

THE LIGHT CURVE AND PERIOD OF THE S-TYPE MINOR PLANET 480 HANSA

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The period and amplitude of light curve variation for asteroid 480 Hansa were determined from photometry obtained on ten nights during the interval 1994 February 3 through 1994 February 28. The period of rotation is 0.67453 ± 0.0006 days (16.19 ± 0.01 hours) and the peak-to-peak photometric variation is 0.58 ± 0.01 magnitudes in the instrumental Kron-Cousins I band. The secondary minimum occurs at a rotational phase 0.528 relative to the primary minimum.

The minor planet 480 Hansa was selected for photometry after inspection of the list of photometric opportunities by Harris & Zappalà (1993). Exposures were obtained using a Kron-Cousins I band filter and a Thomson CSF 1024x1024 front-illuminated CCD camera system. The telescope employed was the 0.61-meter U.S. Naval Observatory cassegrain located in Washington, DC.

The following basic information is given about 480 Hansa by Tedesco (1989), and by Tholen (1989): Tholen type S, $H = 8.71$ m, $G = 0.471$ m, $U-B = 0.43$ m, $B-V = 0.87$ m, albedo $0.17 \pm 0.02\%$, diameter 58 ± 3.5 km. No data on photometric variation such as amplitude or period are given in Lagerkvist et al. (1989).

The photometry was performed on flat-fielded images using the aperture photometry package of DAOPHOT, Stetson (1987). Nightly differential light curves were produced with respect to a single bright unsaturated star in the CCD's 8 arc-minute field of view. All observation times were reduced to the heliocentric times of the phenomena (HJD). See Table I for an observing log.

The period determination was done using a modified Jurkevich method (Morris and DuPuy 1980) and the phase dispersion minimization method (Stellingwerf 1978). Plots of phase versus normalized magnitude for all the indicated possible periods found in the periodogram were generated and compared. The only possible correct period of those indicated in the periodogram was the 0.67453-day period. The first three nights observations were when the minor planet was moving slowly and the same comparison star could be used. Ambiguity of cycles elapsed and confusion whether we were seeing primary or secondary minima, etc. were, thus, removed by use of the common reference star on the first three nights. The light curve indicates a normal variation with two extrema having a peak-to-peak amplitude of 0.58 ± 0.01 magnitude in the instrumental Kron-Cousin's I band. Figure 1 shows the phase versus normalized instrumental I magnitude light curve for 480 Hansa covering the 1994 January through 1994 March

observing run. Each point is a mean of 20 individual magnitude differences. The rms scatter of a single point is 0.013 m and the error of a 20 point mean is 0.003 m. The lightcurve reveals that the secondary minimum does not fall exactly 0.5 phase away from the primary minimum. This indicates that the elongated shape for 480 Hansa is somewhat asymmetric.

References

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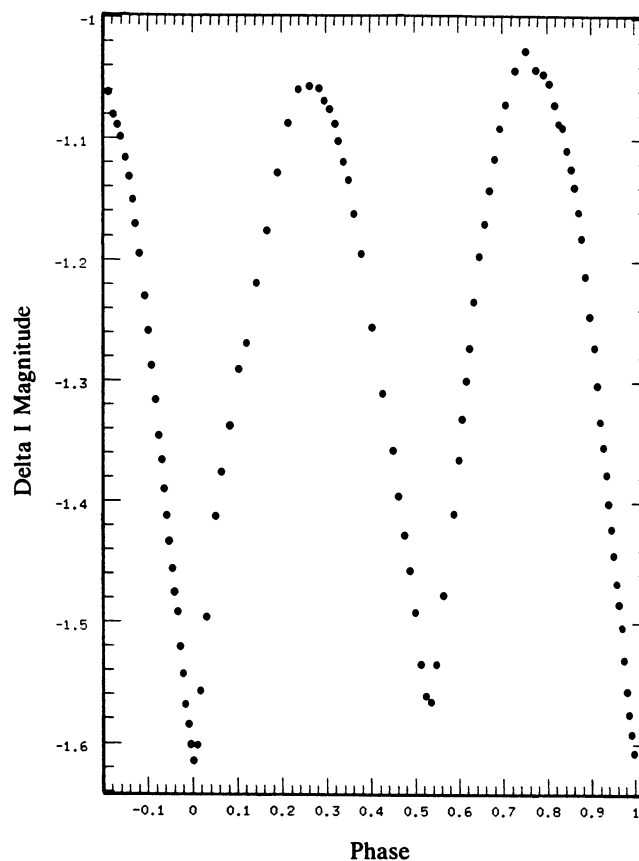


Figure 1. The phase versus normalized instrumental I magnitude light curve for 480 Hansa during its 1994 apparition. Rotational phases were determined from the following heliocentric ephemeris: Minimum (HJD) = $2449386.58056 + 0.67453 * E$. The vertical scale for individual nights was shifted manually to achieve the best fit.

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Table I. The 1994 observing log for 480 Hansa

UT Date	HJD - 2449000.0	Exposure	Phase Angle	Number of Images
1994 Feb 3	386.50678 - 386.6274660	60 sec.	20.3°	152
Feb 4	387.46888 - 387.6283160	60	20.5	201
Feb 5	388.48367 - 388.6208260	60	20.7	173
Feb 7	390.48081 - 390.6291360	60	21.0	186
Feb 8	391.48041 - 391.5497760	60	21.2	87
Feb 17	400.47442 - 400.6642260	60	22.2	225
Feb 18	401.49099 - 401.6416360	60	22.3	173
Feb 19	402.49420 - 402.5707360	60	22.4	95
Feb 27	410.49445 - 410.6145360	60	22.9	147
Feb 28	411.48670 - 411.6134760	60	23.0	130

ASTROMETRIC POSITIONS OF MINOR PLANETS

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The following precise astrometric positions have been measured from photographs obtained by the author, using a 14 cm Schmidt-Newtonian reflector of 50 cm focal length (f3.64). The location of the observing site is: **Longitude** 121°46'06.9" W; **Latitude** 47°25'59.5" N; **Altitude** 283.5 meters. The photographs were measured using the digitized stage microscope, at the University of Washington. The reported UT time is

that of mid-exposure. The number of stars used for determining each position is indicated in the last column by #*. Reference star positions were from the SAO catalog. The calculations for the positions were made on my 286 computer using the Astrometric Reduction Program which appeared in the July 1990 issue of *Sky & Telescope*. The listed standard deviation is from that program. The standard deviation in R.A. is corrected to seconds of arc using $\text{std. dev.} \times \cos \text{dec.} \times 15$. Timing is from WWV, Ft. Collins, Co.

I wish to thank Dr. George Wallerstein, and Eric Olson at the University of Washington, for allowing me time on the Digitized Stage Microscope. Also, Dr. Frederick Pilcher for the computer program used in locating the asteroids.

	DATE (UT) TIME			RA (1950.0)			DEC			STD. DEV.		
Planet	1993			h	m	s	°	'	"	ra	dec	#*
258 Tyche	11	11	6:52:00	2	01	40.00	+6	49	21.9	4.55	3.11	5
	11	11	7:51:00	2	01	38.62	+6	48	57.4	3.98	2.89	5
322 Phaeo	11	11	7:23:00	2	15	15.63	+21	09	31.2	1.57	1.15	9
	11	11	8:25:00	2	15	13.67	+21	09	06.5	2.07	1.93	9
444 Gyptis	11	11	7:13:00	2	41	58.28	+7	05	36.3	1.95	1.33	8
	11	11	8:10:00	2	41	56.32	+7	05	29.0	1.13	1.12	8
690 Wratislavia	11	11	6:45:00	2	17	23.41	+23	17	39.5	1.57	1.31	8
	11	11	7:42:00	2	17	21.67	+23	17	20.1	1.81	2.48	8
735 Marghanna	11	11	7:05:00	2	19	14.48	+13	50	44.0	2.13	2.47	7
	11	11	8:01:00	2	19	11.85	+13	50	59.1	2.26	1.74	7