Ramsey, L.W., 1984, *Astron. J.* 89, 549.
 Kiziloğlu, U., Derman, E., Ögelman, H. and Tokdemir, F., 1983, *Astron. Astrophys.* 123, 17.
 Srivastava, R.K., 1981 *Astrophys. Space Sci.* 78, 123.
 Srivastava, R.K., 1983a, *Inf. Bull. Variable Stars* No. 2450.
 Srivastava, R.K., 1983b, *Bull. Astron. Soc. India* 12, 52.
 Srivastava, R.K., 1984, *Acta Astron.* 34, No. 2, 291.
 Walter, F.M., Gibson, D.M. and Basri, G.S., 1983, *Astrophys. J.* 267, 665.