For a parallax of 0.″150 the mass of the invisible component is 0.1 ⊙, if we adopt the mass of 0.8 ⊙ for each of the two visible components.

The total range in the radial velocity curve is approximately 4 km/sec.

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61 CYGNI AS A TRIPLE SYSTEM

BY K. AA. STRAND

Extensive photographic observations of high accuracy taken at the Potsdam, Lick, and Sproul observatories have revealed perturbations in the orbital motion of 61 Cygni which are caused by a third, invisible member revolving around one of the two visual components.

The only solution which will satisfy the observed motions gives the remarkably small mass of 1/60 that of the sun or 16 times that of Jupiter. With a mass considerably smaller than the smallest known stellar mass (Krüger 60 $B = 0.14\odot$), the dark companion must have an intrinsic luminosity so extremely low that we may consider it a planet rather than a star. Thus planetary motion has been found outside the solar system.

An extensive investigation of the motion in the large orbit is being carried out at the Sproul Observatory. Though not yet completed, the following dynamical elements represent closely the observed arc: $P = 720$ yrs., $e = 0.40$, $a = 24.''554$, $T = 1690$. These elements, together with a parallax of 0.″294, give a total mass, $M_A + M_B + M_C = 1.12\odot$.

The relative motion of the perturbed component with respect to the center of mass of itself and the invisible component, C, has the following dynamical elements: $P = 4.9$ yrs., $e = 0.7$, $a = 0.''020 \pm 0.''003$ (m.e.), $T = 1942.0$.

Since only the positions of A and B relative to each other

TABLE I

Measured Positions of *B* Relative to *A* in 61 Cygni

Epoch	*X*	(m.e.)	*Y*	(m.e.)	Residuals				Plates
					Triple System		Double System		
1914.670	+18″048	±0″005	−14″952	±0″005	+0″006	+0″004	−0″003	+0″010	7 Potsdam
1915.700	.040	.006	15.116	.006	− .007	+ .004	− .005	+ .010	5 Potsdam
1916.727	.053	.007	.283	.007	+ .004	+ .002	+ .015	+ .006	4 Potsdam
1917.627	.025	.009	.433	.008	0	+ .001	− .006	0	2 Potsdam
1918.729	18.002	.006	15.603	.007	− .005	+ .001	− .021	+ .005	3 Potsdam
1935.496	17.798		18.193		+ .004	− .014	+ .008	− .008	2 Potsdam
1937.665	.735	.004	.500	.004	+ .005	+ .004	− .011	+ .005	5 Lick
1939.667	.696	.005	.792	.005	− .004	0	− .008	+ .006	4 Sproul
1940.609	.691	.004	18.932	.004	+ .002	− .004	+ .008	+ .002	6 Sproul
1941.571	.668	.003	19.066	.003	− .005	+ .008	+ .007	+ .010	6 Sproul
1942.606	17.620	0.004	19.221	0.004	−0.002	−0.003	−0.018	−0.002	3 Lick
Median error	±0″0055				±0″006		±0″010		

are known, no decision can be made regarding which of the two components *C* is attached to. This is, however, of minor importance for the determination of the mass of *C* because *A* and *B* are nearly equal in mass. Using the masses derived below we obtain in either case, $M_C = 0.016\ \odot$, hence *C* is revolving in an orbit with a semi-major axis of approximately 0″70 or 2.4 astronomical units. On account of the orbit's large eccentricity, *C*, at periastron, is only 0.7 A.U. from its visible companion.

The two visible components have visual magnitudes of 5.57 and 6.28 and spectra of type K6 and M0. With a parallax of 0″294 and reductions of —0.80 and —1.2 mag. to bolometric magnitudes we obtain the absolute bolometric magnitudes of 7.1 and 7.4. From Eddington's mass-luminosity curve the masses are $M_A = 0.58\ \odot$ and $M_B = 0.55\ \odot$, hence the total mass of the system is $1.15\ \odot$, practically identical with the value for the mass derived from the dynamical elements and the same parallax.

Since the total range in the radial velocity of the visual

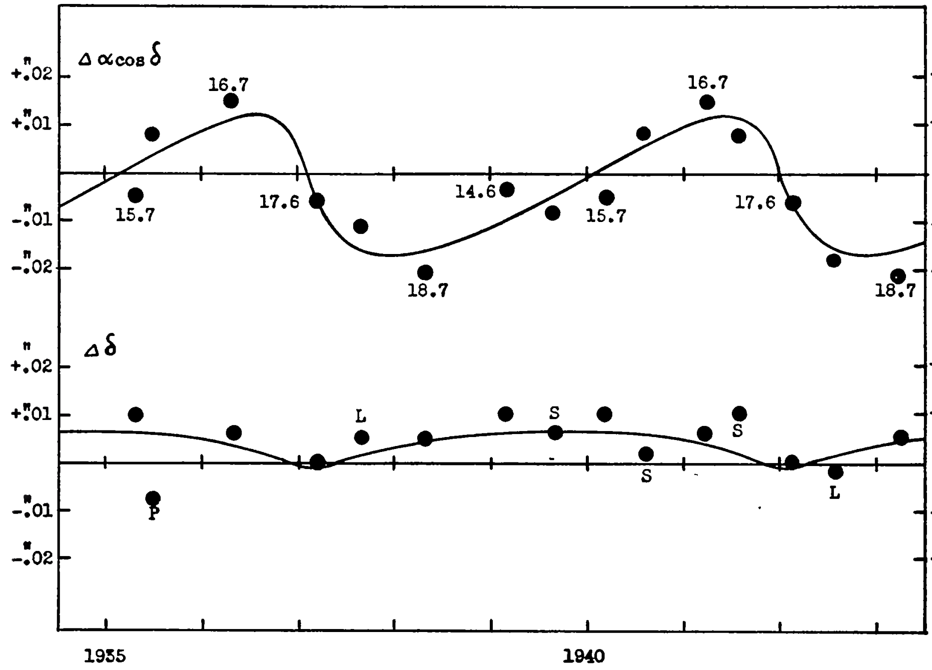

FIG. 1.—The 4.9-year period. The numbered dots refer to Hertzsprung's Potsdam plates; a whole number of periods was added to their epochs. The plates observed after 1935 are marked with letters indicating the observatories at which they were taken.

components caused by the invisible companion amounts to about 1 km/sec, spectroscopic observations can hardly be expected to reveal to which component C is attached.

The interpretation of the observed motion in the small orbit as the motion of the effective center of light of two luminous components with respect to their common center of gravity has to be rejected since the small orbit would require components with nearly equal luminosity ($\Delta m = 0.10$ at the most) to give possible masses. This, however, would give a total mass of no less than $1.50 \odot$ from Eddington's curve or $0.38 \odot$ in excess of the total mass found from the dynamical elements.

The photographic observations used in establishing the perturbation are given below for the equinox of 2000 and with corrections for the perspective effect and proper motion to the mean epoch 1930. If no perturbation is accounted for, the median mean error as computed from the residuals is increased from 0″006 to 0″010.

A great part of the preliminary computations for the large orbit was done by Miss Virginia Burger who also made the second complete set of measures of the Sproul plates. I am indebted to Dr. H. M. Jeffers for the use of the photographic plates taken at the Lick Observatory in 1942.

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THE DISTRIBUTION OF LUMINOSITY IN THE PLANETARY NEBULA NGC 6572

BY CARL K. SEYFERT

The pioneer work of W. H. Wright[1] indicated that monochromatic images of a planetary nebula in various radiations may not be identical in size. Sometime later L. Berman,[2] who investigated the distribution of luminosity in several planetary

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[1] *Lick Obs. Pub.*, **13**, 192, 1918.

[2] *Lick Obs. Bull.*, **15**, 86, 1930.