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SPECTROSCOPIC EVIDENCE FOR THE BINARY NATURE OF THE Ap STAR ET ANDROMEDAE

There are many indications in the literature that the Ap star ET And (= HD 219 749 = HR 8861 = BD +44^{o}4373) is variable with the typical amplitudes $\sim 0.02^{m}$ (V), $\sim 0.03^{m}$ (B) and $\sim 0.05^{m}$ (U) - see Renson (1977). Kizilirmak and Wood (1967) found the variability in their Hβ and Hγ photometry: $\Delta\beta=0.035^{m}$ and $\Delta\gamma=0.049^{m}$. Several periods of light variability were suggested by various authors, namely 0.723^{d}, 1.616^{d} and 2.604^{d}, but some of these periods must be definitely spurious since they are interrelated by Tanner's (1948) formula. Recently, Sezer (1978) found a period of 0.49925 days from his ubv photometry. Moreover, Panov (1978) claims that he has found short-time variability in UBV with a fundamental period of about 140 minutes and two harmonics at 70 and 35 minutes.

Scarce spectroscopic data published until now (Palmer et al., 1968 and Hube, 1970) revealed some variations in radial velocities. We have obtained 23 high-dispersion spectrograms in coudé focus of the Ondřejov 2m telescope between July 1974 and September 1978 with dispersions from 0.85 to 2.4 nm mm^{-1} in blue and red regions of the spectrum. Radial velocities were determined from the repeated measurements of the hydrogen lines on the Abbe comparator and on the microdensitometer tracings. Probable error of one measurement of unit weight was 3,4 km s^{-1}. Radial velocities were determined by using a code written by Dr. P. Harmanec. The results are given in Table 1 where also the data from Hube's (1970) paper are added.

We have then searched for periodicities in radial velocities in the time interval from 0.5 to 2000 days employing Dr.Harmanec's version of Morbey (1978) method. No periodicities suggested by the photometric data were found. However, the period of about

48 days is clearly present in the data.

Table 1

J.D. 2400 000.0+	RV_{obs} (km s^{-1})	O–C (km s^{-1})	Cycle No.	Phase
36461.6860	15.0	5.6	-150	0.735
36470.6900	33.0	-0.5	-150	0.921
36509.5710	14.0	5.4	-149	0.726
36535.5960	- 7.0	7.2	-148	0.265
37864.8490	6.0	-8.1	-121	0.783
37867.8220	15.0	-6.7	-121	0.845
38990.7850	-14.0	-6.2	- 97	0.093
38993.7690	-12.0	1.9	- 97	0.154
39059.5670	-15.0	-10.1	- 96	0.516
42251.4414	0.7	1.3	- 30	0.595
42251.5331	0.3	0.9	- 30	0.597
42427.2617	-17.3	-2.7	- 26	0.235
42631.5417	- 5.4	1.9	- 22	0.464
42631.5743	- 8.9	-1.6	- 22	0.465
42636.5434	5.6	7.9	- 22	0.568
43016.3858	-12.9	-4.2	- 14	0.431
43016.5254	- 7.8	0.8	- 14	0.434
43389.5535	-15.4	-1.5	- 6	0.157
43393.4036	- 8.1	6.5	- 6	0.236
43448.4113	- 5.0	5.9	- 5	0.375
43454.3076	- 8.0	-2.2	- 5	0.497
43747.3747	- 7.9	-5.5	0	0.564
43748.4595	- 5.0	-3.9	0	0.587
43748.6060	- 8.9	-7.9	0	0.590
43757.4098	16.0	3.0	0	0.772
43757.5355	15.0	1.8	0	0.775
43760.4967	24.0	3.5	0	0.836
43760.6078	28.0	7.2	0	0.838
43767.4261	30.0	-4.3	0	0.980
43768.3011	27.0	-1.5	0	0.998
43768.5886	32.4	6.4	1	0.004

Thus the radial velocity data from Table 1 were used for the calculation of the spectroscopic binary orbit by a code written by Dr. J. Horn.

Elliptical orbit for a single-line spectroscopic binary yields the following elements (p.e. are quoted throughout):

Period = (48.304 ± 0.007) days

T (epoch of periastron passage) = (2 443 720.11 ± 0.64) J.D.

T (max. RV) = 2 443 718.00 J.D.

T (min. RV) = 2 443 730.10 J.D.

T (pri. min.)= 2 443 721.76 J.D.

T (sec.min.) = 2 443 708.11 J.D.

ω = ($49.8^{\circ} \pm 6.0^{\circ}$)

ε = (0.50 ± 0.05)

K_1 = (25.7 ± 2.0) km s^{-1}
V_o = $(+2.6 \pm 0.7)$ km s^{-1}
f(m) = 0.0554 $M_\odot$
$a_1 \sin i = 14.8 \times 10^6$ km

Phases in Table 1 are computed from the time of periastron passage and O-C are referred to the above-mentioned elements; (see also Fig.1 where dots represent Hube's data and open circles refer to our Ondřejov measurements).

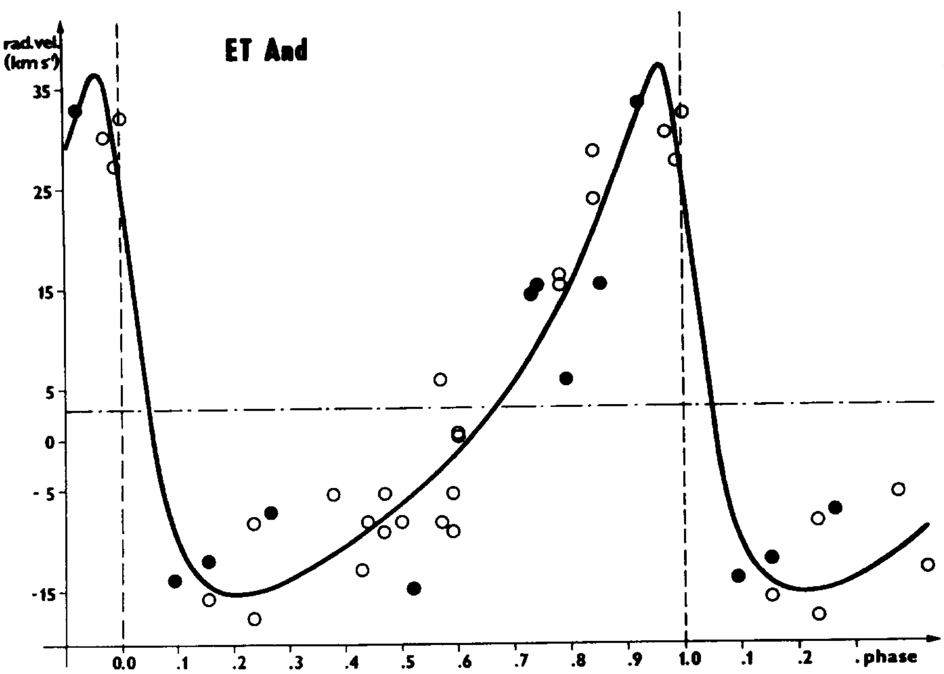

Fig. 1. Radial velocity curve of the Ap star ET And.

Further spectrographic observations, particularly in phases 0 to 0.1, would help to improve the orbit and to clarify whether the rather high eccentricity found in our solution is intrinsic. Photometry of the star extended over a long time span would be obviously most useful.

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