PHOTOMETRIC OBSERVATIONS OF 18 MELPOMENE

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ABSTRACT. Results of photometric observations of the asteroid 18 Melpomene carried out at the Skalnaté Pleso Observatory during February 1990 are presented. Its lightcurve with one distinct and one shallow minimum is obtained. Comparison of the lightcurve with other observations obtained in different aspects and phase angles support the suggestion that 18 Melpomene has an irregular shape and surface.

1. OBSERVATIONAL TECHNIQUE

Our photometric observations of 18 Melpomene belong to the first photometric measurements of asteroids at the Skalnaté Pleso Observatory. We obtained data during three nights of February 22-24, 1990, and a few more values on February 21 and 25, 1990. On the following days the weather was unfavourable and so we were not able to obtain more observations.

The observations were made with a photoelectric photometer, installed in the Cassegrain focus of the 600/7550 mm reflector. A focal diaphragm with diameter of 81" was used. The asteroid was observed in V and B bands of the UBV photometric system.

2. CONDITIONS OF THE OBSERVATIONS

18 Melpomene has a quite eccentric orbit (e = 0.22). During our observations the asteroid was near the opposition, at the heliocentric distance r = 2.66 AU. Zenith distance was approximately 42° in culmination point of the asteroid and

the minimum air mass was thus only 1.3. The values of air mass ranged from 1.3 to 2.7 during the observations.

Stars SAO 118 821 : V = 9.65, B-V = + 0.63 and SAO 118 709 : V = 9.24 have been chosen as comparison and extinction stars. Extinction coefficients for all the nights are listed in Table 1:

	V filter		
1990 Date	Before culmination	After culmination	B filter
Feb 21/22	0.14 ± 0.01		
Feb 22/23	0.15 ± 0.01	0.14 ± 0.02	
Feb 23/24	0.19 ± 0.02	0.13 ± 0.02	
Feb 24/25	0.13 ± 0.02	0.13 ± 0.01	0.30 ± 0.03
Feb 25/26	0.19 ± 0.02		0.35 ± 0.01

3. CHANGES OF THE BRIGHTNESS

Magnitudes and standard errors were calculated by usual way from Pogson equation. Mean standard errors of measurements have been ± 0.023 mag., with minimum on February 22, 1990 (± 0.016 mag.) and maximum on February 23, 1990 (± 0.030 mag.). The differences were caused by changes of the air quality.

The amplitude of the lightcurve from February 1990 is 0.12 mag. at an aspect phase angle only of 5°. One well visible minimum have been observed. The secondary minimum was slighter (0.05 mag.).

The lightcurve from May/June 1984 reveals two equally distinct maxima and minima during one rotation and amplitude 0.35 mag. at an aspect phase angle of about 10° (Zeigler and Florence, 1985). The lightcurve from October 1978 contains an interesting bump near one minimum and amplitude 0.35 mag. at an aspect phase angle of about 20° (Binzel and Harris, 1980). The lightcurve from August/September 1988 has suprisingly low amplitude (0.1 mag.) at a small aspect phase angle. One of the minima is deeper in the lightcurve of November 1988 (Hoffmann and Geyer, 1988). Comparison of our lightcurve with other ones support the suggestion that 18 Melpomene has an irregular shape and surface.

As the asteroid approached the Earth, its average brightness grew-up about 0.051 mag. daily.

Observations in the B filter were carried out on February 24 and 25 only, moreover not during the whole nights. Than is why we mention the lightcurve in the V filter only. Figures 1 - 3 shown lightcurves from single night. The composite lightcurve of 18 Melpomene from February 1990 is shown in Fig. 4. All obtained data are listed in Table 2.

A colour-index B-V on the basis of our own measurements was derived as follows : B-V = (+0.80 ± 0.02).

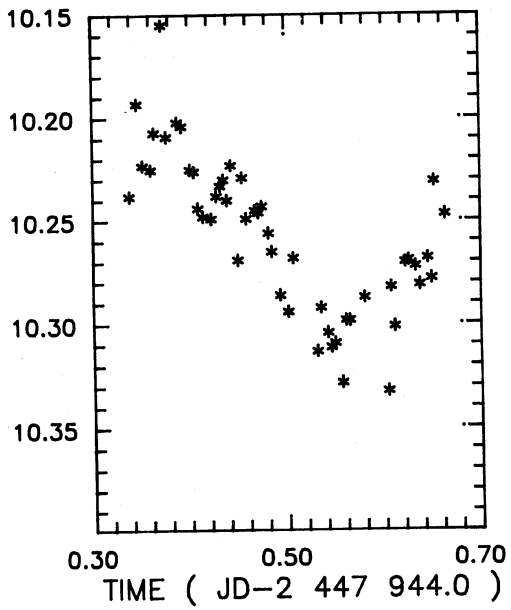

Fig.1.Light curve of 18 Melpomene, observed on Feb. 22/23, 1990

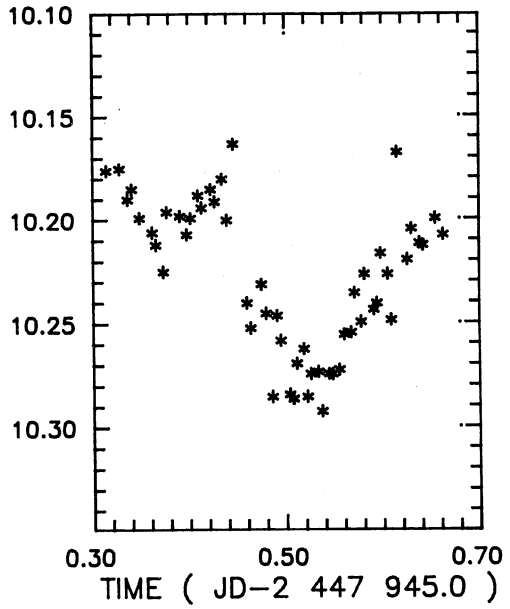

Fig.2.Light curve of 18 Melpomene, observed on Feb. 23/24, 1990

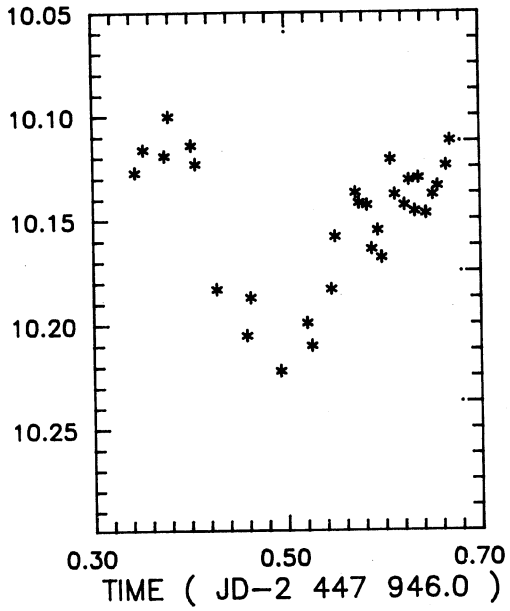

Fig.3.Light curve of 18 Melpomene, observed on Feb. 24/25, 1990

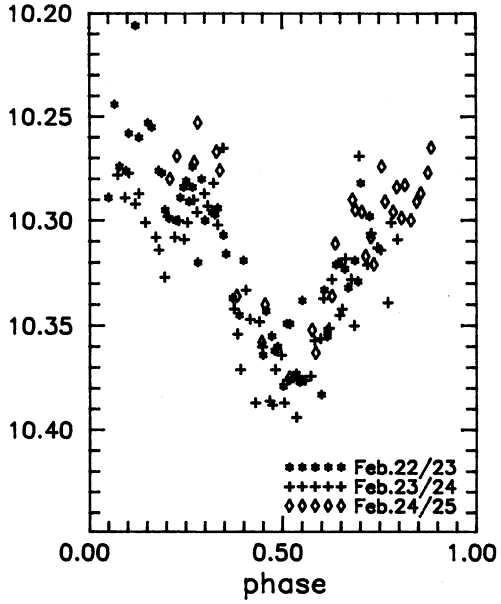

Fig.4. Composite light curve of 18 Melpomene, Feb 1990

Table 2

V filter

Time (JD)	Magnitude
Feb. 21, 1990	
2447943 +	
.359363	10.200 ±.013
.363769	.192 27
.391921	.182 20
.396990	.174 02
.426053	.172 06
Feb. 22/23, 1990	
2447944 +	
.337974	10.238 ±.017
.346365	.193 21
.352094	.223 15
.360405	.225 11
.363946	.207 07
.372638	.155 11
.376574	.209 21
.387905	.202 15
.392453	.204 05
.401053	.225 01
.404930	.226 08
.409050	.244 09
.414070	.248 19
.422805	.249 17
.428194	.238 13
.432071	.233 19
.435439	.230 10
.439085	.240 15
.443310	.223 19
.450104	.269 16
.454733	.229 16
.458831	.249 32
.467800	.245 15
.471261	.246 09
.474907	.243 11
.481793	.256 15
.485115	.265 09
.493425	.286 20
.501666	.294 12
.507002	.268 10
.531087	.313 32
.535034	.292 08
.542013	.304 24

Time (JD)	Magnitude
Feb. 22/23, 1990	
2447944 +	
.545520	10.311 ±.007
.549344	.309 35
.556278	.328 29
.560625	.298 08
.564351	.298 21
.579884	.287 12
.603538	.332 23
.607210	.282 14
.610844	.301 19
.622002	.270 08
.625439	.269 06
.632719	.272 18
.636932	.281 15
.645300	.268 13
.649143	.278 22
.652500	.231 14
.652545	.247 34
Feb. 23/24, 1990	
2447945 +	
.314039	10.176 ±.048
.327951	.175 37
.336377	.190 34
.340509	.185 36
.348645	.199 43
.361875	.206 36
.365648	.212 34
.373182	.225 29
.376817	.196 37
.390405	.198 14
.397453	.207 18
.401469	.199 30
.409328	.188 26
.412974	.194 32
.422557	.185 37
.426631	.191 46
.434212	.180 23
.439085	.200 18
.446145	.163 19
.459861	.240 26
.463564	.252 31

Time (JD)	Magnitude
Feb. 23/24, 1990	
2447945 +	
.474756	10.231 ±.033
.479560	.245 27
.486006	.285 35
.490914	.246 21
.494699	.258 25
.503923	.284 28
.507430	.286 39
.510868	.269 25
.518229	.262 26
.521840	.285 21
.525532	.274 40
.533032	.273 11
.536747	.292 14
.544131	.274 14
.547743	.274 36
.554826	.272 40
.559803	.255 23
.567106	.254 31
.570717	.235 29
.577407	.249 20
.580708	.226 21
.590555	.243 35
.593865	.240 38
.597800	.216 36
.605185	.226 32
.608703	.248 31
.625493	.219 23
.629930	.204 19
.638101	.211 27
.641666	.212 23
.654629	.199 30
.662800	.207 26
Feb. 24/25, 1990	
2447946 +	
.343587	10.127 ±.031
.352824	.116 34
.374537	.119 28
.376981	.100 22
.402118	.114 32
.406412	.123 10

Table 2 - continued

V filter

Time (JD)	Magnitude	
Feb. 24/25, 1990		
2447946 +		
.427518	10.183 ±.043	
.458344	.205	22
.462546	.187	17
.492951	.222	14
.520590	.199	11
.525347	.210	23
.545555	.183	17
.549745	.158	23
.570879	.137	15
.574594	.142	11
.582853	.143	27
.587488	.164	31
.593877	.155	27
.597754	.168	26
.607592	.121	26
.611689	.138	21
.621898	.143	28
.626388	.131	19
.632349	.146	15
.636435	.130	39
.644050	.147	20
.651099	.138	30
.656331	.134	23
.665254	.124	27
.669467	.112	40

Time (JD)	Magnitude	
Feb. 25/26, 1990		
2447947 +		
.322615	10.019 ±.033	
.327141	.032	36
.358189	.063	34
.392013	.019	30
.396134	.042	23
.460347	.065	20
.464421	.068	15
.495613	.136	27
.499918	.136	35

B filter

Time (JD)	Magnitude	
Feb. 24/25, 1990		
2447946 +		
.328067	10.925 ±.025	
.332303	.945	33
.362326	.915	35
.367615	.842	39
.390752	.882	36
.394687	.936	26
.414872	.948	22
.418995	.950	31
.442766	.921	37

Time (JD)	Magnitude	
Feb. 24/25, 1990		
2447946 +		
.449548	10.893 ±.021	
.475578	.957	36
.480821	.991	26
.507430	11.031 ±.016	
.512673	.059	24
.533263	10.975 ±.022	
.537384	.962	23
.556990	.962	30
Feb. 25/26, 1990		
2447947 +		
.338807	10.908 ±.041	
.342627	.927	51
.346145	.909	43
.350000	.932	23
.369571	.912	24
.373449	.902	19
.378009	.915	17
.382187	.939	35
.438090	.886	22
.478379	.896	14

4. ROTATION PERIOD

Our measurements from all the nights running do not cover the whole light curve of the asteroid. The rotation period of 18 Melpomene is in interval from 0.48214^d to 0.48220^d (Binzel and Harris, 1980). It is roughly half a day so at the observations during nights running we observe asteroid nearly at the same phase. We have covered 85 % from the whole rotation period. That is why the phase of 0.0 was adopted to the beginning of the first observation.

It was impossible to determine the rotation period of 18 Melpomene from our observations unambiguously. I used the code written by Zverko (1990) for the Fourier technic with unequally spaced data (Deeming, 1975). The following significant periods have been found: 0.952^d, 0.487^d, 0.322^d, 0.246^d. As it can easily be noticed, these four periods are fractional multiples of a certain period amounting to 0.952^d which clearly reflects the time schedule of our observations.

It is evident that true rotation period of 18 Melpomene must lie within the range found by Binzel and Harris (1980). Taking into account of their value the most probable value of period has been derived as 0.482 ± 0.004^{d}.

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