PHOTOMETRY OF HU TAURI

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Abstract. Photoelectric observations of the bright eclipsing binary system HU Tauri are presented. The observations were made with standard B and V filters. Observations made during the eclipses yielded six epochs of minimum light. A study of all the available times of minimum light has been made. Analysis of all the photoelectric times of minimum light yielded the following new ephemeris: $JD_{\odot}$ 2441275.3166 + $2^{d}.0563107E$. Asymmetries in the light curves of HU Tauri were noticed.

1. Introduction

The light variability of HR 1471 (HU Tauri, $6^{m}.0$, B9 v) was discovered by Strohmeier (1960). Strohmeier and Knigge (1960) found HU Tauri to be an eclipsing variable with an orbital period of 2.056 days. Mammano *et al.* (1967) found the system to be a single-lined spectroscopic binary and determined spectroscopic orbital elements.

2. Observations

Photoelectric observations of HU Tauri were made with the 38 cm refractor telescope of the Nizamiah Observatory on 24 nights during the period JD 2440981 to JD 2441708. Observations were made through standard B and V filters using an unrefrigerated 1P21 photomultiplier a GR 1230A DC amplifier and Brown Recorder. HR 1472 and HR 1479 were used as the comparison and check stars, respectively (see Table I). A total of 638 blue and 453 yellow observations were obtained. All the observations were corrected for atmospheric extinction using the nightly atmospheric extinction coefficients determined from the observations of the comparison star. After applying the extinction corrections the extra-atmospheric magnitude differences Δm (variable star − comparison star) in blue and yellow light were obtained. The heliocentric Julian day of the observation and differential magnitudes, Δm_b and Δm_v on the instrumental system are listed in Tables IIa and IIb. The magnitude differences between the check star and comparison star were computed from the blue and yellow observations made on 15 nights. From the straight mean of all observations, the magnitude difference between check star and comparison star in blue and yellow light

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TABLE I

Variable and comparison star data

		V	$B-V$	$U-B$	Sp. type
HU Tauri	HR 1471	6.0	−0.06	−0.37	B9 v
Comparison star	HR 1472	5.79	+0.31	+0.06	A8 v
Check star	HR 1479	4.68	+0.16	+0.15	A5 v

TABLE IIa

Blue observations of HU Tauri

JD (Hel.)	Δm_b	JD (Hel.)	Δm_b
2440 981.1456	−0.086	981.2954	0.626
981.1463	−0.086	981.2958	0.624
981.1473	−0.086	981.2996	0.552
981.1644	0.013	981.3000	0.550
981.1658	0.008	981.3049	0.493
981.1702	0.080	981.3053	0.492
981.1709	0.084	981.3114	0.461
981.1760	0.078	981.3118	0.458
981.1764	0.086	981.3173	0.393
981.1822	0.149	981.3176	0.409
981.1829	0.167	983.1500	−0.110
981.1840	0.172	983.1514	−0.088
981.1951	0.295	983.1524	−0.092
981.1958	0.315	983.1597	−0.131
981.1965	0.321	983.1607	−0.143
981.1975	0.324	983.1666	−0.170
981.2034	0.304	983.1680	−0.165
981.2041	0.326	983.1687	−0.173
981.2048	0.326	983.1743	−0.163
981.2104	0.413	983.1750	−0.161
		983.1819	−0.125
981.2107	0.414	983.1826	−0.135
981.2280	0.539	983.1889	−0.123
981.2399	0.621	983.1899	−0.117
981.2405	0.643		
981.2565	0.680	983.1954	−0.111
981.2576	0.678	983.1961	−0.111
981.2621	0.679	983.2010	−0.104
981.2625	0.678	983.2017	−0.099
981.2732	0.623	983.2028	−0.094
981.2736	0.615	983.2071	−0.069
981.2778	0.634	983.2079	−0.053
981.2784	0.631	983.2187	0.0
981.2824	0.632	983.2194	−0.008
981.2829	0.631	983.2253	0.065
981.2875	0.593	983.2260	0.067
981.2878	0.587	983.2322	0.108

Table IIa (*continued*)

JD (Hel.)	Δm_b	JD (Hel.)	Δm_b
983.2326	0.103	010.1447	0.099
983.2378	0.131	010.1451	0.095
983.2382	0.130	010.1460	0.081
983.2392	0.167	010.1562	0.016
983.2399	0.148	010.1569	0.015
983.2461	0.214		
983.2472	0.215	010.1693	−0.052
983.2521	0.258	010.1700	−0.058
		010.1976	−0.157
983.2528	0.263	010.1981	−0.165
983.2676	0.366	010.2080	−0.166
983.2687	0.389	010.2087	−0.148
983.2694	0.381	010.2342	−0.129
983.2711	0.425	010.2349	−0.144
983.2718	0.431	010.2446	−0.125
983.2725	0.446	010.2453	−0.121
983.2794	0.502	010.2553	−0.138
983.2808	0.520	010.2557	−0.120
983.2822	0.536	011.0930	−0.184
983.2826	0.569	011.0941	−0.187
983.2882	0.545	011.1087	−0.171
983.2889	0.568	011.1094	−0.165
983.2899	0.552	011.1247	−0.188
983.2947	0.597	011.1258	−0.197
983.2951	0.596	011.1382	−0.170
983.2961	0.634	011.1393	−0.151
983.2972	0.629	011.1511	−0.192
983.3021	0.650	011.1525	−0.189
983.3024	0.648	011.1532	−0.193
		011.1664	−0.180
		011.1671	−0.186
983.3037	0.655	011.1799	−0.176
983.3090	0.683	011.1809	−0.180
983.3097	0.683	011.1930	−0.223
983.3111	0.683	011.1941	−0.213
983.3118	0.707	011.2055	−0.172
983.3232	0.710	011.2066	−0.184
983.3239	0.717	011.2174	−0.177
983.3246	0.705	011.2180	−0.166
983.3294	0.688	011.2289	−0.130
983.3298	0.677	011.2296	−0.139
983.3301	0.706	012.0819	0.549
983.3308	0.638		
2441 010.1057	0.392	012.0841	0.576
010.1075	0.390	012.0938	0.652
010.1172	0.296	012.0947	0.664
010.1179	0.283	012.1065	0.692
010.1193	0.280	012.1076	0.690
010.1290	0.249	012.1086	0.705
010.1301	0.232	012.1093	0.710

Table IIa (*continued*)

JD (Hel.)	Δm_b	JD (Hel.)	Δm_b
012.1201	0.667	262.2092	−0.180
012.1259	0.668	262.2181	−0.176
012.1281	0.657	262.2301	−0.195
012.1299	0.651	262.2577	−0.232
012.1392	0.587		
012.1399	0.572	262.2630	−0.206
012.1475	0.562	262.2716	−0.191
012.1496	0.530	262.2796	−0.203
012.1604	0.416	262.2859	−0.170
012.1612	0.401	262.2889	−0.219
012.1694	0.368	269.3676	−0.281
012.1722	0.318	269.3996	−0.202
012.1819	0.177	269.4079	−0.173
		269.4155	−0.198
012.1826	0.194	269.4225	−0.195
012.1859	0.141	269.4287	−0.232
012.1961	0.135	269.4371	−0.187
012.1982	0.128	269.3530	−0.223
012.2058	0.046	270.1956	−0.169
012.2083	0.038	270.1961	−0.176
012.2160	−0.002	270.2270	−0.170
012.2183	−0.011	270.2279	−0.169
012.2285	0.002	270.2333	−0.189
012.2306	−0.053	270.2342	−0.179
013.0772	−0.198	270.2390	−0.200
013.0789	−0.169		
013.0890	−0.220	270.2430	−0.168
013.1015	−0.142	270.2472	−0.197
013.1136	−0.196	270.2474	−0.163
013.1143	−0.211	270.2482	−0.169
013.1230	−0.140	270.2529	−0.173
013.1244	−0.160	270.2536	−0.182
013.1305	−0.184	270.2589	−0.185
013.1330	−0.183	270.2601	−0.183
013.1622	−0.140	270.2643	−0.194
013.1640	−0.142	270.2654	−0.180
013.1737	−0.204	270.2707	−0.169
013.1751	−0.184	270.2714	−0.175
014.0889	0.122	270.2764	−0.186
014.0896	0.138	270.2772	−0.188
014.1003	0.194	270.2821	−0.190
014.1010	0.209	270.2828	−0.168
014.1093	0.309	270.2881	−0.170
014.1099	0.317	270.2888	−0.182
014.1197	0.419	270.2953	−0.203
014.1201	0.449	270.2960	−0.203
016.0955	−0.113		
016.0969	−0.115	270.3010	−0.202
016.1044	−0.059	270.3018	−0.153
016.1049	−0.074	270.3071	−0.204

Table IIa (continued)

JD (Hel.)	Δm_b	JD (Hel.)	Δm_b
270.3076	−0.211	274.2275	−0.179
270.3571	−0.201	274.2396	−0.172
270.3586	−0.202	274.2407	−0.166
270.3661	−0.201	274.2613	−0.173
270.3669	−0.219	274.2623	−0.152
270.3725	−0.181	274.2772	−0.167
270.3738	−0.188	274.2786	−0.146
270.3793	−0.162	275.1653	−0.145
270.3800	−0.163	275.1659	−0.151
270.3856	−0.212		
270.3865	−0.194	275.1665	−0.158
270.3875	−0.215	275.1771	−0.136
270.3923	−0.207	275.1778	−0.119
270.3930	−0.207	275.1890	−0.091
270.3974	−0.194	275.1897	−0.078
270.3979	−0.187	275.1908	−0.092
270.4020	−0.215	275.2005	−0.037
270.4029	−0.196	275.2013	−0.026
270.4078	−0.210	275.2165	0.076
270.4090	−0.207	275.2172	0.070
270.4113	−0.210	275.2271	0.149
270.4123	−0.186	275.2279	0.154
270.4252	−0.197	275.2375	0.221
270.4261	−0.190	275.2382	0.234
270.4272	−0.183	275.2494	0.300
270.4585	−0.194	275.2501	0.312
270.4345	−0.191	275.2508	0.314
270.4354	−0.184	275.2608	0.413
270.4370	−0.164	275.2614	0.440
270.4388	−0.176	275.2709	0.494
270.4449	−0.135	275.2716	0.512
270.4456	−0.192	275.2809	0.593
270.4518	−0.170	275.2821	0.593
270.4576	−0.198	275.2863	0.612
270.4636	−0.173	275.2875	0.598
270.4726	−0.197	275.2885	0.612
270.4735	−0.200	275.2997	0.649
		275.3002	0.651
270.4811	−0.169	275.3012	0.666
270.4818	−0.172	275.3019	0.658
270.4890	−0.129	275.3288	0.613
270.4890	−0.129	275.3293	0.622
270.4897	−0.164	275.3392	0.568
274.1885	−0.179	275.3399	0.565
274.1904	−0.157	275.3457	0.477
274.2001	−0.147	275.3462	0.462
274.2008	−0.143	275.3582	0.413
274.2140	−0.173	275.3591	0.419
274.2147	−0.173	275.3684	0.317
274.2268	−0.200	275.3695	0.323

Table IIa (*continued*)

JD (Hel.)	Δm_b	JD (Hel.)	Δm_b
275.3790	0.246	295.3928	−0.206
275.3796	0.236	295.3944	−0.202
275.3905	0.141	295.4036	−0.205
275.3912	0.154	295.4042	−0.208
275.4031	0.040	295.4153	−0.204
275.4038	0.091	295.4160	−0.195
275.4203	−0.053	295.4269	−0.205
275.4211	−0.047	295.4276	−0.210
275.4342	−0.121	349.1797	−0.154
275.4349	−0.128	349.1799	−0.167
275.4514	−0.141	349.1876	−0.155
275.4523	−0.152	349.1883	−0.093
275.4629	−0.169	349.1960	−0.172
275.4634	−0.158	349.1967	−0.193
275.4728	−0.145	349.2050	−0.153
275.4737	−0.150	349.2065	−0.144
295.1616	−0.215	349.2153	−0.115
295.1625	−0.220	349.2160	−0.119
295.1706	−0.184	349.2270	−0.080
295.1714	−0.178	349.2351	−0.040
		349.2360	−0.023
295.1797	−0.193	349.2489	0.046
295.1803	−0.201	349.2499	0.053
295.1914	−0.210	349.2591	0.133
295.1923	−0.210	349.2601	0.147
295.2035	−0.236	349.2707	0.232
295.2077	−0.253	349.2714	0.229
295.2202	−0.244	349.2809	0.315
295.2211	−0.243	349.2818	0.309
295.2326	−0.249	349.2920	0.432
295.2686	−0.203	349.2927	0.422
295.2691	−0.203	349.3036	0.536
295.2782	−0.215		
295.2788	−0.215	349.3042	0.531
295.2884	−0.208	687.1124	−0.190
295.2889	−0.249	687.1131	−0.191
295.3014	−0.216	687.1309	−0.199
295.3021	−0.215	687.1316	−0.204
295.2903	−0.208	687.1424	−0.198
295.3171	−0.209	687.1431	−0.196
295.3185	−0.185	687.2555	−0.217
		687.2565	−0.225
295.3308	−0.194	687.2698	−0.221
295.3313	−0.208	687.2705	−0.217
295.3413	−0.225	687.2806	−0.237
295.3417	−0.226	687.2813	−0.229
295.3527	−0.203	687.2906	−0.210
295.3533	−0.201	687.2913	−0.182
295.3826	−0.192	687.3014	−0.211
295.3831	−0.195	687.3021	−0.224

Table IIa (*continued*)

JD (Hel.)	Δm_b	f (el.)	Δm_b
687.3125	−0.204	694.3046	−0.202
687.3132	−0.203	694.3106	−0.204
687.3220	−0.194	694.3180	−0.204
		694.3305	−0.169
687.3227	−0.194	694.3372	−0.177
687.3373	−0.203	702.1230	−0.210
687.3438	−0.207	702.1237	−0.204
688.1072	−0.218	702.1352	−0.219
688.1159	−0.217	702.1656	−0.227
688.1224	−0.214	702.1742	−0.217
688.1381	−0.196	702.1839	−0.211
688.1453	−0.211	702.2034	−0.220
688.1523	−0.207	702.2102	−0.214
688.1599	−0.214	702.2169	−0.234
688.1702	−0.218	702.2243	−0.200
688.1774	−0.236		
688.2402	−0.188	702.2368	−0.210
688.2461	−0.160	702.2496	−0.195
688.2520	−0.193	702.2604	−0.199
688.2579	−0.196	702.2665	−0.196
688.2641	−0.216	702.2730	−0.190
688.2865	−0.184	702.2788	−0.208
688.2924	−0.182	702.2843	−0.204
688.2980	−0.188	702.2912	−0.182
688.3034	−0.185	702.2977	−0.212
688.3090	−0.182	702.3048	−0.195
688.3142	−0.167	704.2092	−0.217
688.3201	−0.183	704.2098	−0.235
694.1275	−0.224	704.2194	−0.140
694.1283	−0.224	704.2200	−0.140
694.1369	−0.204	704.2288	−0.176
694.1449	−0.211	704.2297	−0.153
694.1518	−0.204	704.2374	−0.184
694.1603	−0.198	704.2381	−0.176
694.1904	−0.205	704.2458	−0.163
694.1999	−0.210	704.2614	−0.176
694.2071	−0.203		
694.2284	−0.208		
694.2350	−0.218	704.2791	−0.184
694.2415	−0.231	704.2846	−0.189
694.2476	−0.184	704.2927	−0.191
694.2536	−0.166	704.2982	−0.133
694.2592	−0.207	704.3041	−0.129
694.2647	−0.175	704.3100	−0.191
		704.3173	−0.189
694.2706	−0.217	705.1168	0.587
694.2766	−0.207	705.1175	0.578
694.2849	−0.200	705.1253	0.625
694.2911	−0.177	705.1548	0.276
694.2973	−0.188	705.1614	0.206

Table IIa (continued)

JD (Hel.)	Δm_v	JD (Hel.)	Δm_v
705.1624	0.207	706.2638	−0.201
705.1694	0.180	706.2690	−0.191
705.1760	0.126	706.2745	−0.221
705.1770	0.140	706.2796	−0.219
705.1867	0.016	706.2886	−0.213
705.1876	0.096	706.2935	−0.196
705.1948	−0.035	706.2995	−0.214
		706.3041	−0.185
705.2296	−0.148	706.0993	−0.180
705.2358	−0.192	707.1141	0.509
705.2569	−0.168	707.1241	0.626
705.2622	−0.191	707.1493	0.664
705.2678	−0.199	707.1572	0.659
705.2788	−0.174	707.1644	0.618
705.2837	−0.161	707.1700	0.573
705.2890	−0.158	707.2014	0.355
705.2996	−0.168	707.2075	0.300
705.3052	−0.143	707.2128	0.267
705.3105	−0.159	707.2176	0.217
706.0999	−0.192	707.2231	0.147
706.1076	−0.185	707.2280	0.110
706.1092	−0.204	707.2337	0.111
706.1174	−0.181	708.1126	−0.070
706.1245	−0.178	708.1458	−0.179
706.1532	−0.193	708.1531	−0.159
706.1596	−0.169		
706.1664	−0.188	708.1607	−0.133
706.1726	−0.174	708.1617	−0.126
		708.1682	−0.143
706.1806	−0.184	708.1744	−0.171
706.1863	−0.198	708.1804	−0.176
706.1917	−0.201	708.1866	−0.164
706.1974	−0.219	708.1918	−0.140
706.2027	−0.023	708.1970	−0.149
706.2039	−0.013	708.2022	−0.163
706.2139	−0.158	708.2210	−0.179
706.2194	−0.196	708.2216	−0.157
706.2306	−0.192	708.2242	−0.173
706.2320	−0.219	708.2508	−0.174
706.2375	−0.197	708.2555	−0.195
706.2438	−0.190	708.2753	−0.221
706.2490	−0.215	708.2823	−0.173
706.2539	−0.241	708.2871	−0.184
706.2588	−0.219	708.2971	−0.244

TABLE IIb

Yellow observations of HU Tauri

JD (Hel.)	Δm_v	JD (Hel.)	Δm_v
2441 010.1044	0.633	012.0802	0.739
010.1067	0.631	012.0833	0.774
010.1162	0.497	012.0850	0.784
010.1200	0.477	012.0922	0.789
010.1280	0.479	012.0929	0.819
010.1314	0.451	012.0958	0.835
010.1438	0.339	012.0970	0.853
010.1470	0.299	012.1038	0.853
010.1555	0.260	012.1045	0.860
010.1578	0.239	012.1051	0.869
010.1678	0.199	012.1058	0.881
010.1706	0.161	012.1104	0.890
010.1963	0.090	012.1190	0.873
010.1988	0.090	012.1251	0.857
010.2071	0.096		
010.2095	0.102	012.1274	0.870
010.2335	0.091	012.1288	0.852
010.2356	0.085	012.1371	0.809
010.2547	0.089	012.1382	0.806
010.2571	0.056	012.1465	0.804
		012.1486	0.774
010.2439	0.085	012.1583	0.678
010.2464	0.088	012.1593	0.671
011.0910	0.092	012.1677	0.597
011.0953	0.106	012.1708	0.535
011.0965	0.105	012.1808	0.433
011.1073	0.105	012.1833	0.427
011.1106	0.106	012.1951	0.375
011.1226	0.098	012.1972	0.365
011.1237	0.102	012.2049	0.319
011.1358	0.079	012.2072	0.305
011.1372	0.079	013.0765	0.070
011.1486	0.054	013.0782	0.057
011.1497	0.062	013.0889	0.071
011.1638	0.067	013.1001	0.141
011.1650	0.071	013.1126	0.127
011.1771	0.063	013.1154	0.103
011.1778	0.073	013.1216	0.118
011.1789	0.080	013.1237	0.129
011.1903	0.044	013.1291	0.154
011.1917	0.021	013.1321	0.089
		013.1615	0.097
011.2035	0.038	013.1633	0.092
011.2042	0.039	013.1726	0.044
011.2157	0.065	013.1744	0.034
011.2164	0.062	014.0870	0.355
011.2275	0.073	014.0777	0.397
011.2282	0.062	014.0984	0.466

Table IIb (*continued*)

JD (Hel.)	Δm_v	JD (Hel.)	Δm_v
014.0990	0.483	275.1761	0.128
014.1107	0.576	275.1867	0.143
014.1114	0.586	275.1878	0.150
014.1176	0.638	275.1992	0.237
014.1183	0.635	275.1999	0.240
016.0948	0.100	275.2151	0.284
016.0962	0.106	275.2157	0.300
		275.2255	0.337
016.1037	0.143	275.2264	0.356
016.1056	0.162	275.2360	0.431
262.2081	0.038	275.2367	0.453
262.2193	0.042	275.2478	0.505
262.2275	0.071	275.2484	0.545
262.2568	0.040	275.2295	0.631
262.2623	0.035	275.2599	0.666
262.2706	0.035	275.2692	0.716
262.2716	0.033	275.2699	0.727
262.2789	0.034	275.2799	0.780
262.2845	0.060	275.2807	0.789
262.2882	0.047	275.2854	0.815
269.3523	0.044		
269.3662	0.078	275.2855	0.824
269.3766	0.064	275.2980	0.845
269.3989	0.042	275.2987	0.867
269.4072	0.013	275.3031	0.870
269.4148	0.071	275.3038	0.878
269.4218	0.017	275.3264	0.835
269.4280	0.007	275.3275	0.841
		275.3375	0.815
269.4357	0.073	275.3382	0.814
274.1947	0.052	275.3446	0.774
274.1966	0.091	275.3446	0.732
274.2047	0.099	275.3563	0.674
274.2084	0.079	275.3570	0.664
274.2107	0.110	275.3672	0.559
274.2187	0.081	275.3679	0.560
274.2209	0.116	275.3774	0.494
274.2306	0.073	275.3783	0.486
274.2316	0.077	275.3889	0.391
274.2433	0.103	275.3894	0.388
274.2442	0.116	275.4005	0.303
274.2651	0.096		
274.2658	0.103	275.4017	0.307
274.2791	0.100	275.4172	0.193
274.2805	0.134	275.4182	0.206
274.2820	0.123	275.4189	0.188
		275.4321	0.135
275.1628	0.113	275.4328	0.140
275.1640	0.114	275.4500	0.105
275.1754	0.114	275.4505	0.114

Table IIb (*continued*)

JD (Hel.)	Δm_v	JD (Hel.)	Δm_v
275.4615	0.091	349.2047	0.081
275.4622	0.107	349.2075	0.184
275.4714	0.009	349.2141	0.112
275.4721	0.097		
295.1594	0.029	349.2174	0.034
295.1602	0.011	349.2261	0.211
295.1701	0.067	349.2342	0.221
295.1782	0.044	349.2371	0.295
295.1789	0.050	349.2483	0.295
295.1893	0.058	349.2506	0.362
295.1903	0.113	349.2580	0.381
295.2018	0.058	349.2611	0.374
295.2025	0.056	349.2681	0.499
295.2186	0.043	349.2696	0.509
295.2194	0.066	349.2726	0.535
295.2292	0.048	349.2830	0.572
295.2309	0.046	349.2839	0.557
295.2652	0.055	349.2939	0.627
295.2671	0.060	349.2954	0.657
295.2678	0.054	349.3050	0.809
295.2768	0.052	349.3059	0.782
295.2775	0.052	687.1145	0.037
295.2873	0.049	687.1298	0.053
295.2879	0.047	687.1326	0.043
295.2999	0.024		
295.3007	0.028	687.1417	0.030
295.3150	0.035	687.1441	0.022
295.3157	0.033	687.2545	0.018
295.3294	0.024	687.2576	0.025
295.3301	0.024	687.2691	0.024
295.3397	0.055	687.2715	0.023
295.3405	0.051	687.2759	0.013
		687.2820	0.006
295.3514	0.028	687.2899	0.042
295.3521	0.019	687.2920	0.046
295.3811	0.058	687.3004	0.050
295.3818	0.060	687.3031	0.045
295.3912	0.100	687.3115	0.056
295.3920	0.057	687.3139	0.053
295.4018	0.030	687.3213	0.044
295.4027	0.036	687.3234	0.036
295.4141	0.049	687.3366	0.025
295.4146	0.040	687.3431	0.032
295.4255	0.047	687.1110	0.034
295.4262	0.043	688.1062	0.015
349.1783	0.135		
349.1867	0.204	688.1076	0.006
349.1891	0.072	688.1152	0.032
349.1952	0.104	688.1214	0.045
349.1976	0.132	688.1374	0.037

Table IIb (*continued*)

JD (Hel.)	Δm_v	JD (Hel.)	Δm_v
688.1443	0.032	702.2026	0.068
688.1516	0.020	702.2090	0.041
688.1585	0.017	702.2160	0.033
688.1692	0.026	702.2234	0.070
688.1764	0.046	702.2341	0.040
688.2395	0.062	702.2489	0.043
688.2454	0.076	702.2593	0.048
688.2613	0.092	702.2658	0.042
688.2572	0.063	702.2722	0.036
688.2631	0.044	702.2781	0.051
688.2858	0.045	702.2836	0.052
688.2914	0.068	702.2902	0.057
688.2973	0.065	702.2966	0.069
688.3024	0.070	702.3041	0.069
688.3080	0.074	704.2083	0.059
688.3132	0.045	704.2109	0.052
688.3191	0.050	704.2184	0.058
694.1266	0.032	704.2209	0.065
694.1290	0.042	704.2281	0.045
694.1360	0.057	704.2304	0.065
694.1439	0.045	704.2367	0.043
694.1508	0.041	704.2387	0.051
694.1597	0.043	704.2451	0.053
694.1895	0.035	704.2607	0.072
694.1990	0.027	704.2776	03032
694.2064	0.017	704.2839	0.029
694.2277	0.034	704.2916	0.054
694.2336	0.052	704.2972	0.061
694.2409	0.048	704.3033	0.049
694.2470	0.053	704.3092	0.040
694.2531	0.066	704.3165	0.052
694.2585	0.026	705.1159	0.832
694.2640	0.018	705.1184	0.792
694.2696	0.018	705.1246	0.742
694.2756	0.040	705.1541	0.588
694.2836	0.044	705.1607	0.463
694.2904	0.050	705.1631	0.434
694.2965	0.045	705.1685	0.445
694.3037	0.045	705.1751	0.356
694.3100	0.046	705.1781	0.334
694.3171	0.061	705.1857	0.325
694.3294	0.065	705.1937	0.251
694.3362	0.049	705.2289	0.099
702.1215	0.055	705.2348	0.083
702.1244	0.061	705.2413	0.070
702.1322	0.059	705.2560	0.072
702.1645	0.062	705.2615	0.047
702.1728	0.037		
702.1827	0.027		

Table IIb (continued)

JD (Hel.)	Δm_v	JD (Hel.)	Δm_v
705.2671	0.086	706.3034	0.029
705.2781	0.082	707.1132	0.729
705.2830	0.085	707.1224	0.809
705.2883	0.091	707.1484	0.845
705.2979	0.089	707.1559	0.869
705.3045	0.068	707.1634	0.838
705.3100	0.081	707.1693	0.831
706.0972	0.107	707.1981	0.633
706.1006	0.086	707.2000	0.604
706.1074	0.082	707.2066	0.545
706.1099	0.092	707.2118	0.505
706.1167	0.120	707.2167	0.451
706.1238	0.091	707.2218	0.440
706.1523	0.096	707.2273	0.379
706.1588	0.100	707.2329	0.342
706.1657	0.093	708.1117	0.146
706.1717	0.096	708.1453	0.095
706.1799	0.082	708.1522	0.087
706.1854	0.065	708.1596	0.124
706.1910	0.064	708.1624	0.103
		708.1675	0.116
706.1969	0.084	708.1737	0.079
706.2020	0.087	708.1796	0.087
706.2125	0.097		
706.2187	0.054		
706.2299	0.049	708.1857	0.074
706.2368	0.057	708.1914	0.110
706.2430	0.060	708.1964	0.109
706.2483	0.055	708.2015	0.103
706.2534	0.035	708.2189	0.086
706.2581	0.035	708.2223	0.152
706.2631	0.040	708.2234	0.140
706.2681	0.055	708.2501	0.005
706.2731	0.044	708.2547	0.063
706.2789	0.050	708.2744	0.067
706.2877	0.041	708.2814	0.077
706.2930	0.028	708.2864	0.080
706.2985	0.039	708.2964	0.021

was found to be $-1^{\mathrm{m}}.243 \pm 0.017$ and $-1^{\mathrm{m}}.118 \pm 0.016$, respectively. Thus there is no variation in the brightness of the comparison star. *UBV* standard stars were observed on three nights; after correcting for atmospheric extinction, the standard star observations were used to determine the magnitude and colour transformation coefficients by a least-squares method. These are listed in Table III.

TABLE III

Transformation coefficients

	ε_v	ζ_v	μ_{bv}	ζ_{bv}
JD 2441011	−0.068	5.967	1.478	1.404
	±0.013	±0.083	±0.027	+0.022
JD 2441687	−0.057	5.590	1.372	1.197
	±0.034	±0.012	±0.014	±0.010
JD 2441688	−0.047	5.427	1.387	1.181
	±0.026	±0.010	±0.018	±0.013

3. Times of Minimum and Period

From our photoelectric observations of HU Tauri listed in Tables IIa and IIb, four epochs of primary minimum and two epochs of secondary minimum are determined and are listed in Table IV. All the available, visual, photographic and photoelectric times of primary minimum are collected and listed in Table V. The ephemeris of HU Tauri determined by Strohmeier and Knigge (1960) is Hel. Min. I = $JD_{\odot}$ 2425641.285 + $2^{\mathrm{d}}.056288E$. To improve the epoch and period, a linear least-squares solution is made using all the times of primary minimum listed in Table V. The revised ephemeris is of the form

$$\text{Hel. Min. I} = JD_{\odot}\ 2441275.3219 + 2^{\mathrm{d}}.0562997E.$$
$$(\pm 0.0002) \pm (0.0000008). \qquad (1)$$

With this revised ephemeris the residuals, or (O − C) values in the times of primary minimum are recomputed and given in Table V. Since, the majority of the times of minimum listed in Table V are visual estimates, the scatter in the O − C values is large (see Figure 1). There are no observed times of minimum during the period JD 2429200 to JD 2434500. There are only 11 photoelectrically determined minima out of the 68 times of primary minimum listed in Table V. A linear least-squares solution of the photoelectrically determined times of primary minimum yielded the ephemeris

$$\text{Hel. Min. I} = JD_{\odot}\ 2551275.3166 + 2^{\mathrm{d}}.0563107E.$$
$$(\pm 0.0009) \pm (0.0000012) \qquad (2)$$

With this ephemeris the (O − C) values in the photoelectric times of minimum are recomputed and given in Table VI. The photoelectric times of secondary minimum and the (O − C) values computed with the above-mentioned ephemeris (Equation (2)) are given in Table VII. The O − C values listed in Tables V, VI and VII indicate that there is no variation in the orbital period of HU Tauri. Ephemeris (Equation (2)) determined from the photoelectric times of primary minimum is used in the analysis of the light curves.

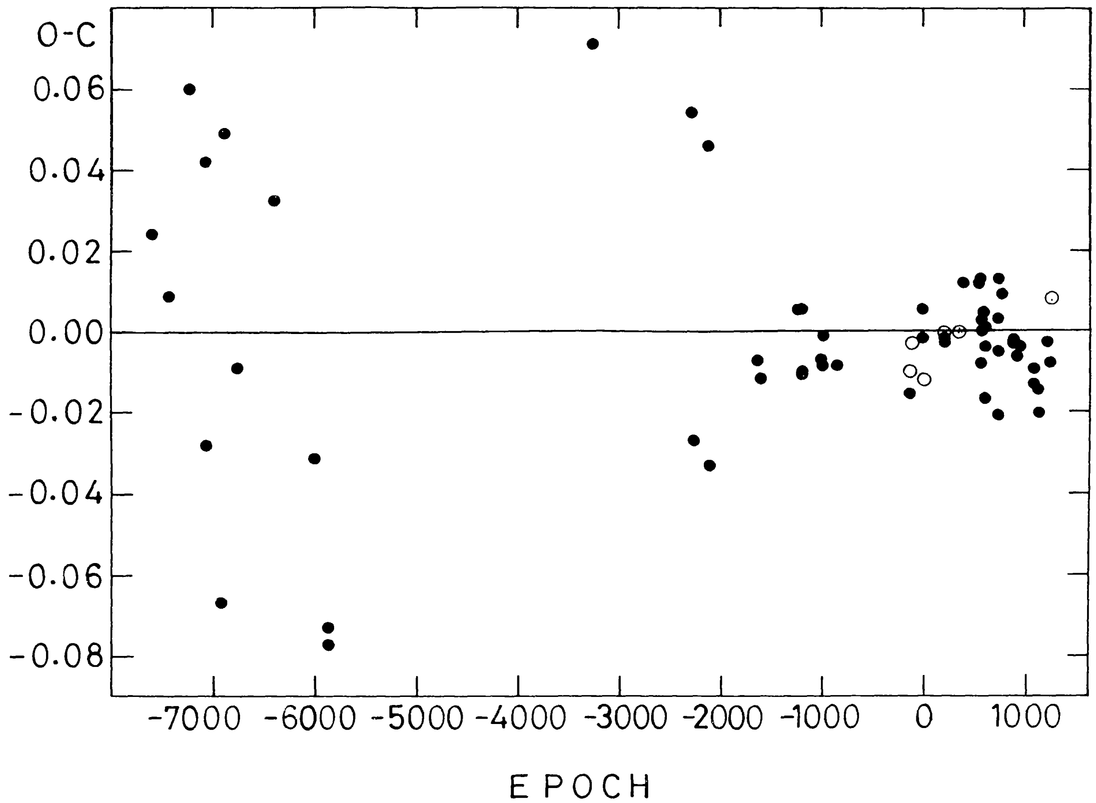

Fig. 1. Residuals of the epochs of the primary minimum of HU Tauri. Residuals are determined from ephemeris given by Equation (1). The open circles refer to photoelectric times of primary minimum.

4. Light Curves

The problem which the observer of HU Tauri encounters in obtaining a complete light curve is that the period of this system is very nearly equal to two days. It is, therefore, possible to obtain the complete light curve at a single site only after several seasons of observing, and hence our light curve suffers from this defect. The heliocentric Julian day of the observations listed in Tables IIa and IIb are converted into orbital phases with the new ephemeris (Equation (2)) determined from the photoelectric times of primary minimum. The blue and yellow light curves of HU Tauri are shown in Figure

TABLE IV

Observed times of minimum

JD (Hel.)	2440981.261	Primary minimum
	2441012.113	Primary minimum
	2441013.140	Secondary minimum
	2441275.310	Primary minimum
	2441706.130	Secondary minimum
	2441707.145	Primary minimum

TABLE V

Times of primary minimum

JD (Hel.)	Epoch	O − C		Reference
2425641.300	−7603	+0.0246	pg	1
2426005.249	−7426	+0.0085	pg	1
406.279	−7231	+0.0600	pg	1
735.269	−7071	+0.0421	pg	1
743.424	−7067	−0.0281	pg	1
2427039.492	−6923	−0.0673	pg	1
101.297	−6893	+0.0487	pg	1
397.346	−6749	−0.0093	pg	1
2428131.487	−6392	+0.0325	pg	1
931.323	−6003	−0.0316	pg	1
2429194.488	−5875	−0.0727	pg	1
196.541	−5874	−0.0767	pg	1
2434635.601	−3229	+0.0713	pg	1
2436597.294	−2275	+0.0540	pg	1
599.269	−2274	−0.0270	pg	1
895.449	−2130	+0.0459	pg	1
899.483	−2128	−0.0331	pg	1
2437925.609	−1629	−0.0007	v	2
958.499	−1613	−0.0115	v	2
2438733.741	−1236	+0.0056	v	3
770.754	−1218	+0.0051	v	3
805.696	−1201	−0.0099	v	3
2439169.664	−1024	−0.0065	v	4
194.338	−1012	−0.0085	v	5
198.458	−1010	−0.0012	v	5
492.501	−867	−0.0086	v	5
2440981.261	−143	−0.0098	pe	This paper
985.368	−141	−0.0156	v	2
2441012.113	−128	−0.0028	pe	This paper
244.476	−15	−0.0014	v	2
248.595	−13	+0.0050	v	2
275.310	0	−0.0119	pe	This paper
314.398	19	+0.0064	v	2
688.637	201	−0.0012	v	2
707.145	210	0.0000	pe	This paper
717.424	215	−0.0024	v	2
984.745	345	0.0000	pe	6
986.801	346	0.0000	pe	6
990.914	348	0.0000	pe	6
2441992.970	349	0.0000	pe	6
2442052.615	378	+0.0120	v	2
375.454	535	+0.0119	v	2
404.244	549	+0.0136	v	2
408.343	551	+0.0001	v	2

Table V (continued)

JD (Hel.)	Epoch	O − C		Reference
410.391	552	−0.0083	v	2
412.458	553	+0.0024	v	2
414.514	554	+0.0021	v	2
445.361	569	+0.0046	v	2
447.409	570	−0.0037	v	2
449.470	571	+0.0010	v	2
451.508	572	−0.0173	v	2
739.410	712	+0.0028	v	2
774.359	729	−0.0054	v	2
776.442	730	+0.0213	v	2
786.715	735	+0.0128	v	2
807.274	745	+0.0088	v	2
2443080.750	878	−0.0030	v	2
105.427	890	−0.0016	v	2
138.335	906	+0.0056	v	2
212.360	942	+0.0039	v	2
504.342	1084	−0.0087	v	2
508.450	1086	−0.0133	v	2
576.301	1119	−0.0202	v	2
578.363	1120	−0.0145	v	2
732.597	1195	−0.0030	v	2
833.3662	1244	+0.0076	pe	2
835.4228	1245	+0.0079	pe	2
837.4797	1246	+0.0085	pe	2

pe, pg and v refer to time of minimum determined by photoelectric, photographic and visual method, respectively. References: (1) Strohmeier and Knigge (1960); (2) Tumer and Kurutac (1979); (3) Robinson (1965); (4) Robinson (1967); (5) Robinson (1966); and (6) Wood (1977).

TABLE VI

Photoelectric times of primary minimum

JD (Hel.)	Epoch	(O − C)	Reference
2440981.261	−143	−0.0032	Present investigation
2441012.113	−128	0.0041	Present investigation
275.310	0	−0.0066	Present investigation
707.145	210	0.0031	Present investigation
984.745	345	0.0012	Wood (1977)
986.801	346	0.0009	Wood (1977)
990.914	348	0.0012	Wood (1977)
992.970	349	0.0009	Wood (1977)
2443833.3662	1244	−0.0009	Tumer and Kurutac (1979)
835.4228	1245	−0.0006	Tumer and Kurutac (1979)
837.4797	1246	−0.0001	Tumer and Kurutac (1979)

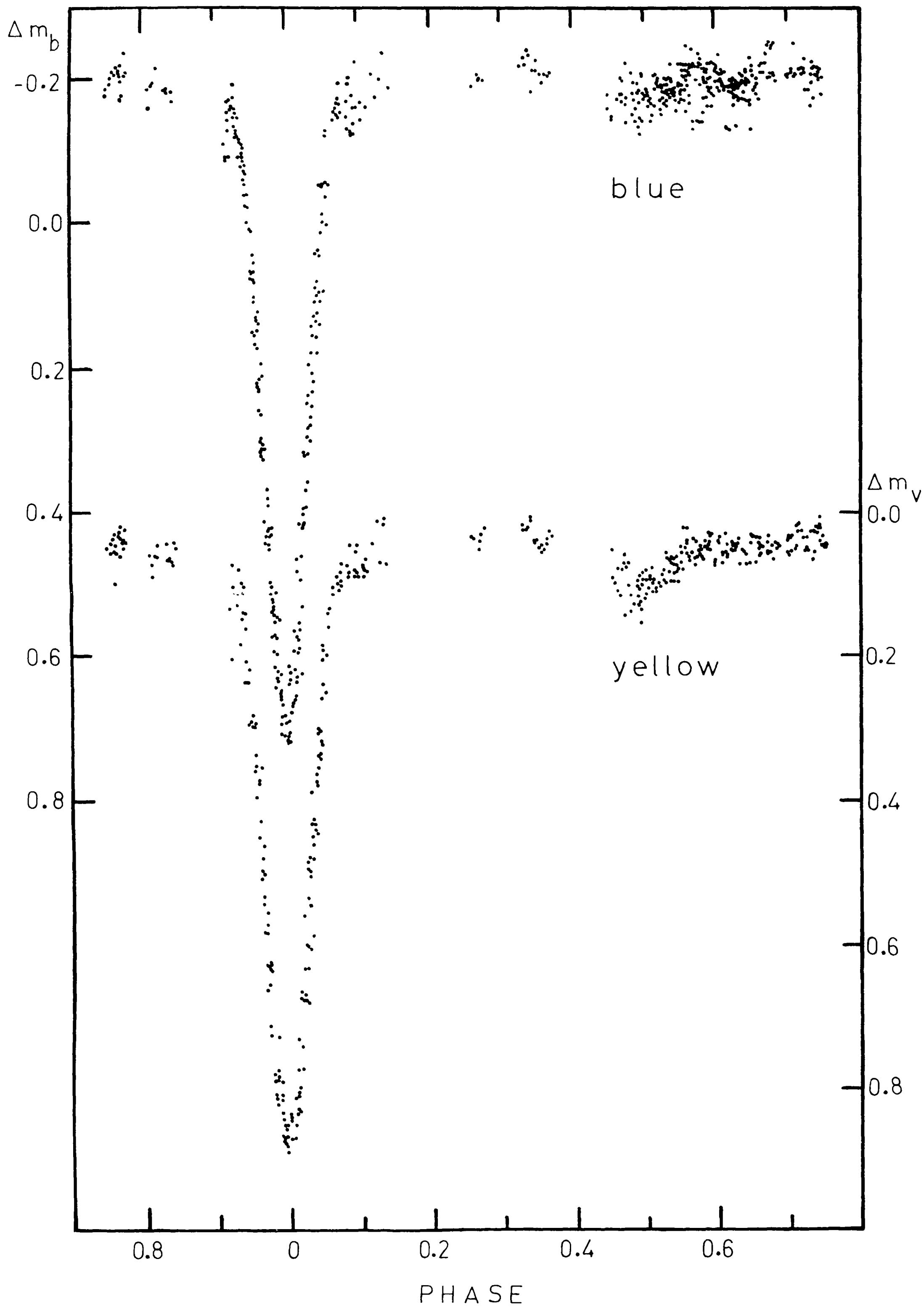

Fig. 2. Blue and yellow light curves of HU Tauri.

TABLE VII

Photoelectric times of secondary minimum

JD (Hel.)	(O − C)	Reference
2441013.14	+0.003	Present investigation
706.13	+0.016	Present investigation
987.83	+0.002	Wood (1977)
989.88	−0.004	Wood (1977)
991.94	−0.001	Wood (1977)
2443400.501	−0.013	Ebersberger *et al.* (1978)
834.3967	+0.002	Tumer and Kurutac (1979)

2. The depths of primary and secondary eclipses are found to be $0^m.82$ and $0^m.06$ in the yellow, and $0^m.84$ and $0^m.04$ in the blue, respectively. The light curves of HU Tauri shown in Figure 2 indicate that the eclipses are partial, and it is an Algol-type close binary system. The light curves indicate asymmetry near the beginning and ending of the primary minimum. The shoulder of the light curve near the first contact is fainter than the shoulder at the fourth contact. There is an increase in brightness immediately after the primary minimum. Similar asymmetry near the first and fourth contacts was found in the light curve of U Cep (Batten, 1974); Bolokadze (1956) suggested that the asymmetry is due to the veiling of the light of the primary star by gas streams. The same explanation can be extended to explain the light curves of HU Tauri, and the spectroscopic observations (Parthasarathy, 1980) do support the existence of gas streams between the two stars. The secondary minimum in the yellow light curve is not exactly at 0.5 phase. The scatter of the observations in the phase interval 0.5–0.75 is large and is significantly greater than the observational errors ($\pm 0^m.020$).

One of us (MP) made spectroscopic observations of HU Tauri with the 102-cm reflector telescope of the Kavalur Observatory. A detailed analysis of the spectroscopic and photometric observations of HU Tauri has been completed and will be published shortly (Parthasarathy, 1980).

Computations were made with the TDC-12 computer of the Indian Institute of Astrophysics, Kavalur and IBM 360/44 computer of the Indian Institute of Science, Bangalore.

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