DIFFERENTIAL UBV PHOTOMETRY OF β LYRAE,VI

by

HOWARD J. LANDIS
Landis Observatory
East Point, GA 30344

LARRY P. LOVELL
Hickox Observatory
Chagrin Falls, OH 44022

DOUGLAS S. HALL
Dyer Observatory
Vanderbilt University
Nashville, TE 37235

Abstract

In a continuing program of photometry of β Lyrae, 219 differential UBV observations were obtained in 1974 at three observatories.

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This is the sixth in a series of papers which, as was explained in Papers I, II, III, IV, and V (Lovell and Hall 1970, 1971; Landis, Lovell, and Hall 1973, 1975; Landis, Lovell, Frazier, and Hall 1974), should be helpful in understanding the changes in the light curve of β Lyrae. Between March and November of 1974, Landis obtained 122 differential UBV observations; between April and October, Lovell obtained 84; in October, Hall obtained 13.

The equipment, observing techniques, and data reduction procedures used by Landis and Lovell were described in Paper V. The equipment used by Hall was described in Paper III. His 1P21 photomultiplier was refrigerated with dry ice on some of the nights, and the transformation coefficients were known for both cases: $\varepsilon = -0.015$, $\mu = 1.015$, $\psi = 0.985$ refrigerated; $\varepsilon = +0.015$, $\mu = 0.985$, $\psi = 0.985$ unrefrigerated. The diaphragm was either 22 or 30 arcseconds in diameter, small enough to exclude the light of β^2 Lyrae.

The standard deviations of observations made on a single night were on the average: $\pm 0^m.004$, $\pm 0^m.006$, $\pm 0^m.006$ in V, B, U for Landis; $\pm 0^m.016$, $\pm 0^m.014$, $\pm 0^m.015$, for Lovell; and $\pm 0^m.003$, $\pm 0^m.004$, $\pm 0^m.007$ for Hall. The difference in sky conditions at the three observatories seems to be the main reason for the difference in deviations. As explained in earlier papers of this series, the actual uncertainty of each differential measure could be somewhat larger.

The observations are listed in Tables I, II, and III, which give the differential magnitudes in the sense β Lyrae minus γ Lyrae. As in the previous papers of this series, phases are computed with the ephemeris

$$JD(hel.) = 2{,}436{,}379.532 + 12^d.93016E.$$

The differential V magnitudes from all three tables are plotted in Figure 1.

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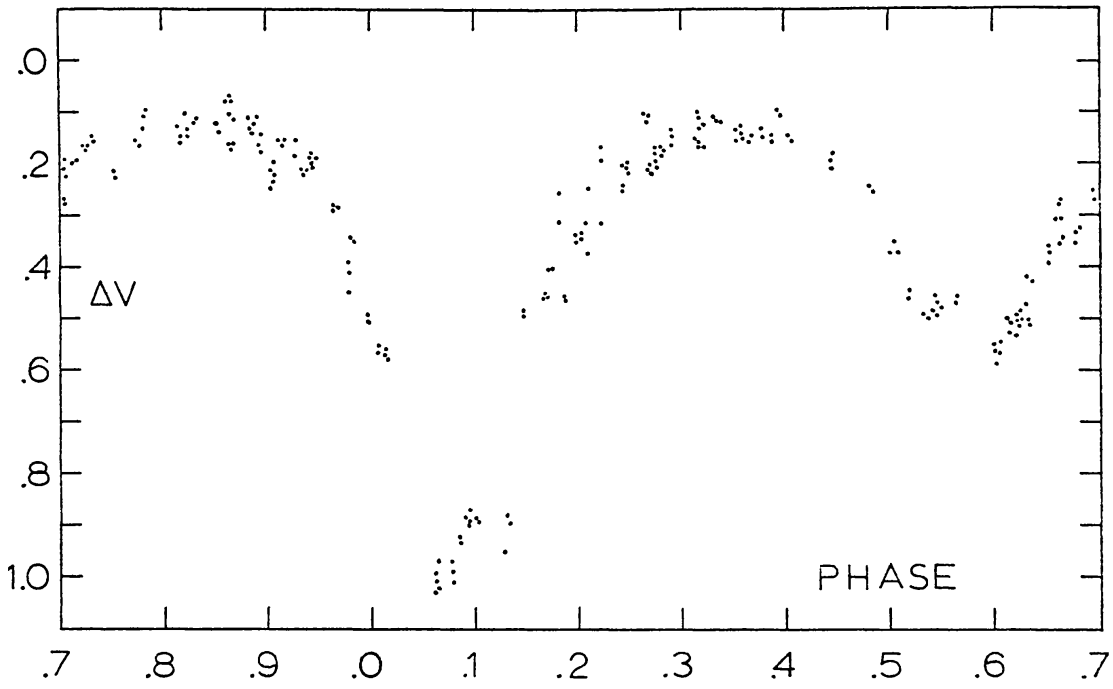

Figure 1. Differential V observations of β Lyrae, in the sense β Lyrae minus γ Lyrae.

TABLE I

DIFFERENTIAL UBV OBSERVATIONS (LANDIS)

JD(hel.) 2442000+	Phase	ΔV	ΔB	ΔU	JD(hel.) 2442000+	Phase	ΔV	ΔB	ΔU
136.9134	0.2676	+0.116	+0.148	-0.357	310.5441	0.6621	+0.274	+0.335	-0.173
.9200	.2680	+0.101	+0.166	-0.366	.5487	.6624	+0.269	+0.366	-0.137
.9248	.2685	+0.107	+0.168	-0.364	313.5525	.9285	+0.180	+0.218	-0.268
155.8728	.7339	+0.156	+0.208	-0.282	.5566	.9289	+0.157	+0.213	-0.256
.8782	.7343	+0.148	+0.203	-0.279	320.5195	.4673	+0.242	+0.303	-0.179
157.8765	.8889	+0.131	+0.169	-0.291	.5231	.4677	+0.243	+0.304	-0.185
.8809	.8892	+0.134	+0.195	-0.278	321.5172	.5446	+0.487	+0.534	+0.083
161.8660	.1974	+0.339	+0.412	-0.066	.5221	.5450	+0.488	+0.535	+0.090
.8711	.1978	+0.348	+0.418	-0.074	322.5152	.6218	+0.501	+0.550	+0.073
162.8522	.2737	+0.193	+0.254	-0.249	.5200	.6222	+0.502	+0.553	+0.080
.8582	.2741	+0.204	+0.251	-0.244	323.5181	.6993	+0.257	+0.319	-0.162
163.8641	.3523	+0.137	+0.180	-0.311	.5233	.6997	+0.268	+0.313	-0.168
.8696	.3524	+0.131	+0.174	-0.325	324.5169	.7766	+0.155	+0.209	-0.282
167.8592	.6609	+0.305	+0.354	-0.105	.5217	.7770	+0.159	+0.211	-0.283
.8657	.6614	+0.305	+0.361	-0.105	325.5212	.8543	+0.127	+0.182	-0.317
174.8458	.2012	+0.343	+0.404	-0.070	.5266	.8546	+0.132	+0.175	-0.314
.8511	.2017	+0.337	+0.401	-0.077	327.5119	.0082	+0.546	+0.630	+0.182
175.8141	.2761	+0.178	+0.227	-0.257	.5173	.0086	+0.553	+0.632	+0.183
.8196	.2766	+0.171	+0.229	-0.260	328.5117	.0855	+0.920	+1.033	+0.620
180.8184	.6632	+0.350	+0.392	-0.073	.5166	.0859	+0.933	+1.048	+0.630
.8244	.6636	+0.345	+0.396	-0.081	330.5174	.2407	+0.247	+0.293	-0.187
207.8545	.7541	+0.218	+0.262	-0.220	.5227	.2411	+0.241	+0.307	-0.172
.8626	.7547	+0.221	+0.276	-0.224	331.5024	.3168	+0.103	+0.157	-0.347
209.8199	.9061	+0.232	+0.226	-0.271	.5074	.3172	+0.106	+0.166	-0.344
.8262	.9066	+0.229	+0.240	-0.245	332.5067	.3945	+0.100	+0.165	-0.316
210.7785	.9802	+0.343	+0.421	-0.033	.5109	.3948	+0.104	+0.173	-0.304
.7843	.9807	+0.344	+0.417	-0.012	341.5394	.0931	+0.868	+0.957	+0.539
215.7595	.3655	+0.150	+0.197	-0.302	.5449	.0935	+0.882	+0.975	+0.537
.7652	.3659	+0.144	+0.195	-0.310	342.4963	.1671	+0.459	+0.537	+0.099
217.7311	.5179	+0.458	+0.477	-0.004	.5008	.1674	+0.460	+0.529	+0.098
.7364	.5183	+0.454	+0.490	-0.009	343.4896	.2446	+0.203	+0.250	-0.246
221.6932	.8244	+0.101	+0.180	-0.305	.5064	.2452	+0.200	+0.263	-0.237
.6992	.8248	+0.136	+0.188	-0.265	344.4968	.3218	+0.110	+0.168	-0.331
.7044	.8258	+0.141	+0.218	-0.298	.5027	.3223	+0.114	+0.163	-0.338
239.6426	.1810	+0.313	+0.395	-0.107	.5090	.3228	+0.116	+0.165	-0.333
.6470	.1814	+0.257	+0.388	-0.113	349.4903	.7080	+0.191	+0.250	+0.252
250.6120	.0609	+1.028	+1.159	+0.740	.4956	.7084	+0.210	+0.250	+0.253
.6168	.0613	+1.024	+1.165	+0.737	.5008	.7088	+0.215	+0.249	+0.234
257.5999	.6013	+0.550	+0.551	-0.066	351.5057	.8639	+0.073	+0.108	+0.322
.6060	.6018	+0.551	+0.581	-0.073	.5105	.8644	+0.067	+0.114	+0.382
260.5902	.8326	+0.119	+0.169	+0.363	.5159	.8647	+0.070	+0.121	+0.385
.5953	.8330	+0.117	+0.162	+0.379	352.5016	.9409	+0.190	+0.233	+0.234
277.6089	.1486	+0.692	+0.763	+0.417	.5066	.9413	+0.199	+0.236	+0.221
.6140	.1492	+0.686	+0.730	+0.381	.5114	.9416	+0.203	+0.241	+0.213
280.5693	.3777	+0.131	+0.167	-0.324	354.4805	.0939	+0.889	+1.004	+0.583
.5739	.3781	+0.146	+0.089	-0.346	.4850	.0943	+0.881	+1.002	+0.577
288.5988	.9987	+0.502	+0.559	+0.135	355.4894	.1720	+0.405	+0.489	+0.047
.6045	.9992	+0.491	+0.575	+0.130	.4946	.1724	+0.403	+0.481	+0.032
295.5471	.5361	+0.462	+0.507	+0.054	358.4928	.4042	+0.148	+0.204	-0.304
.5526	.5368	+0.456	+0.498	+0.049	.4977	.4046	+0.152	+0.211	-0.292
302.5428	.0771	+0.966	+1.043	+0.621	361.4839	.6356	+0.422	+0.471	-0.007
.5484	.0776	+1.011	+1.109	+0.659	.4898	.6360	+0.424	+0.468	-0.003
.5586	.0785	+0.989	+1.099	+0.636	362.4880	.7132	+0.199	+0.255	-0.246
305.5946	.3132	+0.150	+0.210	+0.296	.4953	.7138	+0.199	+0.255	-0.248
.5998	.3136	+0.160	+0.214	-0.297	364.4948	.8684	+0.105	+0.136	-0.368
.6059	.3140	+0.157	+0.215	-0.290	.5002	.8688	+0.106	+0.128	-0.350
306.5574	.3876	+0.147	+0.239	-0.300	365.4841	.9449	+0.184	+0.238	-0.208
.5621	.3880	+0.152	+0.218	-0.306	.4893	.9453	+0.187	+0.232	-0.232
309.5403	.6183	+0.533	+0.569	+0.092	367.4864	.0998	+0.886	+0.986	+0.564
.5443	0.6185	+0.533	+0.565	+0.094	.4927	.1004	+0.892	+0.985	+0.576
					373.4774	.5631	+0.495	+0.540	+0.072
					.4832	0.5636	+0.496	+0.536	+0.090

TABLE II

DIFFERENTIAL UBV OBSERVATIONS (LOVELL)

JD(hel.) 2442000+	Phase	ΔV	ΔB	ΔU	JD(hel.) 2442000+	Phase	ΔV	ΔB	ΔU
154.805	0.6513	+0.375	+0.403	-0.121	236.647	0.9808	+0.390	+0.448	-0.032
.814	.6520	+0.389	+0.407	-0.080	.654	.9814	+0.410	+0.445	-0.014
.822	.6527	+0.366	+0.409	-0.101	240.663	.2914	+0.138	+0.181	-0.345
155.789	.7274	+0.177	+0.217	-0.270	.670	.2920	+0.182	+0.202	-0.326
.798	.7281	+0.176	+0.200	-0.314	.679	.2927	+0.146	+0.164	-0.324
.809	.7289	+0.175	+0.207	-0.295	242.635	.4440	+0.203	+0.267	-0.200
157.863	.8878	+0.108	+0.178	-0.351	.644	.4447	+0.192	+0.259	-0.202
.871	.8884	+0.108	+0.159	-0.354	.653	.4453	+0.185	+0.270	-0.195
.880	.8892	+0.119	+0.175	-0.346	245.652	.6773	+0.354	+0.491	-0.065
162.790	.2688	+0.211	+0.242	-0.242	.659	.6778	+0.336	+0.407	-0.014
.798	.2696	+0.210	+0.242	-0.247	.667	.6784	+0.327	+0.395	-0.077
.809	.2703	+0.201	+0.245	-0.241	250.626	.0620	+0.994	+1.140	+0.732
171.784	.9645	+0.280	+0.346	-0.083	.633	.0626	+1.011	+1.230	+0.730
.798	.9655	+0.289	+0.376	-0.096	.640	.0631	+0.967	+1.112	+0.699
.803	.9659	+0.292	+0.374	-0.093	257.628	.6036	+0.582	+0.606	+0.124
178.755	.5036	+0.370	+0.421	-0.067	.635	.6041	+0.545	+0.595	+0.130
.763	.5042	+0.355	+0.399	-0.017	.643	.6047	+0.556	+0.585	+0.144
.770	.5048	+0.372	+0.426	-0.048	265.621	.2217	+0.318	+0.381	-0.111
183.811	.8946	+0.166	+0.218	-0.323	.630	.2224	+0.288	+0.370	-0.119
.820	.8953	+0.143	+0.196	-0.316	.640	.2231	+0.264	+0.352	-0.130
.829	.8960	+0.157	+0.205	-0.305	274.592	.9155	+0.157	+0.227	-0.243
188.761	.2774	+0.169	+0.216	-0.272	.600	.9161	+0.164	+0.234	-0.254
.770	.2781	+0.181	+0.224	-0.239	.610	.9169	+0.157	+0.227	-0.244
.780	.2789	+0.170	+0.238	-0.274	295.672	.5457	+0.456	+0.531	+0.067
195.725	.8160	+0.126	+0.153	-0.309	.680	.5464	+0.471	+0.548	+0.071
.735	.8168	+0.142	+0.144	-0.362	.690	.5471	+0.476	+0.529	+0.080
.746	.8176	+0.159	+0.160	-0.358	296.692	.6247	+0.495	+0.569	+0.124
202.698	.3553	+0.151	+0.174	-0.355	.701	.6254	+0.510	+0.578	+0.122
.707	.3560	+0.144	+0.173	-0.345	.712	.6262	+0.492	+0.585	+0.107
.717	.3568	+0.147	+0.157	-0.405	305.673	.3192	+0.131	+0.177	-0.320
222.733	.9047	+0.245	+0.220	-0.282	.681	.3198	+0.129	+0.203	-0.309
.742	.9054	+0.213	+0.207	-0.337	.691	.3206	+0.168	+0.192	-0.300
.753	.9063	+0.195	+0.214	-0.307	309.678	.6290	+0.476	+0.520	+0.083
225.647	.1301	+0.953	+0.977	+0.544	.686	.6296	+0.501	+0.531	+0.061
.656	.1308	+0.880	+0.978	+0.578	.695	.6304	+0.508	+0.546	+0.040
.665	.1315	+0.899	+0.981	+0.557	314.664	.0146	+0.560	+0.683	+0.254
226.646	.2074	+0.314	+0.372	-0.117	.669	.0149	+0.569	+0.664	+0.248
.654	.2080	+0.374	+0.417	-0.116	.682	.0160	+0.576	+0.692	+0.256
.661	.2086	+0.250	+0.309	-0.160	317.660	.2463	+0.207	+0.300	-0.172
236.639	0.9802	+0.446	+0.450	+0.013	.669	.2470	+0.180	+0.290	-0.191
					.678	.2477	+0.219	+0.296	-0.175
					324.622	.7847	+0.135	+0.194	-0.303
					.630	.7853	+0.104	+0.196	-0.263
					.640	0.7861	+0.097	+0.177	-0.286

TABLE III

DIFFERENTIAL UBV OBSERVATIONS (HALL)

JD(hel.) 2442000+	Phase	ΔV	ΔB	ΔU
322.535	0.6233	+0.508	+0.530	+0.059
.543	.6239	+0.508	+0.537	+0.071
323.556	.7023	+0.269	+0.318	-0.138
.570	.7034	+0.267	+0.321	-0.136
325.657	.8648	+0.161	+0.217	-0.191
.664	.8653	+0.160	+0.220	-0.187
.676	.8663	+0.169	+0.232	-0.169
326.574	.9357	+0.217	+0.259	-0.198
.580	.9362	+0.213	+0.261	-0.189
.586	.9366	+0.210	+0.264	-0.190
329.580	.1682	+0.459	+0.511	+0.113
.586	.1687	+0.448	+0.509	+0.111
.593	0.1692	+0.449	+0.514	+0.134