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PHOTOMETRIC STUDY OF THE W UMA SYSTEM U PEGASI[1]

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ABSTRACT

A total of 842 observations (277 in *B*, 282 in *V*, and 283 in *R*) for U Pegasí were made in October of 1996 at Mt. Sobaek Observatory. With our data we constructed the *BVR* light curves and determinded 5 times of minimum light. We also obtained physical parameters of the system by combined analysis of both light and radial velocity curves using the Wilson-Devinney code.

1. INTRODUCTION

Since Chandler (1895) discovered the light variability of U Peg (SAO108933, $m_v = 9.0, G2 + G2, p = 0.^d37478$) in 1894, many investigations in photometry and spectroscopy have been carried out (Binnendijk 1960, Saito 1971, Kizilirmak & Pohl 1971, Popovici 1971, Kizilirmak & Pohl 1972, Rigterink 1972, Gordon 1975, Patkos 1980, Rovithis & Rovithis-Livaniou 1981, Keskin & Pohl 1989, Zhai *et al.* 1984, Lu 1985, Zhai *et al.* 1988, Maupome *et al.* 1991, Agerer & Hubscher 1996, Hegedus *et al.* 1996, Borkovits & Hegedus 1996). The mass ratio ($q = m_2/m_1$) of this system is known as 3.15 from the spectroscopic study of Lu (1985), 3.03 from HIPPARCOS astrometry satellite data analysis of Rucinski & Duerbeck (1997), and 3.018 from photometric solution of Zhai *et al.* (1988).

Although there are many results of study, some physical characteristics such as light variation, period variation, the disparity on the H-R diagram related to the mass ratio, and evolution stage of the system are not yet clearly explained. In this paper we present a list of 842 observations made in 1996 and the result of light curve and velocity curve solutions obtained by means of Wilson-Devinney method.

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Table 1a. *B* observations of U Peg in 1996.

$JD_\odot$ 2450300+	ΔB	$JD_\odot$ 2450300+	ΔB	$JD_\odot$ 2450300+	ΔB	$JD_\odot$ 2450300+	ΔB	$JD_\odot$ 2450300+	ΔB
78.0679	.071	78.2288	.050	83.1244	.059	83.9820	.284	84.1417	.636
78.0698	.112	78.2314	.027	83.1269	.051	83.9849	.250	84.1496	.551
78.0727	.100	78.2340	.040	83.1327	.073	83.9873	.241	84.1521	.530
78.0749	.115	78.2367	.029	83.1352	.075	83.9898	.229	84.1546	.518
78.0772	.123	78.2395	.031	83.1376	.077	83.9923	.198	84.1570	.471
78.0795	.116	78.2422	.043	83.1401	.090	83.9952	.174	84.1600	.445
78.0819	.160	78.2448	.040	83.1430	.089	83.9976	.177	84.1624	.400
78.0842	.153	78.2475	.042	83.1455	.098	84.0001	.163	84.1649	.374
78.0878	.170	78.2504	.060	83.1480	.123	84.0026	.141	84.1674	.327
78.0904	.181	78.2530	.061	83.1563	.166	84.0055	.138	84.1703	.307
78.0931	.198	78.2556	.071	83.1588	.178	84.0079	.121	84.1727	.281
78.0957	.210	78.2583	.075	83.1612	.188	84.0104	.117	84.1752	.262
78.0986	.225	82.9646	.193	83.1637	.212	84.0129	.114	84.1777	.223
78.1013	.259	82.9670	.200	83.1666	.237	84.0158	.091	84.1806	.222
78.1039	.267	82.9695	.212	83.1691	.269	84.0188	.092	84.1831	.196
78.1066	.299	82.9720	.223	83.1715	.312	84.0216	.086	84.1855	.192
78.1094	.326	82.9748	.235	83.1740	.312	84.0245	.078	84.1880	.193
78.1121	.363	82.9773	.267	83.1769	.331	84.0270	.081	84.1909	.159
78.1147	.380	82.9798	.302	83.1794	.368	84.0294	.058	84.1934	.158
78.1174	.417	83.0042	.611	83.1819	.394	84.0319	.058	84.1959	.139
78.1202	.452	83.0067	.609	83.1843	.428	84.0348	.068	84.1983	.141
78.1229	.479	83.0092	.629	83.1872	.452	84.0372	.059	84.2028	.116
78.1255	.533	83.0116	.650	83.1897	.473	84.0397	.064	84.2053	.094
78.1287	.554	83.0145	.649	83.1922	.508	84.0422	.064	84.2078	.076
78.1316	.593	83.0170	.645	83.1946	.512	84.0451	.068	84.2118	.064
78.1342	.638	83.0195	.612	83.1975	.520	84.0476	.048	84.2142	.083
78.1369	.648	83.0220	.600	83.2000	.539	84.0501	.047	84.2167	.046
78.1395	.647	83.0248	.573	83.2025	.534	84.0525	.050	84.2192	.046
78.1424	.634	83.0273	.537	83.2049	.537	84.0554	.069	84.2233	.049
78.1450	.630	83.0298	.509	83.2078	.535	84.0579	.073	84.2258	.038
78.1477	.611	83.0322	.470	83.2103	.509	84.0604	.078	84.2306	.045
78.1503	.589	83.0351	.450	83.2128	.456	84.0628	.092	84.2331	.030
78.1532	.580	83.0376	.401	83.2154	.427	84.0657	.100	84.2356	.020
78.1559	.544	83.0401	.370	83.2183	.411	84.0682	.097	84.2381	.033
78.1585	.510	83.0425	.351	83.2208	.397	84.0707	.111	84.2409	.015
78.1611	.459	83.0454	.322	83.2232	.367	84.0731	.120	84.2434	.034
78.1640	.410	83.0479	.282	83.2262	.339	84.0760	.126	84.2459	.038
78.1667	.379	83.0509	.256	83.2286	.308	84.0785	.143		
78.1693	.346	83.0541	.224	83.2311	.270	84.0810	.163		
78.1719	.330	83.0569	.215	83.2439	.178	84.0834	.165		
78.1748	.299	83.0593	.198	83.2463	.152	84.0863	.170		
78.1775	.265	83.0618	.194	83.2488	.142	84.0888	.187		
78.1801	.261	83.0647	.172	83.2513	.144	84.0913	.191		
78.1827	.235	83.0672	.164	83.2542	.144	84.0937	.212		
78.1856	.201	83.0697	.149	83.2566	.129	84.0966	.236		
78.1882	.201	83.0721	.141	83.2591	.120	84.0991	.256		
78.1909	.162	83.0750	.123	83.9414	.539	84.1016	.272		
78.1935	.157	83.0775	.108	83.9438	.532	84.1041	.299		
78.1964	.155	83.0800	.093	83.9463	.545	84.1070	.334		
78.1990	.137	83.0895	.062	83.9487	.546	84.1094	.375		
78.2017	.118	83.0919	.065	83.9516	.543	84.1119	.409		
78.2043	.115	83.1013	.039	83.9541	.536	84.1144	.438		
78.2072	.100	83.1038	.021	83.9566	.522	84.1211	.539		
78.2098	.089	83.1062	.045	83.9591	.498	84.1236	.567		
78.2125	.091	83.1087	.034	83.9619	.484	84.1260	.577		
78.2151	.080	83.1116	.044	83.9644	.459	84.1285	.602		
78.2180	.058	83.1141	.049	83.9669	.443	84.1314	.624		
78.2206	.039	83.1165	.052	83.9746	.363	84.1339	.627		
78.2233	.048	83.1190	.050	83.9770	.332	84.1363	.628		
78.2259	.039	83.1219	.036	83.9795	.306	84.1388	.637		

Table 1b. *V* observations of U Peg in 1996.

$JD_\odot$ 2450300+	ΔV	$JD_\odot$ 2450300+	ΔV	$JD_\odot$ 2450300+	ΔV	$JD_\odot$ 2450300+	ΔV	$JD_\odot$ 2450300+	ΔV
78.0682	.039	78.2292	-.005	83.1223	-.004	83.9673	.374	84.1318	.558
78.0701	.040	78.2318	-.010	83.1248	.001	83.9750	.293	84.1343	.554
78.0730	.052	78.2345	-.007	83.1273	.006	83.9774	.267	84.1368	.569
78.0753	.065	78.2371	-.022	83.1331	.021	83.9799	.239	84.1393	.569
78.0776	.079	78.2400	-.011	83.1356	.025	83.9824	.219	84.1422	.564
78.0799	.068	78.2426	-.017	83.1380	.037	83.9853	.202	84.1446	.549
78.0823	.087	78.2453	-.012	83.1405	.049	83.9877	.178	84.1500	.482
78.0846	.107	78.2479	-.017	83.1434	.062	83.9902	.165	84.1525	.465
78.0882	.115	78.2508	-.015	83.1459	.068	83.9927	.149	84.1550	.422
78.0909	.118	78.2534	.009	83.1484	.079	83.9956	.124	84.1575	.394
78.0935	.147	78.2561	.017	83.1509	.083	83.9981	.113	84.1604	.359
78.0962	.156	78.2587	.021	83.1567	.121	84.0005	.103	84.1628	.323
78.0990	.169	78.2616	.019	83.1592	.141	84.0030	.096	84.1653	.303
78.1017	.193	82.9650	.118	83.1617	.150	84.0059	.086	84.1678	.269
78.1043	.216	82.9674	.142	83.1641	.168	84.0084	.072	84.1707	.236
78.1070	.240	82.9699	.156	83.1670	.195	84.0108	.065	84.1732	.219
78.1098	.261	82.9724	.173	83.1695	.216	84.0133	.057	84.1756	.210
78.1125	.293	82.9753	.199	83.1720	.237	84.0162	.048	84.1781	.187
78.1151	.324	82.9777	.220	83.1744	.266	84.0193	.033	84.1810	.163
78.1178	.351	82.9802	.252	83.1773	.294	84.0220	.025	84.1835	.145
78.1206	.395	83.0046	.529	83.1798	.317	84.0249	.015	84.1860	.139
78.1233	.432	83.0071	.547	83.1823	.351	84.0274	.022	84.1884	.127
78.1259	.460	83.0096	.558	83.1847	.373	84.0298	.014	84.1913	.103
78.1292	.495	83.0121	.575	83.1876	.412	84.0323	.017	84.1938	.103
78.1320	.522	83.0150	.566	83.1901	.428	84.0352	.012	84.1963	.085
78.1347	.548	83.0174	.552	83.1926	.459	84.0377	.013	84.1988	.086
78.1373	.556	83.0199	.539	83.1951	.462	84.0402	.016	84.2033	.061
78.1400	.559	83.0224	.521	83.1979	.474	84.0426	.012	84.2058	.038
78.1428	.561	83.0253	.492	83.2004	.475	84.0455	.007	84.2082	.035
78.1455	.566	83.0277	.468	83.2029	.473	84.0480	.005	84.2122	.035
78.1481	.538	83.0302	.429	83.2054	.463	84.0505	.009	84.2147	.029
78.1508	.507	83.0327	.402	83.2083	.450	84.0530	.014	84.2171	.026
78.1536	.481	83.0356	.361	83.2107	.440	84.0559	.022	84.2196	.010
78.1563	.457	83.0380	.333	83.2132	.416	84.0583	.020	84.2237	-.004
78.1589	.423	83.0405	.307	83.2158	.390	84.0608	.027	84.2262	.004
78.1616	.392	83.0430	.276	83.2187	.349	84.0633	.034	84.2311	-.001
78.1644	.349	83.0458	.245	83.2212	.330	84.0662	.039	84.2335	.006
78.1671	.324	83.0483	.223	83.2237	.309	84.0686	.050	84.2360	.004
78.1697	.286	83.0514	.198	83.2266	.272	84.0711	.048	84.2385	-.004
78.1724	.254	83.0545	.170	83.2291	.247	84.0736	.062	84.2414	-.015
78.1752	.234	83.0573	.155	83.2315	.232	84.0764	.081	84.2439	-.005
78.1779	.204	83.0598	.132	83.2443	.149	84.0789	.087	84.2463	.004
78.1805	.181	83.0622	.118	83.2467	.122	84.0814	.095		
78.1832	.163	83.0651	.109	83.2492	.109	84.0839	.106		
78.1860	.144	83.0676	.104	83.2517	.077	84.0868	.113		
78.1887	.124	83.0701	.097	83.2546	.076	84.0892	.127		
78.1913	.112	83.0726	.083	83.2571	.068	84.0917	.146		
78.1939	.104	83.0755	.069	83.2596	.072	84.0942	.159		
78.1968	.088	83.0779	.057	83.2620	.036	84.0971	.168		
78.1995	.080	83.0804	.051	83.2649	.037	84.0996	.195		
78.2021	.060	83.0899	.021	83.9418	.443	84.1020	.226		
78.2047	.056	83.0924	.012	83.9442	.459	84.1045	.247		
78.2076	.051	83.1017	-.003	83.9467	.474	84.1074	.290		
78.2103	.041	83.1042	-.007	83.9492	.471	84.1099	.307		
78.2129	.033	83.1067	-.008	83.9521	.475	84.1123	.336		
78.2155	.015	83.1091	-.011	83.9546	.474	84.1148	.366		
78.2184	.006	83.1120	-.007	83.9570	.456	84.1215	.466		
78.2210	.000	83.1145	-.001	83.9595	.442	84.1240	.491		
78.2237	.006	83.1170	-.002	83.9624	.422	84.1265	.511		
78.2263	-.009	83.1195	-.004	83.9648	.399	84.1289	.536		

Table 1c. *R* observations of U Peg in 1996.

$JD_{\odot}$ 2450300+	ΔR	$JD_{\odot}$ 2450300+	ΔR	$JD_{\odot}$ 2450300+	ΔR	$JD_{\odot}$ 2450300+	ΔR	$JD_{\odot}$ 2450300+	ΔR
78.0685	.014	78.2295	-.030	83.1227	-.020	83.9652	.364	84.1293	.496
78.0704	.026	78.2322	-.025	83.1252	-.016	83.9677	.341	84.1322	.516
78.0733	.025	78.2348	-.025	83.1276	-.011	83.9753	.256	84.1347	.514
78.0756	.039	78.2375	-.034	83.1335	.000	83.9778	.233	84.1371	.522
78.0779	.051	78.2403	-.039	83.1360	.015	83.9803	.216	84.1396	.519
78.0802	.050	78.2430	-.037	83.1384	.018	83.9828	.194	84.1425	.515
78.0826	.059	78.2456	-.035	83.1409	.029	83.9856	.172	84.1450	.495
78.0849	.075	78.2483	-.026	83.1438	.034	83.9881	.151	84.1504	.440
78.0886	.085	78.2511	-.026	83.1463	.047	83.9906	.133	84.1529	.413
78.0912	.097	78.2538	-.020	83.1488	.049	83.9931	.114	84.1554	.387
78.0939	.116	78.2564	-.006	83.1512	.063	83.9960	.099	84.1578	.361
78.0965	.124	78.2591	-.005	83.1571	.097	83.9984	.085	84.1607	.321
78.0994	.142	78.2619	-.005	83.1596	.116	84.0009	.079	84.1632	.291
78.1021	.164	82.9653	.108	83.1620	.134	84.0034	.068	84.1657	.260
78.1047	.185	82.9678	.120	83.1645	.150	84.0063	.062	84.1682	.235
78.1073	.209	82.9703	.129	83.1674	.174	84.0087	.045	84.1711	.199
78.1102	.233	82.9727	.147	83.1699	.194	84.0112	.035	84.1735	.191
78.1129	.267	82.9756	.175	83.1723	.214	84.0137	.028	84.1760	.162
78.1155	.300	82.9781	.188	83.1748	.242	84.0166	.024	84.1785	.142
78.1182	.328	82.9806	.220	83.1777	.268	84.0196	.014	84.1814	.120
78.1210	.359	83.0050	.496	83.1802	.289	84.0224	.004	84.1839	.114
78.1237	.393	83.0075	.513	83.1826	.322	84.0253	-.003	84.1863	.103
78.1263	.427	83.0100	.518	83.1851	.349	84.0277	-.001	84.1888	.087
78.1295	.465	83.0124	.532	83.1880	.379	84.0302	-.012	84.1917	.081
78.1324	.489	83.0153	.522	83.1905	.402	84.0327	-.013	84.1942	.072
78.1350	.512	83.0178	.513	83.1930	.414	84.0356	-.017	84.1966	.062
78.1377	.519	83.0203	.498	83.1954	.442	84.0380	-.012	84.1991	.056
78.1403	.523	83.0227	.482	83.1983	.450	84.0405	-.013	84.2036	.029
78.1432	.513	83.0256	.448	83.2008	.452	84.0430	-.018	84.2061	.029
78.1458	.512	83.0281	.417	83.2033	.445	84.0459	-.025	84.2086	.012
78.1485	.496	83.0306	.388	83.2057	.442	84.0484	-.019	84.2126	.014
78.1511	.471	83.0330	.364	83.2086	.419	84.0508	-.013	84.2150	-.002
78.1540	.443	83.0359	.334	83.2111	.400	84.0533	-.009	84.2175	-.017
78.1566	.418	83.0384	.300	83.2136	.382	84.0562	-.005	84.2200	-.020
78.1593	.386	83.0409	.268	83.2162	.353	84.0587	-.001	84.2241	-.017
78.1619	.346	83.0433	.244	83.2191	.330	84.0612	.004	84.2265	-.018
78.1648	.319	83.0462	.207	83.2216	.304	84.0636	.006	84.2314	-.034
78.1675	.281	83.0487	.184	83.2240	.271	84.0665	.017	84.2339	-.032
78.1701	.249	83.0517	.156	83.2270	.242	84.0690	.026	84.2364	-.035
78.1727	.221	83.0549	.137	83.2294	.225	84.0715	.032	84.2388	-.031
78.1756	.195	83.0577	.123	83.2319	.203	84.0739	.044	84.2417	-.029
78.1782	.172	83.0601	.108	83.2446	.119	84.0768	.050	84.2442	-.036
78.1809	.150	83.0626	.093	83.2471	.092	84.0793	.058	84.2467	-.036
78.1835	.130	83.0655	.083	83.2496	.096	84.0817	.071		
78.1864	.112	83.0680	.075	83.2521	.083	84.0842	.078		
78.1890	.095	83.0704	.067	83.2550	.058	84.0871	.087		
78.1917	.085	83.0729	.053	83.2574	.045	84.0896	.096		
78.1943	.075	83.0758	.044	83.2599	.036	84.0921	.114		
78.1972	.060	83.0783	.039	83.2624	.024	84.0945	.133		
78.1998	.055	83.0808	.019	83.2653	.015	84.0974	.155		
78.2025	.035	83.0903	-.003	83.2678	.002	84.0999	.169		
78.2051	.023	83.0927	-.012	83.9421	.432	84.1024	.203		
78.2080	.014	83.1021	-.028	83.9446	.435	84.1049	.219		
78.2106	.017	83.1046	-.031	83.9471	.443	84.1078	.246		
78.2133	.003	83.1070	-.032	83.9495	.448	84.1102	.269		
78.2159	-.005	83.1095	-.035	83.9524	.447	84.1127	.304		
78.2188	-.013	83.1124	-.029	83.9549	.439	84.1152	.337		
78.2214	-.020	83.1149	-.025	83.9574	.423	84.1219	.423		
78.2240	-.016	83.1173	-.025	83.9598	.413	84.1243	.449		
78.2267	-.023	83.1198	-.028	83.9627	.385	84.1268	.475		

2. OBSERVATIONS AND LIGHT CURVES

Using the 61cm reflector equipped with PM512 CCD Camera system of Mt. Sobaek Observatory, we observed U Peg on 3 nights in 1996. BD+14°5078 as a comparison star is used. The observations were reduced using the differential photometric method. A total of 842 observations in *BVR* is obtained as listed in Table 1. The probable errors of our data are $\pm 0.^m012$ in *B*, $\pm 0.^m008$ in *V*, and $\pm 0.^m006$ in *R*, respectively.

With our data, we constructed *BVR* light curves, and determined three times of primary minimum light of $JD_\odot 2450378.1407 \pm .0002$, $JD_\odot 2450383.0131 \pm .0002$, $JD_\odot 2450384.1370 \pm .0002$ and two times of secondary minimum light of $JD_\odot 2450383.2010 \pm .0004$, $JD_\odot 2450383.9480 \pm .0005$. The light curves of 26-27 October (Figure 1b) cover the full orbital phase, and two night observations (refer to Figures 1a and 1c) are added here. They are combined to the very nice light curves as shown in Figure 2. In order to calulate orbital phases, we have adopted $p = 0.^d374781802$ from Zhai *et al.* (1984) and $JD_\odot 2450384.1370$ of ours as the epoch.

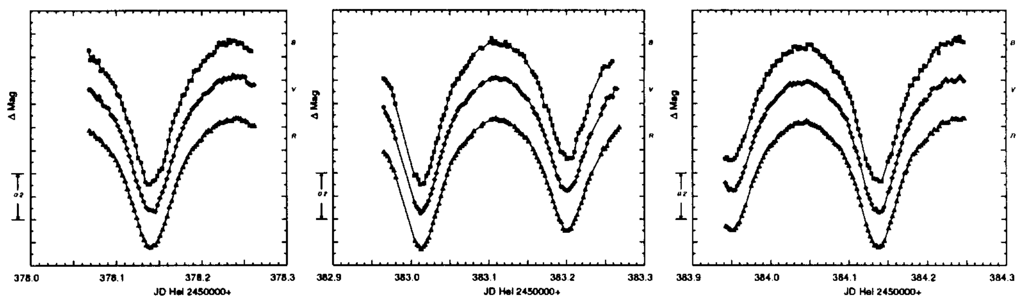

Figure 1. Light curves of U Peg in 1996. (a) on 21-22 Oct., (b) on 26-27 Oct., (c) on 27-28 Oct.

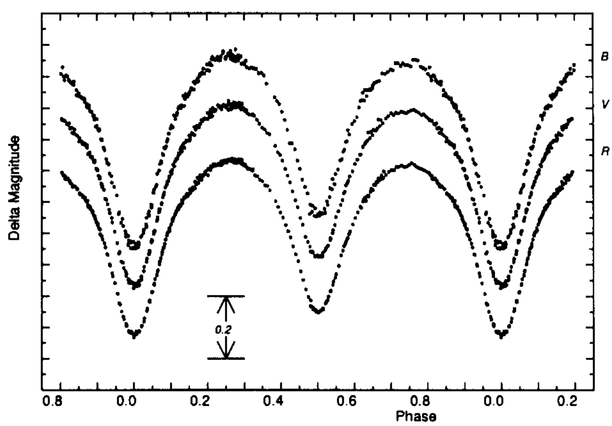

Figure 2. *BVR* light curves of U Pegasi in 1996.

Table 2. Light curve solutions of U Pegasi.

Parameter	(1)	(2)	(3)	(4)
i	76.1 ± 0.1	75.964 ± 0.097	75.44 ± 0.06	75.31± 0.07
g	0.48 ± 0.02	0.281 ± 0.018	0.300	0.300
T_1	7000	5800	5800	5800
T_2	6617 ± 7	5515 ± 4	5418 ± 4	5441 ± 5
A	0.50 ± 0.02	0.493 ± 0.030	0.523	0.523
q	3.012 ± 0.001	3.0186 ± 0.0053	3.0186	3.0186
Ω	6.574 ± 0.003	6.5218 ± 0.0025	6.5140 ± 0.0025	6.5134 ± 0.0032
$L_1(\lambda\, 4400)$	0.324 ± 0.001	0.3296 ± 0.0008	0.3249 ± 0.0114	0.3189 ± 0.0010
$L_1(\lambda\, 5500)$	0.314 ± 0.001	0.3188 ± 0.0007	0.3156 ± 0.0112	0.3105 ± 0.0010
$L_1(\lambda\, 7000)$	------	------	0.3053 ± 0.0075	0.3011 ± 0.0007
$L_2(\lambda\, 4400)$	0.676 ± 0.001	0.6704 ± 0.0008	0.6124 ± 0.0114	0.6108 ± 0.0010
$L_2(\lambda\, 5500)$	0.686 ± 0.001	0.6812 ± 0.0007	0.6264 ± 0.0112	0.6249 ± 0.0010
$L_2(\lambda\, 7000)$	------	------	0.6404 ± 0.0075	0.6391 ± 0.0007
r_1(pole)	0.2724 ± 0.0002	0.2768 ± 0.0022	0.2782 ± 0.0002	0.2775 ± 0.0002
r_1(side)	0.2839 ± 0.0002	0.2895 ± 0.0026	0.2912 ± 0.0002	0.2903 ± 0.0003
r_1(back)	0.3196 ± 0.0004	0.3290 ± 0.0049	0.3319 ± 0.0004	0.3303 ± 0.0005
r_2(pole)	0.4515 ± 0.0002	0.4559 ± 0.0003	0.4572 ± 0.0002	0.4565 ± 0.0002
r_2(side)	0.4837 ± 0.0003	0.4909 ± 0.0004	0.4927 ± 0.0002	0.4917 ± 0.0003
r_2(back)	0.5112 ± 0.0003	0.5194 ± 0.0007	0.5217 ± 0.0003	0.5205 ± 0.0004
Lat_{spot}	------	74.7 ± 2.1	96.50 ± 0.06	------
$Long_{spot}$	------	58.5 ± 3.0	257.99 ± 0.03	------
R_{spot}	------	21.3 ± 0.8	20	------

(1) Zhai *et al.* (1984), (2) Zhai *et al.* (1988), (3) This paper with spot, (4) This paper without spot.

It is remarkable that magnitude at outside-eclipse phase of 0.2-0.3 is quite different to that of 0.7-0.8 in each light curve of Figure 2. Zhai *et al.* (1988) explained such an asymmetry is due to the spot actitvity on the secondary component.

3. LIGHT CURVE SOLUTION

In order to calculate the Wilson-Devinney solution of U Peg using photometric and spectroscopic observations, we made 50 normal points from our data in each filter and adopted the velocity curve data (54 in component 1 and 66 component 2) of Lu (1985). Mode 3 and model atmosphere were applied. g, T_1, A, and q are used as fixed parameters and i, T_2, Ω_1, L_1, Lat_{sopt}, $Long_{sopt}$ are used as adjusted parameters. The values for fixed parameters and initial values for adjusted parameters are adopted from Al-Naimiy (1978), Lu (985), Zhai *et al.* (1988), and Rucinski & Duerbeck (1997). For the luminosity at 0.75 phase of light curve is much lower than that at 0.25, we derived two solutions. One is with a cool spot near $Long$=270°and Lat=90°on the secondary component, other is without any spot. Final adjusted parameters are listed with fixed parameters in the 3rd and 4th columns of Table 2. In order to compare, solutions by Zhai *et al.* (1984, 1988) are also tabulated in the columns 1 and 2 of Table 2, repectively.

We produced theoretical light curves with and without spot using the Wilson and Devinney computer model and plotted in Figure 3 and 4, respectively. The filled circles and solid lines stand for normal points of our observations and model light curves. It is clear that the model light curves with spot fit better to the observations.

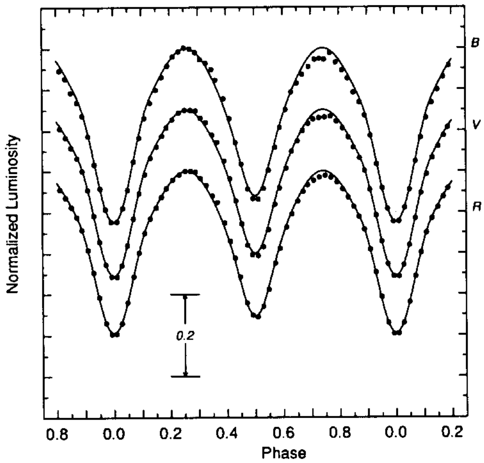

Figure 3. Light curves of U Peg. Solid lines stand for the light of model WITHOUT spot.

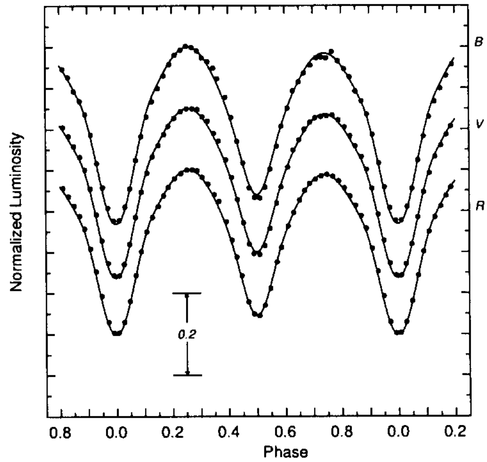

Figure 4. Light curves of U Peg. Solid lines stand for the light of model WITH spot.

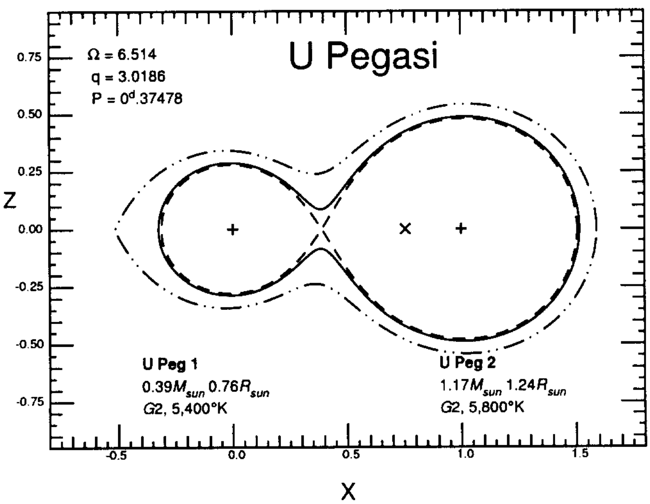

Figure 5. Configuration of U Pegasi.

In the result of this work, it is certainly known the fact that the position of the spot on secondary component is moving. The absolute dimensions of $M_1 = 0.39M_\odot$, $M_2 = 1.17M_\odot$, $R_1 = 0.76R_\odot$, and $R_2 = 1.24R_\odot$ for U Peg system were also obtained using the W-D code based on a combined light and radial velocity curves. Figure 5 shows a configuration of U Peg system we constructed using our solution. It shows that the system is in 15% overcontact of its inner Lagrangian potential surface.

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