THE MASSES AND THE RADII OF THE COMPONENTS OF U CEP

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This system needs no introduction after the publications of Batten (1974) and of Hall (1975). According to Plavec (1983) the spectral type of the primary is B8 V.

Tomkin (1981) obtained simultaneously the radial velocities of the primary (≡ RV1) and the secondary (≡ RV2) of U Cep in the near-infra red, which resulted in the following parameters (in km/s):

$K_1 = 105 \pm 8$ (1a) $\gamma_1 = 19 \pm 7$ (1b) for all ϕ
$K_2 = 182 \pm 3$ (2a) $\gamma_2 = -1 \pm 2$ (2b) $-0.35 < \phi < +0.35$
From the slope of the RVC2 around $\phi = 0$, he finds:
$K_2 = 171 \pm 9$ (3a) $\gamma_2 = -7 \pm 1$ (3b) $-0.05 < \phi < +0.05$ (3c)

The ($M/M_\odot$; $R/R_\odot$) values as published by Tomkin are (4.2; 2.7) for the primary and (2.6; 4.9) for the secondary.

We have tried to reanalyse Tomkin's data. First of all we note that by adding one observed point at each side of the interval (3c), (3a) changes into
$K_2 = 182.5 \pm 5.5$ (4a); $\gamma_2 = -6.9 + 1145 * \Delta\phi$ (4b); $-0.083 < \phi < +0.095$
where $\Delta\phi$ is a possible phase difference between the phases as calculated by Tomkin using Hall and Keel's (1977) ephemeris (obtained from photoelectric measurements between 1972 and 1976) and the real ephemeris during the observations of Tomkin from 1977 to 1979. Note that K_2 according to (4a) now equals (2a).

We also have tried to fit visually the observed RV2 points between $0 < \phi < 0.5$ and $-0.5 < \phi < 0$ into each other by mirroring the latter one once with respect to the abscissa and once with respect to the ordinate. We find:

$$K_2 = \begin{cases} 193 & (5a) \\ 189 & (6a) \end{cases} \quad \gamma_2 = \begin{cases} +4.75 & (5b) \\ +2.25 & (6b) \end{cases} \quad \text{and} \quad \Delta\phi = \begin{cases} +0.009 & (5c) \\ +0.007 & (6c) \end{cases}$$

with a preference for the upper solution. From this exercise we learn that for a reliable mathematical solution the following RV2 observa-

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tions have to be skipped (consecutive numbers in Tomkin's Table 1): 11, 12, 20, 22 and 25 and also those in the intervals $-0.42 < \phi < -0.36$ and $+0.36 < \phi < +0.42$ **(7)**. These intervals were also skipped by Tomkin for his RV2 solution.

From the slope of the RVC1 around $\phi = 0.5$ we find:
$K_1 = 57 \pm 4$ (8a) $\gamma_1 = 11.6 + 358.5 * \Delta\phi$ (8b) $+0.38 < \phi < +0.64$
Formulae (4b) and (8b) result in $\gamma_1 = \gamma_2 = 18.6$ for $\Delta\phi = 0.02$ **(8c)**. Result (8a) differs quite a bit from that of (1a). Now the observed RV1s in the interval $-0.225 < \phi < +0.205$ have to be treated with caution not only with respect to the rotational effect. Hardie (1950) already studied this extensively and proposed a procedure to correct for the asymmetries in the H lines. He published corrected RV1 values and new parameters for Struve's (1944) observations as well as for his own measurements. It is clear from Hardie's work, that Tomkin's RV1 observations in the interval $-0.225 < \phi < 0.205$ **(9)** have to be deleted for the RVC solution.

We have reinvestigated the RV values corrected by Hardie (1950) assuming circular orbits with a general program in which the RVC1 and RVC2 (having the same γ) are fitted simultaneously and in which the parameters $\gamma_1 = \gamma_2$; K_1; K_2 and $\Delta\phi$ (or some subset) can be left free. Table 1 gives a summary of several results for Struve's and Hardie's observations.

	Struve (1944) observations			Hardie (1950) observations		
	orig.	acc. to Hardie (1950)	this paper	not corr.	corr.	this paper
K_1(km/s)	120	85±4	90±3	122	85±2	84±3
γ_1(km/s)	-5	0±5	-3±2.5	+13	+22±3	26±2.5
$\Delta\phi$	0	0	0.0005 ± 72	0	0	0.053 ± 8

As can be seen, the corrected RV1's result in K_1 values $\leqslant$ 90 km/s.

With the restrictions (7) and (9), Tomkin's data are reduced in the same way as indicated above. The results are (in km/s except for $\Delta\phi$):

$K_1=78.7\pm4.1$ $K_2=188.2\pm3.7$ $\gamma_1 = \gamma_2 = 6.5\pm2.8$ $\Delta\phi=0.011\pm0.003$

The mass ratio, q, is now 0.42 ± 0.03 instead of 0.62.

With these data and the V light curve measurements of Markworth (1979) as input values the RVCs of Tomkin [taking into account (7) and (9)] and Markworth's photoelectric results are solved simultaneously with the latest version of the Wilson & Devinney program (Wilson, 1979). Preliminary results are (applying first a phase correction of - 0.011 on Tomkin's data):

$K_1 = 92.0$ $K_2 = 191.1$ $\gamma = 6.7$ $q = 0.48$

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$M_1 = 3.95\ M_\odot$; $R_1 = 2.45\ R_\odot$; $M_2 = 1.9\ M_\odot$; $R_2 = 4.35\ R_\odot$; $T_{eff2} = 4830$ K

[assuming $T_{eff1} = 11250$ K, Plavec (1983)].

For a discussion of these results, see Heintze's paper in these proceedings concerning the Utrecht Photometric System.
In Figure 1, Tomkin's RV observations as used in this investigation (filled circles, the open symbols are not used) are shown together with the solution.

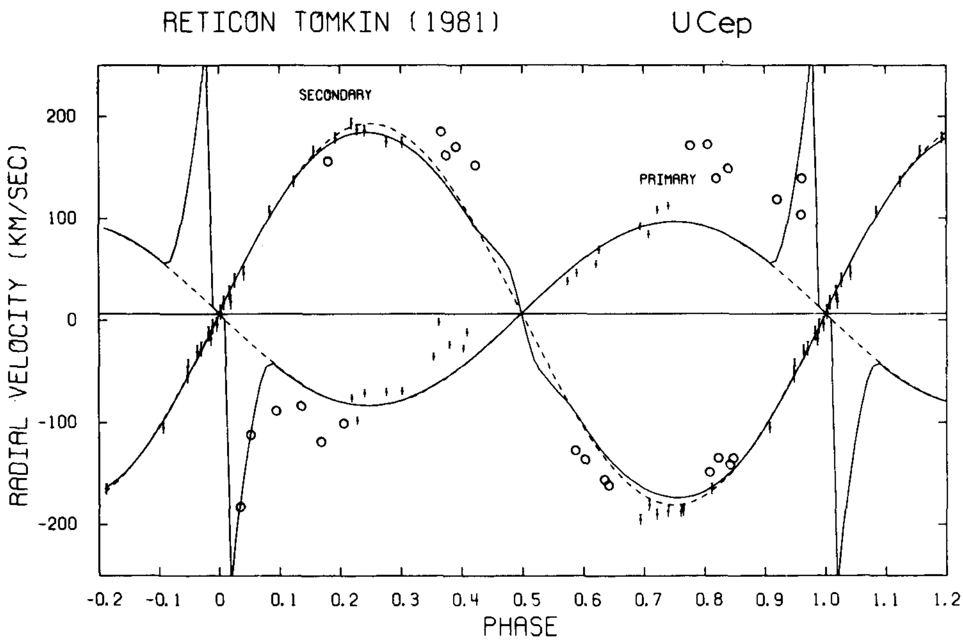

Figure 1. The observed RV's according to Tomkin (1981) (the open symbols represent observations not used to find the solution) and the solution found. The full-drawn-line is the solution assuming the primary to rotate 5 x faster than the synchronous velocity and the secondary to rotate with synchronous angular velocity. The dashed line is a sinusoidal solution.

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