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AR AURIGAE - TRIPLE SYSTEM?

The binary AR Aur is well known as a detached system. Since the discovery of its variability by Pedersen and Steensgard in 1931 it has been observed by several observers photoelectrically. Between 1935 and 1939 the period was $4^d.13467$ according to Huffer and Eggen (1947). There are two other estimations referred to this period, $4^d.134581$ by Nassau (1937) and $4^d.1346607$ by Woodward (1943). O'Connell (1979) analysed all the visual, photographic and photoelectric observations made up to 1978 and claimed that the period of this binary had undoubtedly changed. He derived the value $4^d.134686$ for the period between 1963 and 1970. Besides, he concluded that the period became decreasing in about 1974.

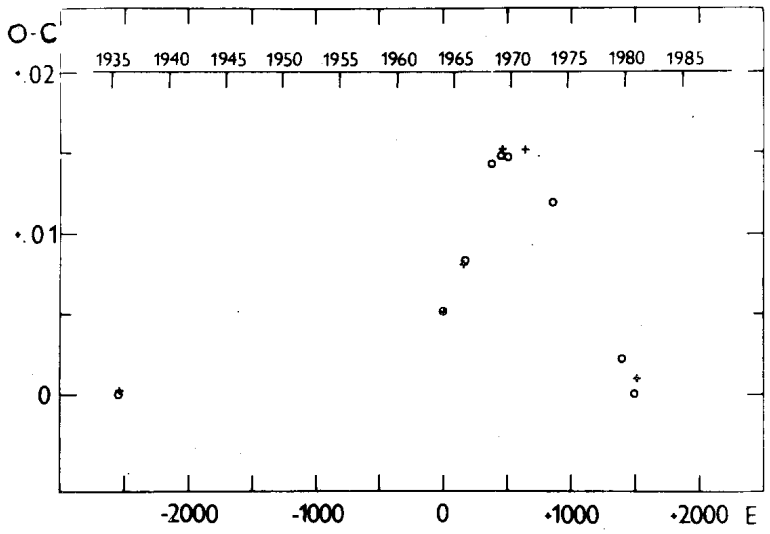

Figure 1

AR Aur is one of the objects we have studied from the point of view of their Ap characteristics. Between 1979 and 1981 we managed to observe two primary and one secondary minima photoelectrically. The observations were made by the photoelectric photometer attached to the cassegrain focus of the 0.6 m telescope at the Skalnaté Pleso Observatory. Our results together with all the photoelectric minima given by O'Connell (1979) are listed in Table I. Because of their large scatter we have omitted the visual and the photographic minima. Figure 1 shows the O-C diagram constructed according to the ephemeris

$$JD/MinI/ = 2\ 427\ 887.7217 + 4.1346662 \times /E + 2543/ \qquad /1/$$

The period in this formula is the average one that we obtained taking into account only the first and the last primary minima from Table I. It is obvious in Figure 1 that a continual change of the period has taken place in the system. The part since 1964 up to now can be fitted well by a parabola that results in the following ephemeris

$$JD/MinI/ = 2\ 438\ 402.1832 + 4.134695 \times E - 2.2 \times 10^{-8} \times E^2 \qquad /2/$$

$$\pm .0007 \qquad \pm .000002 \qquad \pm .2$$

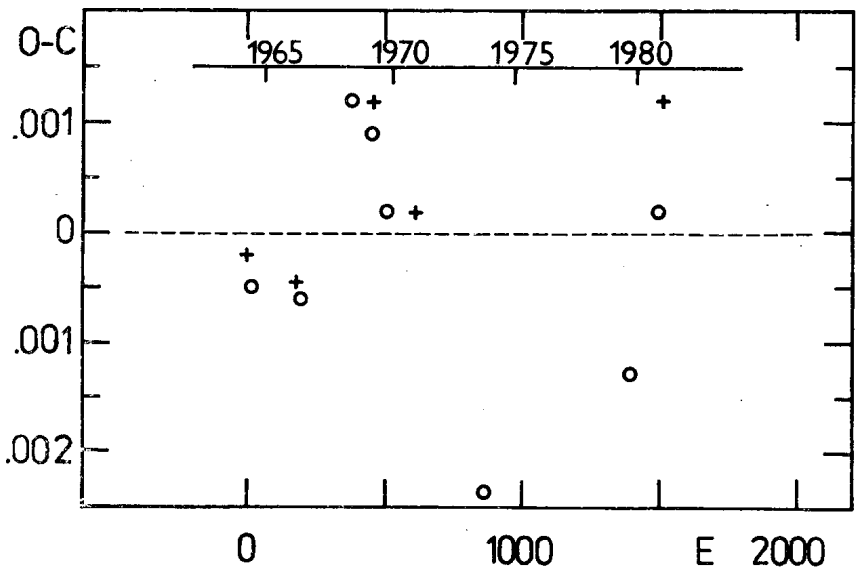

Figure 2

The O-C residua after this parabola fitting are shown in Figure 2. The mean period derived for our three minima is $4^d.134652 \pm .000006$.

All the observations obtained so far have displayed at first an increase of the period until about 1964 followed by a decrease till 1981. As this system is detached, such cyclic changes of the period can be induced by a third body in the system. Unfortunately, a lack of observations between 1935 and 1964 does not allow us to decide whether the residua in Figure 1 should be best fitted by a double or a single wave. At any rate, a duration of one cycle is shorter then about fifty years, therefore the third body can not be the star HR 1732, that was said to be in a physical connection with AR Aur (Hoffleit, 1964).

Table I

JD 2 400 000.+	E	Date	O - C /1/	O - C /2/	Observer
27 887.7217	-2543	1935.23	.0000		Huffer and Eggen
27 889.7892	-2542.5	1935.24	+.0002		"
38 404.2504	0.5	1964.03	+.0052	-.0002	O'Connell
38 435.2603	8	1964.11	+.0051	-.0005	"
39 098.8783	168.5	1965.93	+.0092	-.0004	Johansen
39 154.6964	182	1966.08	+.0093	-.0006	"
39 940.2880	372	1968.23	+.0143	+.0012	O'Connell
40 246.2538	446	1969.07	+.0148	+.0009	"
40 248.3215	446.5	1969.08	+.0152	+.0012	"
40 498.4683	507	1969.76	+.0147	+.0002	Gülmen
40 930.5414	611.5	1970.94	+.0151	+.0002	Battistini et al.
41 941.464	856	1973.71	+.0119	-.0023	Schellerman et al.
44 153.5008	1391	1979.77	+.0022	-.0013	This paper
44 612.4465	1502	1981.02	.0000	+.0002	"
44 614.5150	1502.5	1981.03	+.0012	+.0014	"

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