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PHOTOELECTRIC PHOTOMETRY OF THE ECLIPSING
 BINARIES RZ Cas AND AR Lac

For the past two seasons this investigator has been engaged in photometric studies of the eclipsing binaries RZ Cas and AR Lac. All observations have been made with the 18" Cassegrain reflector and photoelectric photometer of the Kutztown State College Observatory. Thus far about 1400 observations in U,B,V have been obtained on RZ Cas and about 1650 on AR Lacertae. Detailed studies of both RZ Cas and AR Lac will be published after these investigations have been completed.

RZ Cassiopeiae is a 6th magnitude eclipsing binary of the semi-detached type, the components of which are of spectral types A2V and KOIV. As a comparison the A2 star HR 791, a star previously used by several investigators, has been chosen. This investigation yields values of $V = 5.91$, $B-V = +0.11$, and $U-B = +0.12$ for HR 791.

RZ Cas has long been known to have a variable period, and a vast number of times of minimum light, chiefly visual, have been obtained over the years. The following table lists the recent photoelectric times of minimum light which have been obtained for this star including five which have been obtained by this investigator.

Hel. JD	E	O - C	Ref.
2439025.3008	0	-0.0017	IBVS No.148
32.4730	6	-0.0010	148
62.3562	31	+0.0010	148
68.3316	36	+0.0001	148
784.2876	635	+0.0015	322
877.514	713	-0.0016	285
40054.4168	861	+0.0042	456
127.3742	922	+0.0044	456
274.3375	1045	-0.0011	501
519.3669	1250	+0.0021	530
746.4607	1440	-0.0016	530
758.4125	1450	-0.0023	530
819.3702	1501	-0.0023	530
1162.406	1788	-0.0032	647
1199.4583	1819	-0.0037	647
1708.6392	2245	+0.0008	-
1726.5680	2260	+0.0008	-
1732.5442	2265	+0.0008	-
1990.7188	2481	+0.0014	-
2094.7056	2568	+0.0015	-

A least squares solution with all data given equal weight yields the following ephemeris:

$$\text{Hel. Min I} = \text{JD } 2439025.3025 + 1^{\text{d}}.1952499 \cdot E$$

$$\pm \quad 6 \pm \quad \quad \quad 4 \text{ p.e.}$$

For RZ Cas the following magnitudes and colors have been obtained.

	V	B-V	U-B
maximum	6.18	+0.14	+0.08
primary	7.72	+0.22	+0.14
secondary	6.26	+0.12	+0.07

The depths of the minima are as follows:

	V	B	U
minimum I	1 ^m 54	1 ^m 62	1 ^m 68
minimum II	0.08	0.06	0.05

Although the primary minimum of RZ Cas has been suspected of being a complete occultation, these data prove that the eclipses cannot be complete. The values of B-V and U-B at primary minimum are completely incompatible with those of a K-type subgiant.

AR Lacertae is a 6th magnitude eclipsing binary system, consisting of a G2 subgiant and a KO subgiant. As a comparison star the investigator has used the F8 star HD 210731, whose magnitudes and colors he has determined as V = 7.37, B - V = +0.57, and U - B = +0.07.

AR Lacertae is also known to have a variable period. The following table lists the recent photoelectric times of minimum light which have been obtained for this star including five which have been obtained by this investigator.

Hel. JD	E	O - C	Ref.
2439376.4926	0	-0 ^d .0029	IBVS No. 201
383.4386	3.5	+0.0019	201
876.268	252	+0.0065	456
2440932.3168	784.5	+0.0020	817
1592.7219	1117.5	+0.0019	-
1593.7124	1118	+0.0008	-
1604.6224	1123.5	+0.0032	-
1936.8022	1291	-0.0028	-
1938.7874	1292	-0.0008	-

A least squares solution, in which the time of the primary minima were given double the weight of the shallower secondaries, yielded the following ephemeris:

$$\text{Hel Min. I} = \text{JD } 2439376.4955 + 1^{\text{d}}.9831987 \cdot E$$

$$\pm \quad 15 \pm \quad \quad \quad 15 \text{ p.e.}$$

One thing that is apparent from the residuals is that those for primary minimum tend to be negative while those for secondary tend

to be positive. Excluding the evidently imprecise results for JD 2439876, the times of primary minimum have an average residual of $-0^{\text{d}}.0014$ while the times of secondary have an average of $+0^{\text{d}}.0022$. This difference of $0^{\text{d}}.0036$ implies that secondary minimum occurs 5.2 minutes after 0.50 phase or at a phase of 0.5018. A small orbital eccentricity is indicated.

For AR Lacertae the following magnitudes and colors have been obtained.

	V	B-V	U-B
maximum	6.11	+0.72	+0.26
primary	6.77	+0.83	+0.50
secondary	6.43	+0.71	+0.22

The depths of the minima are as follows:

	V	B-V	U-B
minimum I	$0^{\text{m}}.66$	$0^{\text{m}}.77$	$1^{\text{m}}.01$
minimum II	0.32	0.31	0.27

AR Lacertae has complete eclipses, the primary being an occultation and the secondary a transit. The primary eclipse is total for 129 minutes, and during that time only the KO component is visible. The values of B-V and U-B obtained for primary minimum are normal for a star of this type.

AR Lacertae has recently been discovered to be a source of radio outbursts. The observations of this investigator, however, do not indicate substantial short-term light fluctuations.

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