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THE PERIOD CHANGE OF RT Aur: AN UPDATE

RT Aur (HR 2332) is a 3.73 classical Cepheid which is of some interest because it occupies a point in the Cepheid instability strip on the HR diagram that is very nearly the same as that occupied by Polaris. The two stars are both naked-eye objects of very low reddening, have the same value of $<B-V>_o$ (Fernie 1990) and nearly the same period (3.97 for Polaris.) A remarkable difference between them, however, is that RT Aur has a V-mag amplitude of 0.8 mag, while Polaris now has an amplitude $\leq$ 0.01 mag (Fernie, Kamper, and Seager, in press.) As detailed in Fernie et al, they are not at the edge of the instability strip.

In pursuit of other similarities or dissimilarities between the stars, I took note of Polaris having a well-documented rate of period increase (Arrelano Ferro 1983) and decided to examine the period change, if any, of RT Aur. This had already been done by Szabados (1977), who compiled O-C data going back to 1897 which suggested the star had shown a small period jump around JD 2430000, but that otherwise the period(s) had been constant. Szabados' own data, however, are now 20 years old, and since then new photoelectric data or sources not then available to Szabados have been obtained. I detail these below and combine them with the earlier data to update our knowledge of RT Aur's period change.

The additional data I have used are those of Kelsall (1971), Feltz and McNamara (1980), Evans (1976), Moffett and Barnes (1985), and Eggen (1985). I used the well-defined lightcurve of Moffett and Barnes as a template to fit to the other data sets where these were less complete. The observed times of maximum V light so obtained were:

Kelsall:	2438692.624 $\pm$ 0.041	E = -813
Feltz & McNamara:	2440131.746 $\pm$ 0.048	-427
Evans:	2440970.569 $\pm$ 0.041	-202
Moffett & Barnes:	2444079.920 $\pm$ 0.015	+632
Eggen:	2444523.920 $\pm$ 0.015	+751

The cycle count, E, is on Szabados' system.

Combining these results with the other 66 in Szabados' Table 23, and assigning a weight of 3 to photoelectric determinations and 1 to visual determinations, the best fitting linear ephemeris was JD_{max} = 2441723.726 + 3.7282205 E. The O-C residuals from this fit, although small and with considerable scatter, show a trend suggestive of a higher-order term being present. I have formed normal points in bins of 2000 cycles, and these are shown in Figure 1 with a second-order polynomial fitted by least-squares. This leads to an ephemeris for the time of maximum V light that is

$$\begin{array}{rcccc} JD = & 2441723.663 & + & 3.728166\ E & - & 8.3\cdot10^{-9}\ E^2 \\ & \pm\ 19 & & 12 & & 1.8 \end{array}$$

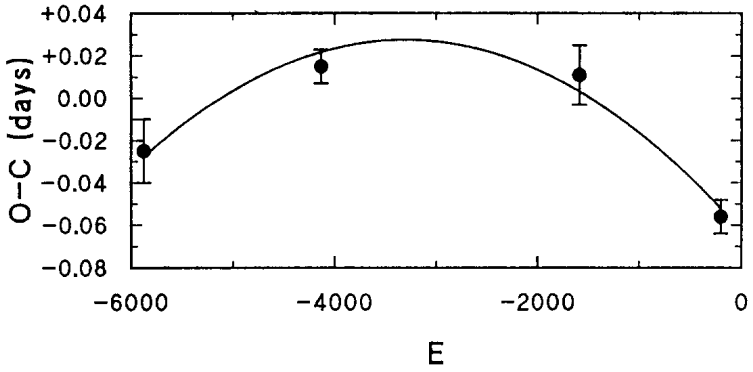

Figure 1

RT Aur thus has a rate of period change, $dP/P = -4.6 \cdot 10^{-9}$ or -0.14 sec/yr. This is among the smaller values known, although not as small as the value of -0.089 sec/yr known for δ Cep. By contrast Polaris shows a value of +3.3 sec/yr. The two stars do, therefore, differ significantly in their rate of period change. As discussed in Fernie et al, however, this is unlikely to be related to their relative amplitudes.

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