Rev. Mexicana Astron. Astrof., 16, 7-12 (1988)

PHOTOELECTRIC PHOTOMETRY OF THE DWARF CEPHEID AD CMi

E. Rodríguez, A. Rolland, and P. López de Coca

Instituto de Astrofísica de Andalucía, Spain

Received 1987 November 30

RESUMEN

Una nueva fotometría fotoeléctrica *uvbyβ* de la Cefeida Enana AD CMi se ha llevado a cabo. Se han obtenido seis nuevos máximos de luz. El análisis de los máximos de luz sugiere la posibilidad de una efemérides cuadrática para AD CMi. Se han determinado los siguientes parámetros físicos: Te = 7550 K, log g = 3.83 y M_V = 1.68 mag. Con el método Wesselink se obtiene un radio de 2.8 $R_\odot$ y una masa de 1.9 $M_\odot$.

ABSTRACT

New *uvbyβ* photoelectric photometry of the Dwarf Cepheid AD CMi has been carried out. Six new times of maximum light have been obtained. Analysis of the times of maximum light suggests the possibility of a quadratic ephemeris for AD CMi. The following physical parameters have been determined: Te = 7550 K, log g = 3.83 and M_V = 1.68 mag. Wesselink's method provides a radius of 2.8 $R_\odot$ and a mass of 1.9 $M_\odot$.

Key words: **PHOTOMETRY – STARS-δSCUTI – STARS-PULSATION**

I. INTRODUCTION

The light variability of AD CMi (HD 64191) was discovered by Hoffmeister (1934) and confirmed by Zessewitch (1950) who considered it to be an eclipsing variable of Algol type. Abhyankar (1959) obtained a complete light curve and calculated the elements of the orbit finding that AD CMi is an ultrashort-period variable. New light curves were obtained by Anderson and McNamara (1961). Breger (1975) observed again the light variation and obtained a linear ephemeris but he did not find evidences that AD CMi may be a star belonging to population II. The star is rather a normal δ Scuti except for the large amplitude of the light variation. Finally, Balona and Stobie (1983) report new light and radial velocity curves.

II. OBSERVATIONS

The observations were carried out on March 1984, by using the simultaneous *uvbyβ* Strömgren photometer and the 75-cm telescope at the Sierra Nevada Observatory in Spain. Stars BD +2° 1804 (used by Abhyankar) and BD +2° 1822 were used as comparison stars. All data are presented in Table 1 in magnitude differences in Strömgren indices –variable minus BD 2° 1804– vs. Heliocentric Julian Day. In Table 2 the Hβ-values for the variable are presented.

III. RESULTS AND DISCUSSION

Six new times of maximum light of the star have been determined and are listed in Table 3. Each maximum has been derived as an average over the four *uvby* bands.

TABLE 1

DIFFERENCES: AD CMi – BD +2° 1804
(in magnitudes)

HDJ	*V*	(*b*−*y*)	m1	c1
2445766+				
.3497	1.1469	−.1480	.0020	.4787
.3589	1.0477	−.1686	−.0003	.5391
.3674	.9963	−.1762	.0070	.5740
.3731	1.0028	−.2006	.0309	.5913
.3788	1.0187	−.1831	.0102	.5984
.3846	1.0298	−.1907	.0333	.5815
.3922	1.0665	−.1938	.0446	.5459
.3977	1.0816	−.1628	.0098	.5411
.4032	1.1043	−.1517	−.0078	.5650
.4101	1.1345	−.1497	.0086	.5229
.4155	1.1815	−.1552	.0234	.5018
.4211	1.2073	−.1274	−.0040	.4972
.4284	1.2260	−.1025	−.0142	.4621
.4347	1.2721	−.1241	.0128	.4438
.4402	1.2954	−.1277	.0140	.4535
.4476	1.2943	−.1154	.0183	.4043
.4530	1.2810	−.1295	.0259	.4356
.4589	1.2781	−.1323	.0159	.4390
.4647	1.2564	−.1562	.0349	.4233
.4719	1.1917	−.1808	.0428	.4646
.4778	1.1079	−.1699	.0160	.4975
.4856	1.0400	−.1863	.0254	.5376
.4911	1.0142	−.1975	.0339	.5625
.4985	.9877	−.1786	.0023	.6206
.5000	1.0149	−.2047	.0330	.5800
.5016	1.0031	−.1828	.0054	.6120
.5032	1.0278	−.1968	.0279	.5987

TABLE 1 (CONTINUED)

HJD	V	(b−y)	m1	c1
2445766+				
.5098	1.0482	−.1861	.0280	.5616
.5156	1.0683	−.1780	.0220	.5733
.5214	1.0809	−.1697	.0185	.5626
2445767+				
.3837	1.0483	−.1660	.0357	.4958
.3907	1.1135	−.1657	.0213	.5238
.3979	1.1594	−.1446	.0131	.4892
.4034	1.2017	−.1508	.0341	.4521
.4091	1.2244	−.1368	.0334	.4260
.4153	1.2466	−.1224	.0253	.4342
.4224	1.2738	−.1192	.0226	.4038
.4290	1.2983	−.1183	.0186	.4008
.4347	1.2890	−.1240	.0210	.4199
.4405	1.2821	−.1303	.0211	.4391
.4477	1.2498	−.1435	.0236	.4336
.4538	1.1688	−.1321	.0164	.4826
.4672	1.0314	−.1724	.0145	.5224
.4687	1.0142	−.1756	.0020	.5882
.4702	1.0223	−.1913	.0167	.5649
.4754	.9773	−.1798	.0210	.5844
.4791	1.0084	−.2010	.0299	.5905
.4894	1.0238	−.1991	.0406	.5778
.4959	1.0355	−.1676	.0083	.5636
.5046	1.0813	−.1908	.0367	.5479
.5123	1.1060	−.1536	.0082	.5245
.5179	1.1511	−.1672	.0376	.5070
.5235	1.1864	−.1584	.0365	.4633
.5291	1.2078	−.1493	.0318	.4513
.5344	1.2327	−.1269	.0059	.4613
2445768+				
.3265	1.0368	−.1748	.0043	.5460
.3321	1.0113	−.1869	.0122	.5601
.3336	.9969	−.1759	−.0123	.6081
.3352	1.0188	−.2075	.0282	.5911
.3367	1.0070	−.1955	.0046	.6162
.3383	1.0057	−.1921	.0019	.6013
.3398	.9954	−.1876	.0029	.6056
.3414	1.0000	−.1793	.0035	.5814
.3430	.9981	−.1816	.0022	.6013
.3445	1.0133	−.1872	.0044	.5973
.3461	1.0092	−.1870	.0110	.5984
.3477	1.0245	−.1991	.0226	.6047
.3532	1.0350	−.1968	.0378	.5802
.3587	1.0507	−.1820	.0324	.5345
.3791	1.1402	−.1427	.0033	.5026
.3859	1.1912	−.1385	−.0029	.4896
.3924	1.2137	−.1241	.0046	.4759
.3984	1.2532	−.1177	−.0037	.4723
.4041	1.2668	−.1141	.0118	.4348
.4114	1.3004	−.1097	−.0122	.4613
.4175	1.3013	−.1270	.0061	.4783
.4262	1.2637	−.1304	.0158	.4473
.4392	1.1490	−.1451	.0175	.4382
.4447	1.0830	−.1550	.0178	.4580
.4506	1.0399	−.1977	.0672	.4673
2445768+				
.4521	1.0277	−.1803	.0216	.5269
.4545	1.0130	−.1932	.0441	.5157
.4560	1.0056	−.1953	.0427	.5385
.4576	1.0113	−.1954	.0315	.5476
.4592	.9944	−.1950	.0328	.5678
.4607	.9951	−.2018	.0390	.5597
.4623	1.0009	−.2055	.0424	.5853
.4639	.9973	−.1945	.0315	.5909
.4654	.9976	−.2019	.0434	.5787
.4717	1.0120	−.1930	.0313	.6027
.4798	1.0455	−.1876	.0316	.5721
.4858	1.0693	−.1786	.0191	.5678
.4921	1.0921	−.1707	.0292	.5366
2445769+				
.3633	1.1478	−.1443	.0036	.5137
.3698	1.1955	−.1431	.0193	.4702
.3744	1.2251	−.1434	.0378	.4418
.3776	1.2406	−.1321	.0217	.4487
.3810	1.2584	−.1287	.0216	.4445
.3845	1.2762	−.1228	.0155	.4256
.3879	1.2822	−.1174	.0174	.4081
.3914	1.2795	−.1027	.0074	.3981
.3950	1.3030	−.1142	.0021	.4442
.3985	1.2921	−.1054	−.0009	.4334
.4018	1.2801	−.1180	.0046	.4189
.4053	1.2707	−.1079	.0086	.4073
.4087	1.2690	−.1042	.0020	.4180
.4118	1.2640	−.1331	.0237	.4074
.4155	1.2457	−.1373	.0109	.4480
.4203	1.2083	−.1547	.0213	.4563
.4243	1.1632	−.1574	.0213	.4513
.4275	1.1225	−.1582	.0053	.4874
.4309	1.0746	−.1599	−.0006	.5235
.4342	1.0700	−.2063	.0568	.4978
.4377	1.0289	−.1849	.0110	.5461
.4385	1.0347	−.1938	.0136	.5630
.4400	1.0139	−.1847	.0075	.5742
.4408	1.0190	−.1913	.0050	.5951
.4416	1.0119	−.1878	.0147	.5707
.4430	1.0138	−.2009	.0226	.5895
.4439	1.0105	−.1880	.0001	.6107
.4447	1.0094	−.1894	.0060	.6025
.4455	1.0209	−.2003	.0192	.6049
.4463	1.0128	−.1876	−.0026	.6085
.4471	1.0138	−.1907	.0065	.6094
.4479	1.0019	−.1865	.0071	.6037
.4487	1.0169	−.1921	.0116	.6137
.4545	1.0329	−.1964	.0221	.6050
.4579	1.0309	−.1752	−.0098	.6028
.4611	1.0311	−.1723	.0127	.5782
.4643	1.0546	−.1725	.0138	.5533
.4677	1.0640	−.1708	.0142	.5500
.4712	1.0930	−.1626	.0036	.5384
.4750	1.1021	−.1565	−.0067	.5493
.4782	1.0985	−.1450	−.0011	.5360

→

TABLE 1 (CONTINUED)

HDJ	V	$(b-y)$	m1	c1
2445769+				
.4815	1.1422	-.1698	.0335	.5064
.4849	1.1517	-.1532	.0188	.4838
.4889	1.1710	-.1465	.0227	.4783
.4934	1.2115	-.1566	.0401	.4590
.4975	1.2287	-.1368	.0080	.4888
.5020	1.2534	-.1234	-.0011	.4787
.5057	1.2619	-.1104	-.0118	.4736
.5111	1.2957	-.1288	.0216	.4444
.5153	1.3040	-.1226	.0128	.4526
.5190	1.3062	-.1167	.0031	.4512
.5228	1.3049	-.1315	.0261	.4419
2445771+				
.3454	1.2361	-.1272	.0097	.4690
.3499	1.2629	-.1454	.0555	.4013
.3529	1.2747	-.1285	.0159	.4289
.3559	1.2774	-.1300	.0365	.4053
.3590	1.2989	-.1213	.0008	.4353
.3628	1.2986	-.1254	.0255	.4238
.3658	1.3125	-.1299	.0241	.4199
.3688	1.2978	-.1246	.0165	.4295
.3722	1.2832	-.1229	.0117	.4265
.3752	1.2702	-.1156	.0044	.4128
.3792	1.2732	-.1446	.0344	.4300
.3823	1.2610	-.1416	.0168	.4309
.3856	1.2281	-.1614	.0492	.4229
.3889	1.1779	-.1430	.0046	.4793
.3931	1.1315	-.1542	.0051	.4916
.3961	1.0846	-.1660	.0355	.4487
.3991	1.0717	-.1825	.0404	.4647
.3997	1.0703	-.1841	.0345	.4800
.4004	1.0538	-.1924	.0519	.4942
.4011	1.0364	-.1729	.0176	.5225
.4018	1.0466	-.1844	.0286	.5096
.4025	1.0274	-.1614	-.0087	.5140
.4032	1.0305	-.1907	.0407	.5068
.4039	1.0110	-.1662	-.0010	.5341
.4046	1.0178	-.1857	.0222	.5291
.4053	1.0137	-.1866	.0369	.5094
.4060	.9963	-.1895	.0374	.5213
.4067	.9902	-.1735	.0092	.5714
.4074	1.0072	-.1990	.0417	.5263
.4081	1.0316	-.2245	.0703	.5244
.4088	.9993	-.1906	.0213	.5576
.4095	.9973	-.1836	.0048	.5760
.4102	.9971	-.1979	.0315	.5759
.4109	1.0097	-.1947	.0198	.5660
.4116	1.0084	-.2074	.0427	.5577
.4123	1.0003	-.1922	.0195	.5883
.4130	.9952	-.1901	.0153	.5890
.4158	1.0118	-.2119	.0555	.5737
.4188	1.0057	-.1954	.0318	.5807
.4218	1.0310	-.2020	.0338	.5743
.4248	1.0242	-.1945	.0444	.5654
.4285	1.0348	-.1883	.0333	.5690
.4316	1.0502	-.1821	.0235	.5776
.4347	1.0528	-.1680	.0118	.5416

HJD	V	$(b-y)$	m1	c1
2445771+				
.4377	1.0661	-.1647	.0334	.5158
.4411	1.1030	-.1858	.0460	.5093
.4448	1.0998	-.1639	.0224	.5142
.4478	1.1181	-.1434	-.0072	.5213
.4509	1.1389	-.1538	.0017	.5233
.4539	1.1710	-.1627	.0146	.5116
.4571	1.1821	-.1510	.0132	.4889
.4613	1.1954	-.1345	.0109	.4669
.4645	1.2129	-.1160	-.0172	.4878
.4677	1.2379	-.1295	-.0051	.4977
.4708	1.2477	-.1008	-.0396	.4881
.4741	1.2521	-.1032	-.0083	.4545
.4771	1.2945	-.1510	.0483	.4241
.4802	1.2933	-.1182	.0085	.4061
.4846	1.2929	-.1251	.0300	.4352
.4877	1.3078	-.1267	.0188	.4066
.4910	1.3211	-.1455	.0317	.4249
.4944	1.3024	-.1404	.0207	.4468
.4976	1.2922	-.1261	.0117	.4386
.5008	1.2566	-.1107	-.0043	.4376
.5046	1.2578	-.1445	.0300	.4211
2445772+				
.3546	1.2887	-.1319	.0362	.4253
.3603	1.2513	-.1261	.0189	.4329
.3660	1.2363	-.1367	.0301	.4404
.3717	1.1874	-.1501	.0283	.4475
.3814	1.0863	-.1580	-.0048	.5074
.3892	.9958	-.1797	.0239	.5423
.3907	.9921	-.1744	.0280	.5067
.3923	.9875	-.1849	.0204	.5642
.3938	.9657	-.1556	-.0190	.5633
.3953	.9845	-.1934	.0329	.5526
.3969	.9742	-.1782	.0045	.5879
.3984	.9860	-.1865	.0190	.5785
.3999	.9936	-.1957	.0237	.5896
.4055	1.0088	-.1853	.0139	.6042
.4299	1.1132	-.1623	.0256	.5170
.4355	1.1389	-.1490	.0054	.5063
.4414	1.1731	-.1337	-.0151	.5218
.4470	1.2176	-.1523	.0347	.4621
.4528	1.2515	-.1524	.0498	.4235
.4596	1.2695	-.1194	.0077	.4324
.4685	1.3012	-.1109	-.0075	.4446
.4750	1.2994	-.1009	-.0273	.4576
.4884	1.2697	-.1401	.0108	.4348
.4942	1.1995	-.1623	.0560	.4305
.5009	1.1199	-.1830	.0617	.4585
.5092	1.0465	-.1766	-.0077	.5682
.5152	1.0202	-.1806	-.0118	.5933
.5168	1.0074	-.1799	-.0085	.5987
.5183	1.0005	-.1894	.0064	.5914
.5199	.9974	-.1742	.0032	.5829
.5214	1.0107	-.1960	.0272	.5713
.5230	.9984	-.1888	.0167	.6113
.5245	1.0149	-.1761	-.0038	.5912
.5260	1.0183	-.1946	.0309	.5690

TABLE 2

PHOTOMETRY OF AD CMi
(in magnitudes)

HJD	Hβ	HJD	Hβ	HDJ	
2445766+					
.3597	2.7832	.4799	2.8044	.4615	2.8047
.3682	2.8189	.4902	2.7814	.4631	2.8140
.3739	2.7871	.4966	2.8078	.4647	2.8194
.3929	2.7786	.5054	2.7812	.4662	2.8018
.3985	2.8008	.5131	2.7479	.4726	2.7784
.4040	2.7863	.5187	2.7535	.4866	2.7712
.4162	2.7425	.5243	2.7738	.4929	2.7720
.4219	2.7639	.5298	2.7288		
.4291	2.7497			2445772+	
.4355	2.7247	2445768+		.3553	2.7206
.4410	2.7071	.3273	2.7977	.3667	2.7374
.4483	2.7379	.3328	2.8223	.3725	2.7514
.4538	2.7573	.3344	2.8058	.3822	2.7693
.4597	2.7498	.3359	2.8254	.3899	2.7735
.4786	2.7860	.3375	2.8222	.3915	2.7889
.4919	2.7731	.3391	2.7927	.3930	2.7931
.5024	2.7818	.3406	2.8228	.3946	2.8062
.5040	2.8047	.3438	2.8184	.3961	2.8035
.5106	2.7869	.3453	2.8025	.3977	2.7729
.5164	2.7830	.3469	2.7895	.4007	2.8110
.5221	2.7697	.3540	2.7973	.4062	2.8123
		.3595	2.7784	.4363	2.7662
2445767+		.3799	2.7425	.4421	2.7413
.3725	2.7971	.3866	2.7541	.4477	2.7364
.3915	2.7867	.3933	2.7698	.4536	2.7684
.3986	2.7712	.3992	2.7099	.4604	2.7218
.4042	2.7635	.4049	2.7145	.4693	2.7280
.4099	2.7187	.4122	2.7430	.4758	2.7522
.4161	2.7751	.4184	2.7450	.4828	2.7552
.4232	2.7300	.4270	2.7368	.4950	2.7754
.4298	2.7450	.4400	2.7635	.5017	2.7444
.4354	2.7244	.4455	2.7708	.5100	2.7661
.4485	2.7341	.4514	2.7781	.5160	2.7865
.4679	2.8012	.4530	2.8085	.5175	2.7775
.4694	2.7918	.4552	2.7780	.5206	2.8054
.4709	2.7927	.4568	2.7995	.5222	2.7768
.4762	2.7829	.4584	2.8227	.5237	2.7932
.4784	2.7959	.4599	2.8032	.5268	2.7798

Earlier times of maximum were derived from data of Abhyankar (1959), Anderson and McNamara (1961) and Balona and Stobie (1983). In total, times of twenty maxima (from 1959 to 1984) were used for the determination of the ephemeris of the light curve of AD CMi. We adopted as an initial epoch 2436601.8227 (from Abhyankar (1959)) and the initial period 0.12297443 (from Breger (1975)) to calculate the cycles E in Table 3. A least squares solution of the linear ephemeris leads to the following elements:

$$T_0 = \text{HJD } 2436601.8223 \quad (2)$$

TABLE 3

TIMES OF MAXIMA OF AD CMi

	HJD	E (cycle)	$(O-C)_L$ (day)	$(O-C)_q$ (day)
M1	2436601.8227	0	.0003	.0002
M2	2436602.8066	8	.0005	.0003
M3	2436602.9296	9	.0005	.0003
M4	2436604.8971	25	.0004	.0002
M5	2436627.7700	211	.0001	-.0001
M6	2436628.7538	219	.0001	-.0001
M7	2436629.7373	227	-.0002	-.0004
M8	2436629.8602	228	-.0003	-.0005
M9	2436931.762	2683	-.0008	-.0006
M10	2436932.747	2691	.0004	.0006
M11	2436969.762	2992	.0001	.0003
M12	2443182.4297	53512	-.0012	.0005
M13	2443536.3494	56390	-.0019	-.0005
M14	2443536.4727	56391	-.0016	-.0001
M15	2445766.3713	74524	.0014	.0008
M16	2445768.3377	74540	.0002	-.0004
M17	2445768.4606	74541	.0001	-.0005
M18	2445771.4134	74565	.0015	.0009
M19	2445772.3961	74573	.0004	-.0002
M20	2445772.5187	74574	.0000	-.0005

$$P = 0^d.122974446 \quad (6)$$

Residuals $(O-C)_L$ with respect to this linear ephemeris are shown in the third column of Table 3, and are plotted in Figure 1. From this figure it appears that a quadratic fit of the form,

$$T_{max}(\text{Hel}) = T_0 + P_0 E + A E^2$$

and following coefficients:

$$T_{max}(\text{Hel}) = 2436601.8226 \quad (2) + 0.12297431 \, E \quad (2) +$$

$$+ 1.9 \times 10^{-12} \, E^2 \quad (3)$$

fit the data much better than the linear ephemeris. Nevertheless it is necessary to confirm this type of ephemeris with a new set of observations. The residuals $(O-C)_q$ are shown in the last column of Table 3.

The star follows a loop in the color-magnitude plane which indicates, as it occurs usually among this class of variables, that temperature variations are uniform except at the maximum and minimum light.

A reddening of $E(b-y) = 0.017$ mag was derived and an unreddened $(b-y)_0$ was calculated from relations given by Crawford (1975*a*) in Philip, Miller and Relyea (1976). The mean values for the unreddened indices are given in Table 4.

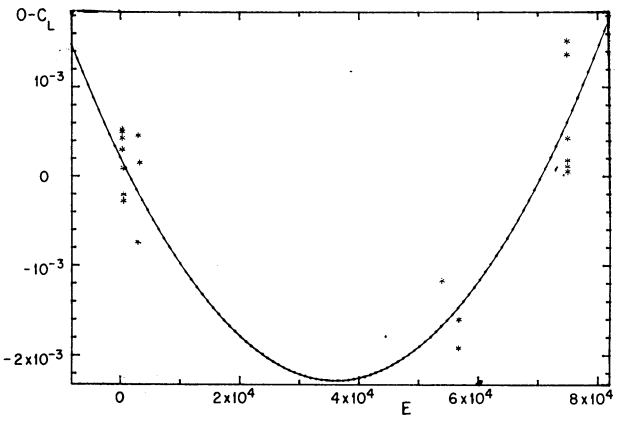

Fig. 1. O−C versus epoch diagram using the linear ephemeris. O−C in fraction of day.

From the formulae given by Petersen and Jørgensen (1972) we find that the temperature of AD CMi varies between 7280 K and 7820 K. The mean temperature averaged over the whole period of pulsation is 7550 K. On the other hand, we find that gravity varies from log g = 3.72 to log g = 3.93, with an average value of log g = 3.83.

By means of formulae given by Crawford (1975*b*) we obtain $M_V = 1.68$ mag. Furthermore, we obtain a $Q_{obs} = 0.037$. This value of the pulsation constant, although higher than normal, is not an unusual value in other δ Scuti stars, as it is the case, for instance, for HR 3185 and HR 7020 (Breger and Bregman 1975) and BD + 43° 1894 (Costa *et al.* 1984), and can be considered as indicative of pulsation in the fundamental mode.

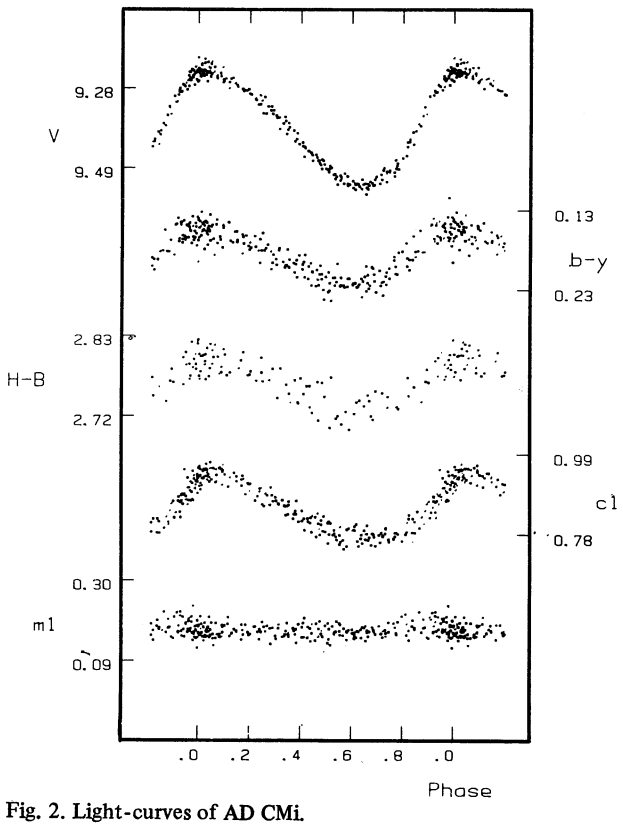

Fig. 2. Light-curves of AD CMi.

TABLE 4

PARAMETERS FOR AD CMi

Parameter	Mean Value	Sigma	Error	Range
V	9.39	± .10	...	9.227 to 9.522
E $(b-y)$	0.017	± .007	...	.002 to .023
$(b-y)_0$	0.168	± .022	...	.132 to .196
m_0	0.185	± .003	...	.181 to .190
c_0	0.85	± .06	...	.780 to .943
β	2.760	± .021	...	2.733 to 2.796
T_e (K)	7550	± 190	...	7280 to 7820
log g	3.83	± .06	...	3.72 to 3.93
M_V	1.68	± .19	...	1.33 to 1.96
Vr (km s^{-1})	38.8	...	± .1	...
$R/R_\odot$	2.77	...	± .21	...
$M/M_\odot$	1.9	...	± .5	...
d (pc)	350	...	± 50	...

The light-curves of AD CMi determined by us are given in Figure 2.

For the determination of the Wesselink (1946) radius we chose the radial velocity values given by Balona and Stobie (1983) and we have made a Fourier analysis to obtain an analytical function of the radial velocity with a mean value of 38.8 km s^{-1}. Inspection of the radial velocity curve shows that the times of maximum light and minimum radial velocity coincide, as usually occurs in Dwarf Cepheids.

On the other hand, the observed displacement of the radius obtained by integrating the radial velocity curve amounts to 42300 km as shown in Figure 3. This observed displacement is not the actual increase of the radius of the star since that is the mean observed value along the line of sight averaged over the whole disc of the star. In order to obtain the true variation in the radius, it is necessary to multiply it by a factor p, the value of which depends on the law of limb darkening for the star. Adopting the value p = 1.34 (Breger 1975) we find 56700 km for the actual variation of the radius of the star. The

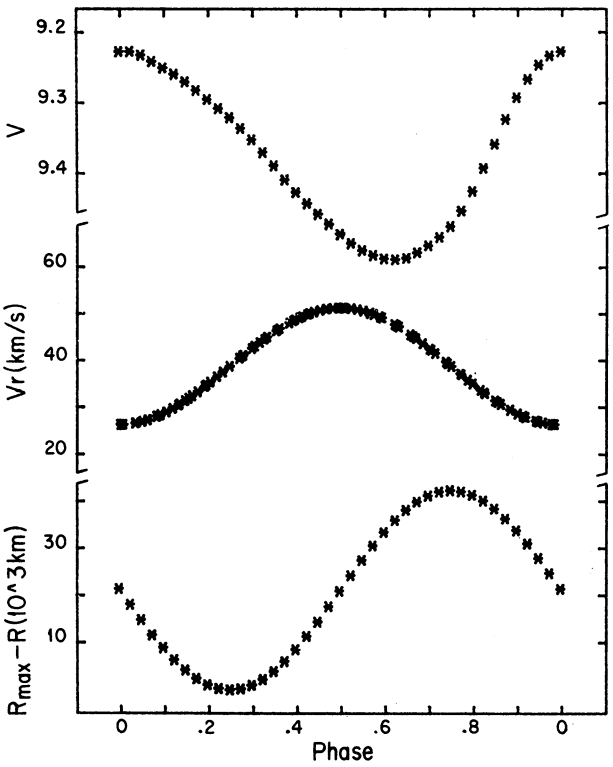

Fig. 3. Observed V, radial velocity and radius variations of AD CMi.

least squares solution of the equations (see Imbert 1981) leads to a radius of 2.77±0.21 $R_\odot$. Furthermore, adopting log g = 3.83, we obtained a mass of 1.9±0.5 $M_\odot$. From Strömgren photometry we derive a radius of 2.37± 0.18 $R_\odot$ and a mass of 1.4±0.4 $M_\odot$ which agree with the above values within the error bars. Table 4 summarizes the values obtained for AD CMi.

After this paper was submitted for publication, we found that additional data on AD CMi were available in a recent paper by Jiang (1987). The citation contains 12 new times of light maximum for AD CMi that were secured during February 1981, December 1985, and January 1986. Jiang suggests a quadratic ephemeris and the pulsation period of this star is continually increasing in agreement with us.

We thank Dr. Garrido for valuable comments during the preparation of this paper. This research was supported by the Comisión Asesora de Investigación Científica y Técnica (CAICYT) under project PR84-0071.

REFERENCES

Abhyankar, K.D. 1959, *Ap.J.*, **130**, 834.
Anderson, L.R. and McNamara, D.H. 1961, *Pub. A.S.P.*, **72**, 506.
Balona, L.A. and Stobie, R.S. 1983, *South African Astr. Obs. Circ. No. 7*, p. 19.
Breger, M. 1975, *Ap. J.*, **201**, 653.
Breger, M. and Bregman, J.N. 1975, *Ap. J.*, **200**, 343.
Costa, V., Garrido, R., López de Coca, P., Peniche, R., Peña, J. H., Quintana, J.M., and Rolland, A. 1984, *Astr. and Ap. Suppl.*, **57**, 233.
Crawford, D.L. 1975*a*, *Dudley Obs. Reports*, **9**, 17.
Crawford, D.L. 1975*b*, *Ap. J.*, **80**, 955.
Hoffmeister, C. 1934, *Ap. J.*, **130**, 824.
Imbert, M. 1981, *Astr. and Ap. Suppl.*, **44**, 319.
Jiang Shi-Yang 1987, *Chin. Astr. and Ap.*, **11**, 343
Petersen, J.O. and Jørgensen, H.E. 1972, *Astr. and Ap.*, **17**, 367.
Philip, A.G.D., Miller, T.M., and Relyea, L.J. 1976, *Dudley Obs. Reports*, **12**, 1.
Wesselink, A.J. 1946, *Bull. Astr. Inst. Netherlands*, **10**, 83.
Zessewitch, B.P. 1950, *Astr. Circ. USSR*, **100**, 18.

Pilar López de Coca, Eloy Rodríguez, and Angel Rolland: Instituto de Astrofísica de Andalucía, Apdo. 2144, Granada, Spain.