EXTREMA OF THE POLAR AM HER: RESULTS OF MULTITELESCOPE MONITORING

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ABSTRACT. The characteristics of 250 extrema of AM Her from the photographic, photoelectric and TV observations are tabulated.

Key words: Stars: Cataclysmic: Polars: AM Her

AM Her is a prototype of polars which shows significant cycle–to –cycle variations of the light curve with few year–scale variations of mean brightness and phase (e.g. Andronov 1987). To study them, the monitoring of this object was started in 1988 in Odessa. The complete table of early observations and the atlas of photovisual light curves was published by Andronov et al. (1984).

Photographic monitoring was carried out in Kishinev, some results of which were published by Smykov and Shakun (1985) and are reanalyzed in the present work. The photographic observations ($n = 1216$) were obtained at the 50-cm telescope AZT-3 by using the ORWO ZU-21 plates.

The monitoring was continued in 1986–88 in the Abastumani Astrophysical Observatory at the Schmidt camera. The photovisual negatives ($n = 341$) were obtained on the A600 film by I.L.Andronov, G.N.Kimeridze, S.V.Kolesnikov and N.V.Poplavskaya. The brightness of the comparison stars was published by Andronov and Korotin (1982).

TV observations were obtained by E.P.Pavlenko, S.V.Kolesnikov and I.G.Borodina at the MTM–500 complex of the Crimean Astrophysical Observatory (CrAO) described by Abramenko et al. (1988). At the first regime, only one filter was used all the night. At the second, two filters switched every exposure. The observations are used as the instrumental magnitude differences "var-d" ($n = 21$, 134, 216 for b, v, r).

The star was observed by N.M.Shakhovskoy at the 1.25m telescope AZT-11 of the CrAO by using the UBVRI photometer–polarimeter of the Helsinki University (Korhonen et al., 1984). The brightness of the comparison star "d" was determined by linking to the standard star BD+26°2930 (Neckel and Chini, 1980): $U = 14\overset{\mathrm{m}}{.}02$, $B = 13\overset{\mathrm{m}}{.}72$, $V = 13\overset{\mathrm{m}}{.}10$, $R = 12\overset{\mathrm{m}}{.}58$, $I = 12\overset{\mathrm{m}}{.}17$. The instrumental magnitudes were converted to the standard system. One run was obtained in V only ($n = 27$). Some results of further monitoring of AM Her were presented by Shakhovskoy et al. (1994).

For the analysis we have used the smoothing by the method of "running parabolae" introduced by Andronov (1990, 1997). The filter half–width $\Delta t = 0\overset{\mathrm{d}}{.}04$ was used which is sufficient enough to fit the two–wave light curves often observed in AM Her.

The extrema are listed in Table 1 where are marked as the "primary" and "secondary" maxima and minima. In the case of absense of the secondary minimum we have marked the single maximum as the "primary". The weighted mean phase shifts between the primary minima in a given color in respect to the minimum in V are $-0\overset{\mathrm{p}}{.}082 \pm 0\overset{\mathrm{p}}{.}016$ (U), $-0\overset{\mathrm{p}}{.}061 \pm 0\overset{\mathrm{p}}{.}020$ (B), $0\overset{\mathrm{p}}{.}008 \pm 0\overset{\mathrm{p}}{.}018$ (R), $0\overset{\mathrm{p}}{.}028 \pm 0\overset{\mathrm{p}}{.}019$ (I). The shift increases with wavelength exceeding 3σ in U, B.

In this work we present the tables of characteristics of individual extrema. These results joined with other published data will be discussed elsewhere.

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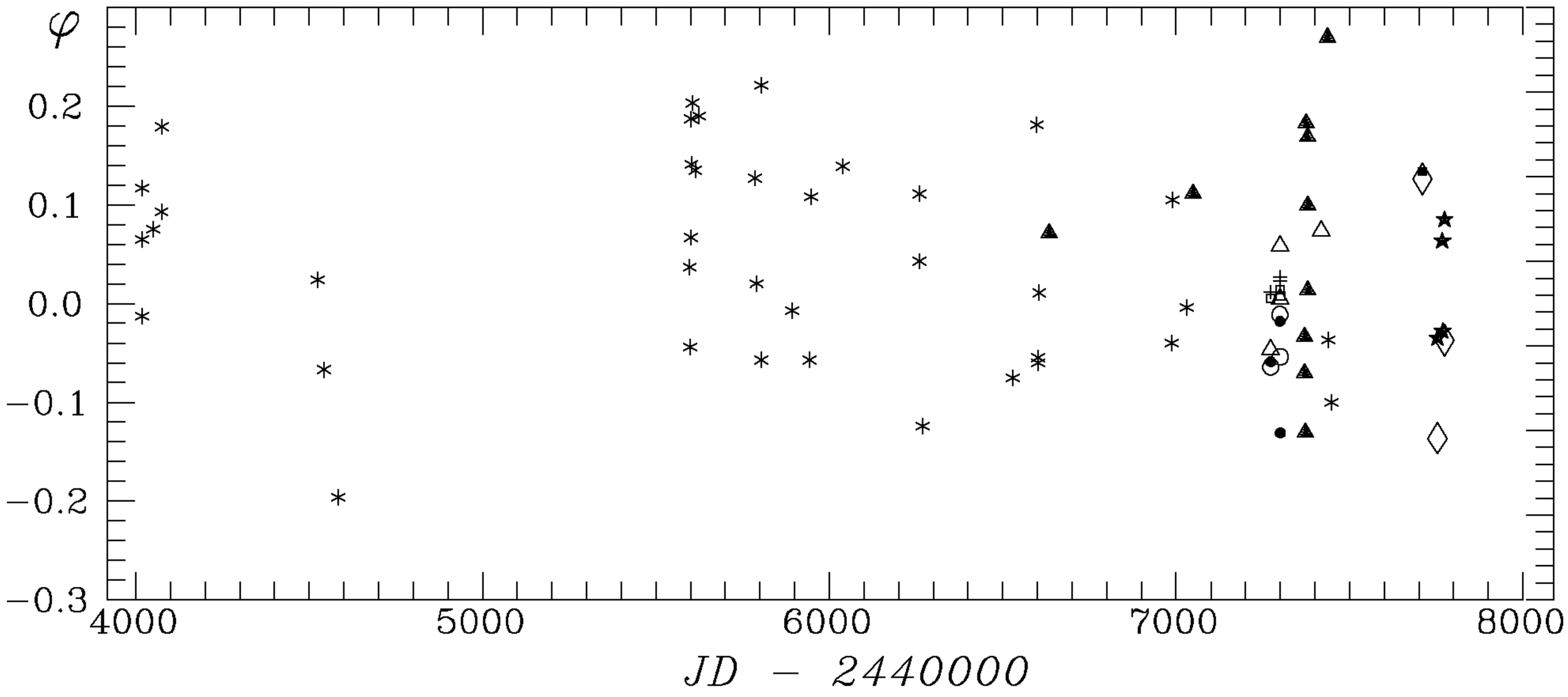

Figure 1: Dependence of the phase of the primary minimum on time for different observational sets. The labels used in the figure are listed in Table 1 in brackets. The phases are computed according to the ephemeris $Min.HJD = 2443014.713 + 0.128927 \cdot E$ (Szkody and Brownlee, 1977).

Table 1. The characteristics of extrema of AM Her: main (1) and secondary (2) minima and (3,4) maxima, i.e. the sequence is 1425...

T_e	ϕ_e	$\sigma[\phi_e]$	m_e	$\sigma[m_e]$	type	T_e	ϕ_e	$\sigma[\phi_e]$	m_e	$\sigma[m_e]$	type
Kishinev, pg (*)						4524.349	0.228	0.181	14.70	0.13	4
4017.455	-0.405	0.114	12.64	0.07	5	4542.360	-0.067	0.052	13.23	0.05	1
4017.516	0.065	0.047	13.34	0.08	1	4583.214	-0.196	0.212	13.22	0.14	1
4018.408	-0.013	0.024	13.47	0.07	1	5597.338	-0.319	0.041	13.46	0.11	5
4019.386	-0.427	0.173	12.93	0.10	2	5597.383	0.037	0.049	14.40	0.12	1
4019.417	-0.188	0.034	12.67	0.12	5	5599.363	0.394	0.053	14.38	0.16	2
4019.456	0.117	0.027	13.44	0.13	1	5599.397	-0.349	0.088	13.82	0.14	5
4019.490	0.380	0.024	12.68	0.10	4	5599.436	-0.044	0.023	14.48	0.19	1
4019.515	-0.428	0.052	12.86	0.15	2	5600.353	0.067	0.069	14.31	0.20	1
4050.393	0.075	0.149	13.38	0.15	1	5600.378	0.265	0.031	13.81	0.17	4
4074.451	-0.327	0.072	12.55	0.16	5	5600.406	0.482	0.089	14.20	0.28	2
4074.505	0.093	0.235	13.42	0.13	1	5601.338	-0.291	0.025	14.00	0.15	5
4074.533	0.311	0.050	13.19	0.04	4	5601.399	0.187	0.005	14.69	0.07	1
4075.370	-0.194	0.101	12.60	0.09	5	5602.296	0.141	0.056	14.51	0.06	1
4075.419	0.179	0.026	13.41	0.10	1	5602.326	0.372	0.034	14.14	0.09	4
4075.467	-0.445	0.023	12.64	0.06	4	5602.344	-0.489	0.029	14.25	0.10	2
4076.398	-0.223	0.044	12.56	0.07	5	5602.368	-0.298	0.064	14.11	0.11	5
4076.513	-0.333	0.066	12.46	0.03	5	5605.269	0.203	0.124	14.43	0.15	1
4078.532	0.326	0.018	12.51	0.10	4	5605.319	-0.415	0.046	13.96	0.13	4
4467.380	0.358	0.022	15.42	0.04	2	5607.412	-0.180	0.025	14.10	0.03	5
4467.403	-0.458	0.055	15.35	0.04	5	5610.354	-0.358	0.064	14.04	0.08	5
4467.475	0.096	0.200	15.24	0.04	4	5613.326	-0.304	0.024	14.66	0.12	5
4472.376	0.110	0.116	15.26	0.07	4	5613.383	0.135	0.289	14.88	0.05	1
4472.405	0.333	0.015	15.45	0.07	2	5618.336	-0.451	0.054	15.64	0.08	2
4524.283	-0.278	0.142	14.64	0.03	5	5618.340	-0.417	0.638	15.63	0.08	2
4524.322	0.024	0.167	14.92	0.09	1	5618.388	-0.042	0.055	15.40	0.13	5

Table 1 (continued).

T_e	ϕ_e	$\sigma[\phi_e]$	m_e	$\sigma[m_e]$	type	T_e	ϕ_e	$\sigma[\phi_e]$	m_e	$\sigma[m_e]$	type
Kishinev, pg (*)						Kishinev, pg (*)					
5623.351	0.449	0.151	15.71	0.07	2	6598.520	0.181	0.049	14.01	0.04	1
5624.349	0.190	0.057	15.65	0.08	1	6600.486	0.425	0.037	14.42	0.06	4
5785.500	0.127	0.038	14.76	0.07	1	6601.434	-0.218	0.029	14.38	0.10	5
5789.440	-0.313	0.031	14.55	0.01	5	6601.455	-0.055	0.066	14.54	0.10	1
5789.482	0.020	0.163	14.73	0.06	1	6602.486	-0.060	0.120	14.81	0.05	1
5792.529	-0.347	0.112	15.27	0.05	2	6605.460	0.011	0.121	14.57	0.10	1
5792.554	-0.155	0.070	15.17	0.04	5	6986.433	-0.040	0.099	14.23	0.09	1
5796.470	0.218	0.030	15.26	0.05	4	6986.464	0.202	0.008	13.99	0.03	4
5804.464	0.221	0.072	15.43	0.25	1	6988.417	0.349	0.084	13.97	0.12	4
5804.515	-0.381	0.024	15.15	0.08	5	6989.383	-0.159	0.007	14.00	0.02	5
5804.557	-0.057	0.092	15.68	0.07	1	6989.417	0.105	0.086	14.37	0.08	1
5824.502	-0.360	0.063	15.65	0.03	2	6989.442	0.296	0.040	14.09	0.15	4
5827.376	-0.062	0.325	15.50	0.14	5	6989.470	-0.482	0.114	14.28	0.20	2
5827.389	0.032	0.128	15.48	0.11	5	7025.421	0.362	0.006	13.97	0.01	2
5893.394	-0.007	0.034	14.18	0.14	1	7031.389	-0.348	0.050	13.61	0.02	5
5914.490	-0.380	0.071	14.10	0.06	5	7031.433	-0.004	0.039	14.00	0.04	1
5943.375	-0.342	0.175	13.76	0.07	5	7040.419	-0.306	0.045	13.58	0.05	5
5943.411	-0.057	0.052	13.92	0.07	1	7382.426	0.410	0.025	13.50	0.05	4
5947.300	0.108	0.029	14.32	0.14	1	7382.455	-0.364	0.150	13.77	0.10	2
5947.352	-0.495	0.029	13.87	0.07	5	7386.417	0.365	0.145	13.53	0.05	4
6005.373	-0.464	0.035	13.97	0.14	5	7387.358	-0.331	0.098	13.38	0.10	5
6039.229	0.139	0.258	14.13	0.14	1	7389.412	-0.406	0.014	13.71	0.03	2
6039.254	0.329	0.078	13.90	0.12	4	7389.455	-0.067	0.055	13.51	0.04	5
6039.284	-0.436	0.116	14.25	0.15	2	7438.323	-0.037	0.092	13.69	0.02	1
6137.520	-0.489	0.103	14.11	0.12	5	7448.332	-0.401	0.062	13.63	0.04	5
6165.433	0.017	0.010	15.34	0.02	4	7448.371	-0.100	0.029	13.92	0.08	1
6165.474	0.331	0.060	15.71	0.04	2	Abastumani, pv (▲)					
6176.441	0.397	0.111	15.79	0.14	2	6633.274	0.741	0.073	14.35	0.07	5
6176.476	-0.333	0.045	15.41	0.06	5	6633.317	0.074	0.023	14.70	0.05	1
6176.552	0.258	0.038	15.24	0.12	4	6633.356	0.380	0.043	14.27	0.14	4
6194.472	0.254	0.140	15.45	0.06	4	6633.485	0.376	0.088	14.61	0.06	2
6194.507	-0.475	0.233	15.70	0.11	2	6634.498	0.240	0.135	14.40	0.11	4
6259.424	0.043	0.031	14.69	0.05	1	7048.338	0.114	0.053	13.97	0.06	1
6260.392	-0.452	0.040	14.21	0.08	2	7049.250	0.191	0.097	13.50	0.15	4
6260.426	-0.187	0.130	14.07	0.06	5	7059.333	0.399	0.455	13.71	0.10	4
6260.464	0.111	0.055	14.43	0.05	1	7063.334	0.430	0.092	13.59	0.11	4
6262.432	0.373	0.039	14.37	0.10	4	7063.360	0.633	0.033	13.79	0.10	2
6262.453	-0.465	0.006	14.46	0.03	2	7064.243	0.481	0.025	12.96	0.24	4
6269.459	-0.124	0.033	14.63	0.10	1	7064.346	0.275	0.038	13.43	0.14	4
6288.394	-0.263	0.102	15.72	0.07	2	7078.308	0.571	0.082	13.73	0.05	5
6288.425	-0.021	0.109	15.45	0.05	5	7080.230	0.477	0.029	13.91	0.09	2
6301.475	0.202	0.079	15.49	0.06	4	7080.260	0.716	0.047	13.51	0.15	5
6305.399	-0.364	0.042	15.76	0.08	2	7348.382	0.354	0.087	12.94	0.09	4
6327.421	0.448	0.031	15.48	0.05	5	7348.402	0.514	0.038	13.00	0.07	2
6327.456	-0.283	0.193	15.67	0.07	2	7370.379	-0.031	0.111	13.63	0.11	1
6334.395	-0.459	0.054	15.78	0.06	2	7370.438	0.431	0.059	12.87	0.06	4
6528.427	-0.484	0.020	15.64	0.22	2	7370.503	-0.068	0.094	13.73	0.15	1
6528.457	-0.251	0.082	15.20	0.19	5	7373.332	-0.128	0.011	13.83	0.15	1
6528.480	-0.075	0.018	15.77	0.13	1	7373.430	0.638	0.035	12.71	0.10	5
6528.513	0.179	0.030	15.08	0.12	4	7373.501	0.185	0.009	14.33	0.20	1
6581.450	-0.221	0.100	14.45	0.04	5	7378.329	0.636	0.037	12.83	0.08	5
6598.488	-0.067	0.037	13.69	0.05	5	7378.378	0.016	0.099	13.59	0.11	1

Table 1 (continued).

T_e	ϕ_e	$\sigma[\phi_e]$	m_e	$\sigma[m_e]$	type
Abastumani, pv					(▲)
7378.461	0.657	0.100	13.09	0.12	5
7379.301	0.171	0.176	13.59	0.11	1
7379.349	0.549	0.061	12.97	0.12	5
7379.421	0.102	0.024	13.85	0.06	1
7427.450	0.633	0.057	13.78	0.07	2
7433.470	0.325	0.171	13.72	0.16	2
7436.428	0.272	0.103	13.79	0.11	1
7437.425	0.998	0.030	12.79	0.14	5
CrAO, AZT–11, U (×)					
7272.438	0.305	0.030	12.91	0.02	2
7272.467	-0.470	0.017	12.80	0.02	5
7272.520	-0.059	0.050	13.31	0.12	1
7272.546	0.149	0.007	12.65	0.06	4
7299.342	-0.018	0.014	11.96	0.04	1
7299.364	0.155	0.054	11.86	0.04	4
7299.398	0.417	0.039	12.06	0.03	2
7300.314	-0.479	0.156	12.18	0.03	2
7300.323	-0.407	0.085	12.17	0.03	5
7300.359	-0.131	0.039	12.29	0.02	1
7300.402	0.203	0.035	12.05	0.02	4
7389.348	0.099	0.014	12.00	0.02	4
7389.395	0.467	0.027	12.43	0.02	2
CrAO, AZT–11, B (◯)					
7272.432	0.261	0.028	13.93	0.02	2
7272.466	-0.471	0.058	13.83	0.02	5
7272.519	-0.064	0.039	14.01	0.03	1
7299.343	-0.011	0.023	13.23	0.04	1
7299.376	0.250	0.145	13.14	0.03	4
7299.392	0.374	0.043	13.18	0.02	2
7299.448	-0.196	0.124	12.95	0.02	5
7300.312	-0.496	0.082	13.27	0.03	2
7300.327	-0.376	0.066	13.24	0.03	4
7300.368	-0.054	0.034	13.48	0.02	1
7300.414	0.300	0.026	13.22	0.02	4
7389.349	0.107	0.030	13.27	0.02	4
7389.403	-0.476	0.052	13.52	0.02	2
7389.448	-0.126	0.078	13.33	0.02	5
CrAO, AZT–11, V (△)					
7272.456	0.451	0.050	13.48	0.04	4
7272.464	-0.491	0.084	13.48	0.04	2
7272.487	-0.314	0.036	13.41	0.05	5
7272.522	-0.044	0.027	14.03	0.04	1
7299.352	0.061	0.011	13.52	0.05	1
7299.433	-0.308	0.034	12.78	0.03	5
7300.328	-0.371	0.031	12.91	0.03	5
7300.376	0.007	0.020	13.67	0.02	1
7300.426	0.389	0.018	13.01	0.02	4
7389.424	-0.313	0.019	13.01	0.03	5
7418.301	-0.331	0.032	13.03	0.04	5
7418.353	0.076	0.245	13.48	0.04	1
CrAO, AZT–11, R (□)					
7272.454	0.436	0.033	12.73	0.03	4

T_e	ϕ_e	$\sigma[\phi_e]$	m_e	$\sigma[m_e]$	type
CrAO, AZT–11, R (□)					
7272.462	0.498	0.024	12.74	0.03	2
7272.488	-0.302	0.018	12.58	0.04	5
7272.528	0.005	0.014	13.45	0.03	1
7299.346	0.014	0.039	12.77	0.04	1
7299.437	-0.277	0.023	11.98	0.02	5
7300.308	0.476	0.038	12.29	0.03	2
7300.330	-0.349	0.018	12.12	0.03	5
7300.376	0.008	0.016	12.98	0.02	1
7300.422	0.361	0.013	12.26	0.01	4
7389.378	0.337	0.038	12.43	0.02	4
7389.398	0.486	0.039	12.47	0.03	2
7389.425	-0.306	0.019	12.33	0.03	5
CrAO, AZT–11, I (+)					
7272.456	0.449	0.065	12.00	0.02	4
7272.462	0.493	0.030	12.00	0.02	2
7272.489	-0.296	0.020	11.85	0.03	5
7272.529	0.012	0.011	12.66	0.02	1
7299.347	0.023	0.052	12.08	0.05	1
7299.384	0.312	0.032	11.70	0.03	4
7299.391	0.362	0.072	11.71	0.03	2
7299.438	-0.274	0.021	11.36	0.02	5
7300.331	-0.346	0.020	11.50	0.02	5
7300.379	0.027	0.021	12.33	0.03	1
7300.420	0.347	0.015	11.61	0.02	4
7389.375	0.309	0.016	11.73	0.02	4
7389.400	-0.500	0.023	11.83	0.02	2
7389.426	-0.297	0.022	11.70	0.03	5
CrAO, MTM–500, b (■)					
7710.351	-0.095	0.070	-0.56	0.04	5
7710.381	0.134	0.078	-0.44	0.04	1
7710.394	0.238	0.053	-0.46	0.04	4
7710.429	-0.492	0.060	-0.21	0.05	2
CrAO, MTM–500, v (◇)					
7710.379	0.126	0.004	0.35	0.06	1
7710.432	-0.469	0.094	-0.37	0.07	4
7710.463	-0.225	0.087	-0.13	0.08	2
7753.407	-0.136	0.135	0.51	0.07	1
7753.444	0.146	0.154	0.29	0.06	4
7753.471	0.357	0.095	0.36	0.05	2
7774.306	-0.037	0.032	0.36	0.04	1
7774.342	0.243	0.023	-0.08	0.04	4
7774.383	-0.438	0.051	0.27	0.03	2
CrAO, MTM–500, r (⋆)					
7753.420	-0.035	0.043	0.50	0.05	1
7753.478	0.410	0.070	0.07	0.04	4
7767.357	0.063	0.064	0.33	0.03	1
7768.447	-0.483	0.028	0.27	0.06	2
7768.474	-0.275	0.066	0.08	0.03	5
7768.506	-0.028	0.103	0.22	0.03	1
7773.420	0.085	0.103	0.39	0.03	1
7773.463	0.424	0.032	0.05	0.04	4
7773.492	-0.350	0.014	0.28	0.04	2