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PHOTOMETRIC VARIATION OF ZETA AURIGAE

Zeta Aur is a prototype for a group of long period spectroscopic (and eclipsing) binary systems that consists of a K-type supergiant and a B-type main sequence companion. Before and after the eclipses in these systems, the light of the hot secondaries shine through the extended atmospheres of K-type supergiants. The Zeta Aur system has been studied in detail since Harper (1924) first discovered it to be an eclipsing binary. The primary is a K3 or K4 Ib or II type star (Wright 1970), and the secondary is a B7 V star (Wright 1970; Faraggiana and Hack 1980). For a more complete early bibliography on the system see Wilson (1960), Wright (1970), and Hack and Stickland (1987).

To investigate the nature of the photometric variations outside the eclipses of Zeta Aur, we have observed the system with UBV filters attached to the photoelectric photometer of the 30 cm Maksutov Telescope of Ankara University Observatory. Lambda Aur was taken as comparison star. A sequence; comparison-comparison sky-variable-variable sky-variable-comparison-comparison sky in each of the three filters was followed to secure on differential observation in the sense of variable minus comparison. Thus, altogether 56 differential magnitude measurements in each bandpass were obtained on 23 nights in 1982 and 1983. The individual differential magnitudes (a few measurements per night) were corrected for differential atmospheric extinction and the times of measurement were reduced to heliocentric Julian date. The nightly mean observations were listed in Table 1 and plotted in Figure 1 against the heliocentric Julian date.

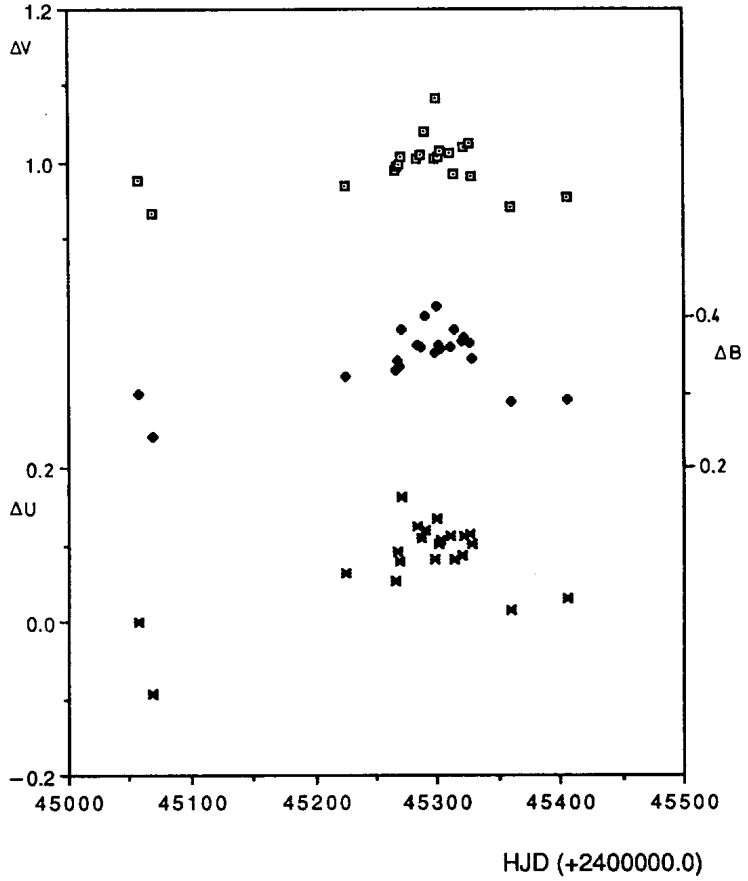

Figure 1. The nightly mean UBV observations of Zeta Aurigae.

Although we have no observations between HJD 2445069 and 2445224, a periodic light variation with an amplitude around $0^m.1$ in all three bandpasses is seen in Figure 1. It seems the amplitude of the variation increases towards the shorter wavelengths. The 1982 eclipse of the secondary by the supergiant occurred on 9 th August but unfortunately we have no observations during the eclipse. A preliminary period analysis of our observations for the low amplitude long term variation yields two probable periods: 151 days and its double 302 days. The true period is more probably around 300 days.

Table 1. The nightly mean UBV observations of Zeta Aurigae.

HJD	DV0	DB0	DU0
45057.2360	-0.977	-0.298	+0.000
45068.3055	-0.933	-0.241	+0.094
45224.5912	-0.969	-0.321	-0.065
45265.6013	-0.991	-0.328	-0.054
45267.4122	-0.996	-0.341	-0.093
45268.4956	-0.996	-0.333	-0.079
45271.3300	-1.007	-0.382	-0.164
45283.4022	-1.004	-0.360	-0.125
45286.3371	-1.010	-0.359	-0.110
45289.3310	-1.040	-0.398	-0.121
45298.4594	-1.004	-0.350	-0.082
45299.3175	-1.083	-0.412	-0.136
45300.4175	-1.008	-0.360	-0.101
45302.3812	-1.014	-0.355	-0.107
45311.2721	-1.012	-0.358	-0.113
45313.2580	-0.984	-0.380	-0.082
45320.2965		-0.366	-0.087
45321.2515	-1.019	-0.370	-0.111
45326.2642	-1.024	-0.364	-0.116
45327.2850	-0.981	-0.342	-0.103
45360.4640	-0.941	-0.287	-0.015
45405.2723	-0.954	-0.290	-0.031

Although Hutchings and Wright (1971) suggested that such light variations in these systems should come from the H-alpha emission region with a radius of 150 $R_\odot$, surrounding the Be components, we believe that a pulsation of cool supergiant in these systems is involved in the observed photometric variations. The K supergiant component of Zeta Aur is probably a semiregular low amplitude red variable, like α Herculis, with a pulsation period greater than 100 days.

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