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ORBITAL ELEMENTS OF SB2 SYSTEM 66 Eri

YUSHCHENKO, A.V.[1]; GOPKA, V.F.[1]; KHOKHLOVA, V.L.[2]; TOMKIN, J. [3]

[1] Astronomical observatory of Odessa National University, park Shevchenko, Odessa, 65014, Ukraine, e-mail: yua@lens.tenet.odessa.ua

[2] Institute of Astronomy, Russian Academy of Sciences, Pyatnitskaya 48, Moscow, Russia, e-mail: vlk@khokh.msk.ru

[3] Department of astronomy, University of Texas, Austin, TX 78712, USA

The first orbit of 66 Eri (EN Eri) was published by Frost & Struve (1924). They measured hydrogen-core lines and very few other lines. Young (1976) on the base of 15 radial velocities obtained from 13 Å/mm spectra have found a new orbit (P_{orb}=$5\overset{d}{.}522731$) and pointed that the chemical composition of the components is different. He used Frost & Struve (1924) radial velocities in combination with his own data to improve the determination of period. He used 24 separate line pairs for radial velocity measurements, including Fe II, Ti II, Ni II, Si II, Sr II, Ca II, Mg II lines.

Schneider (1987) observed 66 Eri in *uvby* photometric system and reported finding of weak variability ($0\overset{m}{.}002$ in v and $0\overset{m}{.}005$ in u) with the period of $7\overset{d}{.}8586$. In GCVS EN Eri is designated as a variable star of α^2 CVn type. The system has been observed in wide range of wavelengths from X-rays to far infrared.

Yushchenko et al. (1998) found the effective temperatures and surface gravities of the components (T_{effA}=11100±100 K, T_{effB} =10900±100 K, lgg=4.2 for both components) and found preliminary chemical composition of the components. Yushchenko et al. (1999) published detailed spectroscopic investigation of 66 Eri based on spectral observations with resolution $\Delta\lambda/\lambda$=36000. They determined chemical composition of the components, and it appeared that each component was a peculiar star, but each in a different way. Secondary component showed strong lines of heavy elements, while the primary one showed only a small overabundance of barium. Woolf & Lambert (1999) analyzed Hg abundances in a set of HgMn stars, using spectra with resolution $\Delta\lambda/\lambda$=160000-190000. They included 66 Eri B in their set of HgMn stars. 66 Eri A was included for comparison with 66 Eri B. Woolf & Lambert (1999) confirmed the different Hg abundances in the components of 66 Eri: 5.83 for component B and less than 2.2 for A.

Yushchenko et al (1999) analyzed *HIPPARCOS* photometry and found light variation with an amplitude near $0\overset{m}{.}005$. They tried to find the period of light variation, it appears that the period is equal to one half of orbital period and no significant peaks were found near $7\overset{d}{.}86$.

The phase shift of *HIPPARCOS* light curve plotted with the period equal to one half of the orbital period and two precision radial velocities obtained from spectra with resolving power 36,000 and S/N>100 (see Yushchenko et al., 1999) permit us to claim that our value of orbital period is more accurate than that given by Young (1976).

In this investigation we used 5 high-dispersion echelle spectra of 66 Eri obtained at 2.7 meter telescope of McDonald observatory with a spectral resolution of 60,000 and S/N ratio =>100. We used URAN software (Yushchenko, 1998) and synthetic spectra of the components calculated by Yushchenko et al. (1999) for processing the spectra and line identification. Only unblended lines of Fe II were used for radial velocity measurements. The technique of decomposition of a spectrum on Gaussian components was used (Casatella, 1976). This method permits one to find wavelengths of spectral lines with high precision. The obtained radial velocities were averaged with weights inversely proportional to the width of the spectral order contained a line used. Results of radial velocity measurements are given in Table 1, where one can find heliocentric Julian dates of the observations and exposure times (in seconds), mean radial velocities (in km/s), numbers of used lines and errors of weighted means (in km/s) for each component of the system.

Table 1. Radial velocities

$HJD_\odot$	Exposure	V_{r1}	N	σ	V_{r2}	N	σ
2450689.989	120	−79.5	19	0.2	+139.7	19	0.3
2450690.982	300	−4.6	17	0.2	+67.0	28	0.1
2450691.990	180	+96.3	22	0.3	−30.5	24	0.2
2450692.986	240	+124.6	14	0.2	−59.4	28	0.2
2450693.977	240	+57.7	27	0.2	+5.3	25	0.2

The orbital elements were obtained by a least-squares adjustment to our 5 radial velocities, 2 radial velocities obtained by Yushchenko et al. (1999) and 15 values from Young (1976), with weights inversely proportional to squares of their formal errors. The results and their errors are given in Table 2 together with Young (1976) results.

Table 2. Orbital elements of 66 Eri

	This work		Young (1976)	
P, $days$	5.522599	0.000006	5.522731	0.000009
T, $HJD_\odot$	2441384.11	0.05	2441384.13	0.1
e	0.087	0.004	0.095	0.01
w, ^{o}	160.3	3.4	161	6
K_1, km/s	102.7	0.7	103.8	1.3
K_2, km/s	100.5	0.7	100.7	0.7
γ, km/s	32.4	0.3	32.6	0.8
$a_1 sin\ i$, km/s	7.77×10^6	0.05×10^6	7.85×10^6	0.1×10^6
$a_2 sin\ i$, km/s	7.60×10^6	0.05×10^6	7.61×10^6	0.06×10^6
$M_1 sin^3 i$	2.35	0.03	2.38	0.05
$M_2 sin^3 i$	2.40	0.03	2.45	0.05
M_1/M_2	0.98		0.97	

The comparison of our results with Young's (1976) solution of the orbit shows an excellent agreement for all elements. The errors of our solution are significantly smaller.

Frost & Struve (1924) data are well fitted by our elements. Fig. 1 show all available observations of radial velocities of 66 Eri. Phases were calculated with our elements.

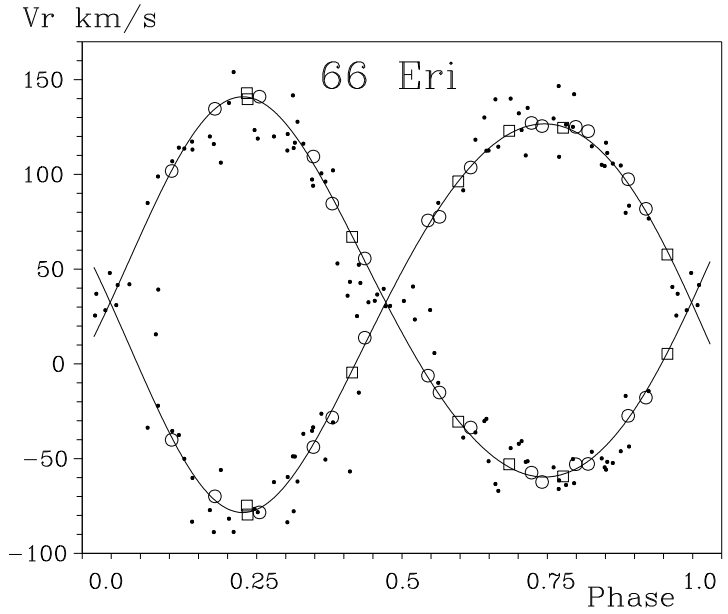

Figure 1. Radial velocity curves for 66 Eri. Solid lines are the velocity curves calculated with our new elements. Frost & Struve's (1924) data are marked by points, Young's (1976) data - by circles, data from Yushchenko et al. (1999) and this work are marked by squares.

The inclination of the orbit and hence the question of synchronization of rotation and orbital motion of the components of this binary still remains doubtful until the light variation found by Yushchenko et al. (1999) from *HIPPARCOS* data will be confirmed by more precise photometry and more reliable estimation of the distance will be available.

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