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DETERMINING THE PERIOD OF AN ECLIPSING BINARY: V1094 Tau = DHK41

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V1094 Tau = DHK41 = SAO 76494 is a ninth-magnitude star of spectral type G0 at RA $4^h9^m6^s$ DEC $+21°49'11''$ (1950). It was discovered to be an eclipsing variable by Kaiser in October 1994 from patrol photographs. A period of 3.176 day was published after several eclipses were observed visually (Kaiser 1994). Initially it was thought to be a possible member of the Hyades star cluster. Subsequent analysis suggests that if true, it would be on the outer reaches of the far side of the cluster.

Continued visual and photoelectric observations in 1995 revealed that the 3.17 day period was actually not the true period, but the interval between the secondary minimum and the following primary minimum in an eccentric orbit. Using the time of the discovery photograph, two visual and three photoelectric times of minima a new period of 4.49407 day was published (Kaiser et al., 1995).

In 1996 Larry Marshall, of Gettysburg College, informed us that his colleagues had been conducting a radial velocity study of this system and that the 4.49 day period was actually in error and that the true period is double that figure (Marshall, 1996). Doubling the period revealed that all observations to date fit both periods. The main change in the light curve was to shift the secondary eclipse from phase 0.3 to phase 0.65. The other obvious change was to widen the observational gaps in the light curve.

In January of 1997 two new times of minimum were determined by the Kwee–Van Woerden (1956) method. The first by Frey using his .51 meter telescope and SSP3 photoelectric photometer. The second by Kaiser using his .35 meter telescope and ST6 CCD. GSC 1263 606 was used as an comparison star in both cases. These data were combined with the earlier times for a least squares solution. The photoelectric/CCD data were given a weight of 10, the visual data 2, and the discovery photograph 1. The result refined the period to the sixth decimal. Table 1 lists the new O−C's. Figures 1 and 2 plot the data from Kaiser et al. phased to the new period.

$$\text{New Elements} \quad \text{Min. I} = \text{JD}\,2\,449\,701.7059 + 8^d.988487 \times \text{E} \qquad (1)$$
$$\pm 0.0003 \pm 0.000007$$

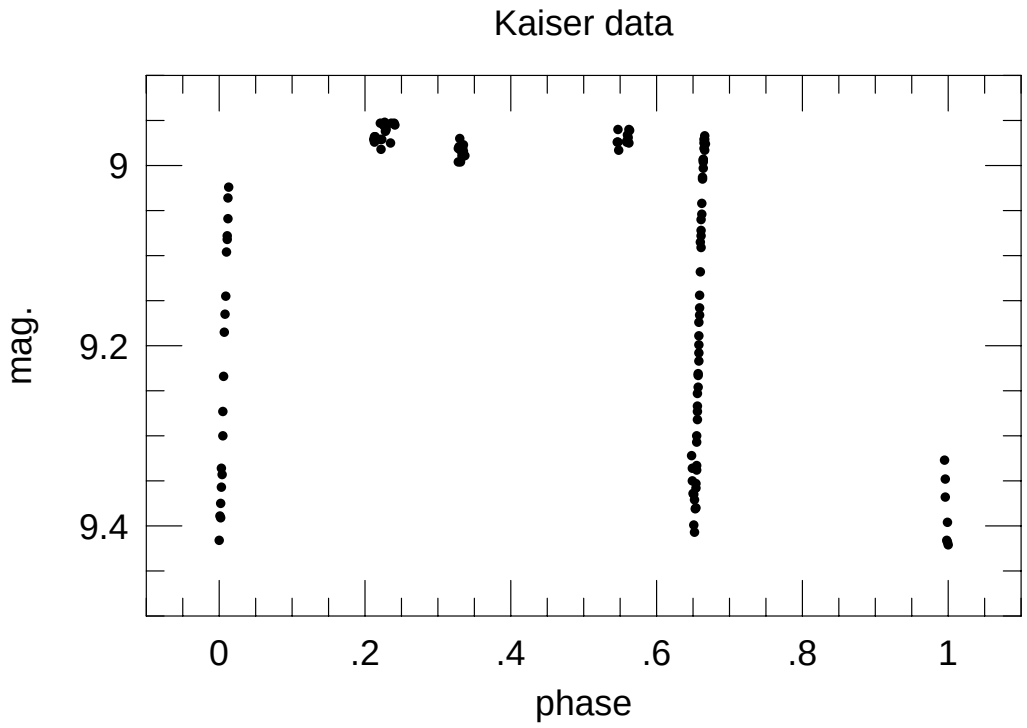

Figure 1.

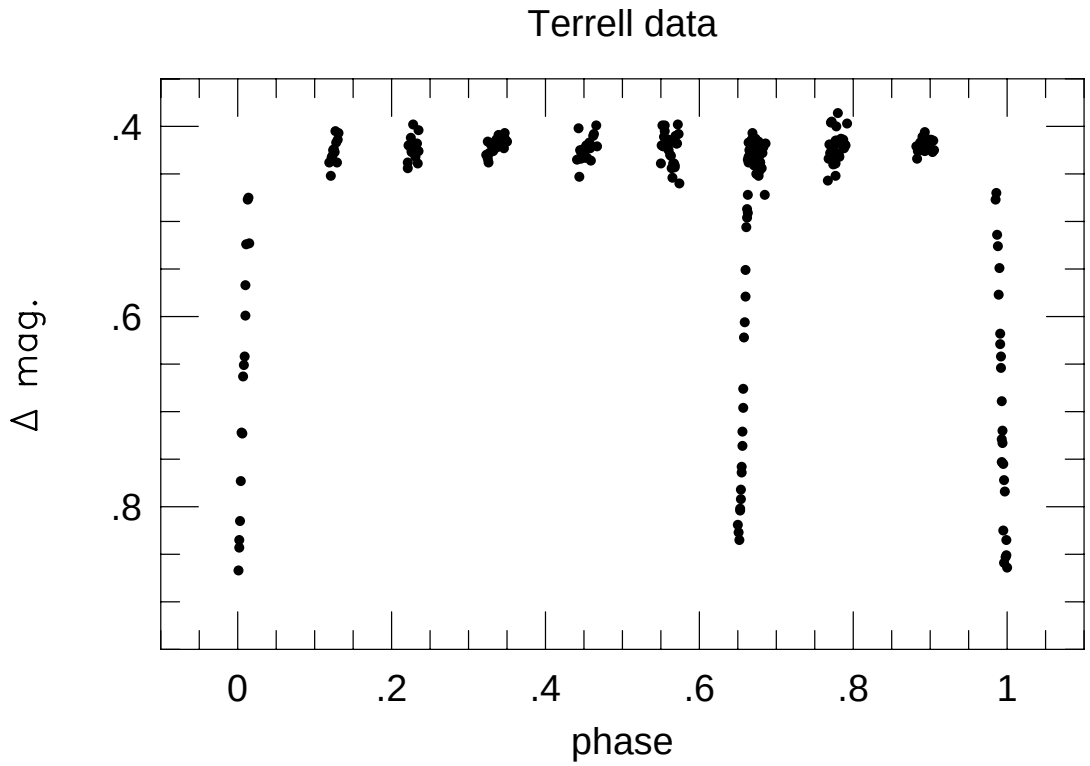

Figure 2.

Table 1: Comparison of observed minus calculated times of minima

HJD	Epoch	O−C	Observer
49602.846	−11	+0.013	Kaiser discovery ptg
49656.762	−5	0.001	Baldwin visual
49683.727	−2	−0.002	Baldwin visual
49701.7061	0	0.000	Terrell pep
49710.6950	+1	0.001	Kaiser pep
49755.6355	+6	−0.001	Kaiser pep
50456.7393	+84	0.000	Frey pep
50474.7156	+86	0.000	Kaiser CCD

Observations spanning nearly 100 cycles show that V1094 Tau is an Algol type eclipsing binary with an eccentric orbit, apparently equal eclipses with a period very close to nine days exactly. All of these factors contributed to the difficulty in determining the true period. With a spectral type of G0, it just qualifies as one of a handful of known detached late-type main-sequence eclipsing binaries.

References:

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