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HD 104901B AN F-TYPE SUPERGIANT ECLIPSING BINARY

HD 104901B has been classified FOIb-II by Stephenson and Sanduleak (1973), FOIb/III by Houk and Cowley (1975) and FOIIp by Gahm, Ahlin and Lindroos (1983). The star is 23 arcsec south of the B8Ib/II supergiant HD 104901A. The pair forms Dunlop 117 and the separation has remained fixed for over a century. Observations in 1978 and in 1980 indicated possible variability and the star was monitored for a week in 1981, but significant variation was not noted. However a long run of observations in 1982 and 1983 revealed a variation of 0.35 mag. The intermediate-band and β observations are listed in Table I and a few (R,I) observations are in Table II. The adopted light elements, max = JD 2445065.0 + 106.6 days were used to compute the phases and the results are shown in Figure 1. A value of P = 53.3 days can not be entirely rejected without additional observations, although the distinct difference in width of the two minima makes the shorter period unlikely. The observations cover a span of 4 years so the periodicity is well established. The star is most likely an eclipsing binary. The components are probably near contact and the slight reddening, shown by (b-y), at both eclipses is normal for such systems.

The behaviour of the β index in Figure 1 is of some interest. There is obviously strong Hβ emission at some phases and this is confirmed by the spectra taken by Gahm et al.(1983);

Table I

Intermediate band and Hβ Observations of HD 104901B

JD 244	V	b-y	M_1	C_1	β	Phase
3637.660	$7^m.67$	$0^m.370$	$0^m.050$	$1^m.572$	2.593	0.610
3638.650	7.69	0.374	0.057	1.562	2.596	0.620
4305.720	7.76	0.381	0.057	1.522	2.608	0.878
4421.605	7.65	0.364	0.075	1.615	2.625	0.964
4670.700	8.00	0.374	0.060	1.470	2.576	0.300
4694.760	7.66	0.359	0.059	1.605	2.618	0.527
4695.795	7.66	0.363	0.063	1.604	2.614	0.537
4698.774	7.65	0.369	0.059	1.575	2.624	0.565
4702.785	7.66	0.370	0.063	1.545	2.604	0.612
5019.854	7.62	0.364	0.054	1.568	2.624	0.576
5020.847	7.66	0.371	0.050	1.544	2.635	0.586
5025.788	7.76	0.373	0.059	1.540	2.588	0.632
5026.785	7.80	0.386	0.056	1.524	2.586	0.642
5032.750	7.97	0.391	0.074	1.472	2.598	0.697
5049.778	7.77	0.372	0.075	1.579	2.599	0.857
5050.740	7.75	0.373	0.073	1.539	2.601	0.866
5051.757	7.75	0.371	0.064	1.567	2.598	0.876
5057.726	7.64	0.354	0.070	1.593	2.600	0.930
5058.705	7.65	0.366	0.059	1.593	2.598	1.941
5068.667	7.66	0.365	0.059	1.545	2.588	0.035
5069.642	7.69	0.370	0.053	1.603	---	0.044
5070.656	7.70	0.366	0.067	1.577	2.601	0.053
5083.698	7.84	0.385	0.076	1.426	2.592	0.175
5090.719	7.91	0.375	0.076	1.452	2.569	0.240
5091.670	7.93	0.382	0.068	1.499	2.553	0.250
5119.569	7.65	0.364	0.053	1.664	2.626	0.512
5150.521	7.84	0.374	0.092	1.500	---	0.802
5151.510	7.84	0.369	0.073	1.550	2.635	0.812
5152.528	7.81	0.385	0.073	1.543	2.619	0.820
5153.503	7.80	0.370	0.079	1.539	2.607	0.830
5353.854	8.01	0.364	0.115	1.415	2.593	0.710
5366.847	7.83	0.380	0.072	1.498	2.599	0.832
5376.805	7.68	0.375	0.066	1.598	2.599	0.925
5377.812	7.72	0.365	0.057	1.629	2.605	0.934
5378.851	7.66	0.363	0.074	1.608	2.624	0.944
5382.858	7.67	0.347	0.069	1.623	2.587	0.982
5383.840	7.67	0.350	0.071	1.669	2.606	0.991
5384.833	7.67	0.355	0.072	1.636	2.606	0.000
5385.840	7.66	0.352	0.062	1.604	2.611	0.010
5386.809	7.67	0.360	0.065	1.591	2.601	0.019
5403.802	7.87	0.391	0.076	1.408	---	0.178
5412.760	7.90	0.382	0.058	1.467	2.545	0.262
5429.667	7.75	0.380	0.064	1.610	---	0.421
5430.625	7.73	0.382	0.060	1.613	2.582	0.430
5450.569	7.77	0.375	0.058	1.528	2.604	0.617
5451.587	7.76	0.378	0.054	1.523	2.584	0.626
5459.691	7.93	0.384	0.053	1.448	---	0.703
5467.639	7.96	0.393	0.075	1.395	2.593	0.777
5493.542	7.69	0.353	0.080	1.687	2.587	0.020

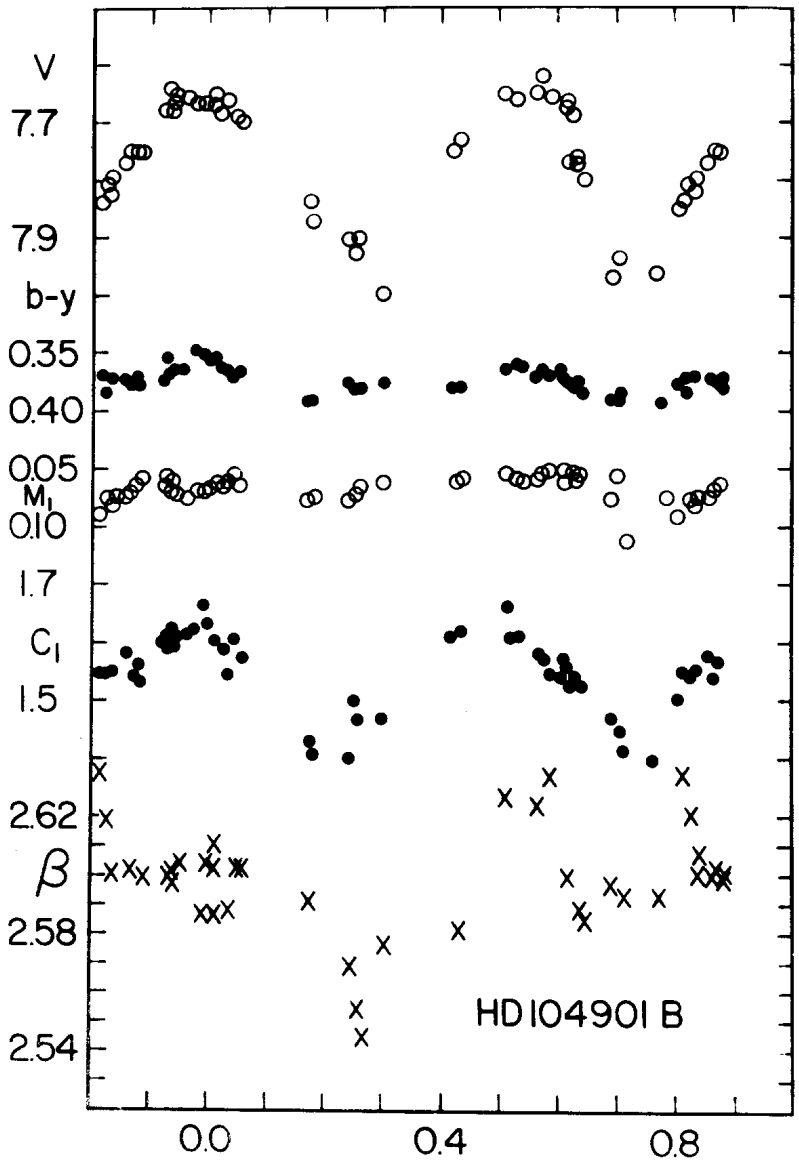

Figure 1

Light and color curves for HD 104901B

Table II

JD 244	R	R-I	Phase
5074.697	$7^m.54$	0.219	0.091
5089.680	7.63	0.237	0.232
5381.872	7.37	0.230	0.972
5411.680	7.61	0.244	0.252

"Hα, Hβ and Hδ lines show distinct P Cygni profiles with a sharp edge between the emission and absorption components. The peak of the emission components is red-shifted by 90 km/sec relative to the stellar radial velocity as determined from the metallic lines." A striking feature of the β index is the relative stability with phase and the behaviour of the Hβ emission must be characterized by some regularity. The run of the β values in the figure also supports the long period with the largest values of β (smallest, or non-existent, emission) bracketing the second minimum and the strongest emission (smallest values of β) occuring near the first minimum.

The photometric parameters of the A component (HD 104901, CPD - 61°3933) are listed in Table III. Applying the reddening

Table III

Photometric Parameters for HD 104901A

V	b-y	M_1	C_1	β	Δ[a]	No.
7.43	0.204	0.021	0.790	2.630	2.5.5.2	7

E(b-y)	[u-b]	M_V	V_0	Mod.	Sp.T.[b]
0.240	0.913	-2.9	6.4	9.3	B8Ib/II

[a] Mean difference in observed values of (b-y), M_1, C_1 and β.

[b] Houk and Cowley (1975).

and modulus to HD 104901B gives (b-y) = 0.115 mag. and M = -2.7 mag at maximum light. A third component of Dun 117, 26 arcsec north of HD 104901A and apparently a background early type star, gives (V, b-y, M_1, C_1, β) = (10.19, 0.136, 0.026, 0.219, 2.650) mag from 7 observations, yielding E(b-y) = 0.220 mag, M_V = -2.15 mag and a modulus of 11.4 mag. The 10 brightest members of NGC 4103, which is 5° north, give E(b-y) = 0.211 ± 0.015 (σ) mag and a modulus of 11.45 ± 0.25 (σ) mag from observations by Stetson (1981). NGC 4755 (κ Cru cluster) is 6° north-east with a reddening of E (b-y) = 0.230 ± 0.20 (σ) mag and modulus of 11.4 mag, derived from observations by Shobbrook (1983). The clusters may be part of the association Cru OBI at a distance of 1.9 kpc and containing Dun 117C.

Although there is no reason to doubt the validity of the distance derived from HD 104901A, 0.72 kpc, or the assumption that the A and B components are at the same distance, it should be noted that a distance of 1.9 kpc for all three components is not contradicted by other available evidence. Values of M_V = -5.0 and -5.2 mag for components A and B, respectively, do not disagree with the wide luminosity class limits imposed by the available spectral classifications, quoted above.

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