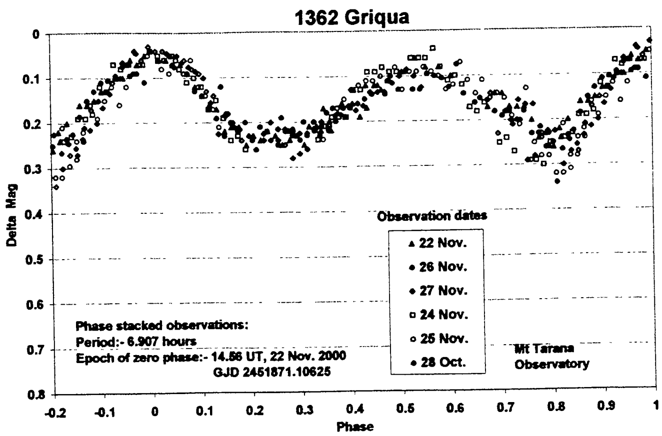

Figure 1. Lightcurve for asteroid 1362 Griqua.

Discussion

Using AAVSO variable star software, a period search was made using data from all seven nights. The results agree well with the graphical method discussed above. The best frequency was found to be 3.4722 (cycles/day), which is a period of 0.2880 days. If we assume (as a first approximation) that we are viewing the asteroid nearly perpendicular to the axis of rotation, then the maximum amplitude of 0.25 magnitudes implies a ratio a/b of approx 0.8, where a, b and c are the axes of a tri-axial ellipsoid and the rotation is about the shortest axis, c. The small difference of around 0.05 magnitudes in the two maxima imply a very small difference in topography, shadowing, or albedo between the opposite hemispheres. Slight variations in the shape and depth of the extrema from night to night indicates that there are topographic and/or shadowing effects present.

By co-incidence, the heliocentric co-ordinates (B° = -19.15 and L° = 70.79) for the 20th Nov 1971 observations (see Taylor et al, 1976) were very similar to those of the present observations (Table I). Thus the partial lightcurve obtained by Gehrels in 1971 bears a great similarity to the light curves determined herein. As it turns out, this early lightcurve covers approximately 94% of the complete rotational period.

Conclusion

Minor planet 1362 Griqua was observed over 104 rotational cycles and the synodic period determined as 6.907 ± 0.003 hours. All rotational phases of the light curve were observed and thus this is believed to be a secure result. The light curves show the doubly periodic features typical of an irregularly shaped, tri-axial ellipsoid. The maximum amplitude of the light curve at this opposition was 0.25 ± 0.02 magnitudes. This value is typical of C class asteroids of this diameter (Burns and Tedesco, 1979). The difference between the two maxima was only 0.05 magnitudes, implying a very small difference in albedo between the opposite hemispheres. With a revolution rate of 3.475/day, this minor planet is one of the 'fast rotators' among the asteroids of less than 50 km diameter, which have a bi-modal distribution of rotation periods (Binzel et al 1989). It appears to be the only member of its group to have a rotational light curve determined.

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PHOTOMETRY OF ASTEROID 773 IRMINTRAUD

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Asteroid 773 was chosen for lightcurve work in response to a posting on the MPML e-mail list by radar astronomers requesting a period solution for this object. Observations over five nights yielded a solution of 6.7514 ± 0.0007 hours. The amplitude was found to be 0.2 magnitudes and the reduced magnitude for zero phase angle 9.20 ± 0.20.

Observations

The asteroid 773 Irmintraud was observed in response to a request by Ellen Howell at Arecibo for a rotation period solution. The object was observed on 1/20, 1/21, and 1/22 universal time. Those three nights yielded a preliminary period of 6.73 hours with a somewhat low resolution composite curve. Two additional nights were added 2/4 and 2/5 to refine the lightcurve. These additional nights did refine the period to 6.75 hours but left the curve noisier than the author expected. The data were sent to Brian Warner and Dr. Alan Harris for assistance. Dr. Harris confirmed the period and provided the final solution of 6.7514 hours reported here (see Figure 1). His suggestion of the cause of the noise as systematic was later confirmed by the author and attributed to unusual focus variations across the imaging CCD. Additional data was collected through a minus blue filter in the late hours of 2/4 but thrown out as being noisier and not compatible with this data set. This was due to the bright moon illuminating part of the primary mirror at that time.

The data was calibrated through a photometric V filter to a LONEOS reference star Be 11 12 or alternatively designated GSC 2891-0566. This star was reported as having a B-V value of 0.74 and Vmagnitude of 13.92. The data were transformed to reduced magnitude at zero phase angle. The midpoint of the curve then provided an H value this opposition of 9.20 in the V band assuming a normal phase coefficient of about 0.20. The H value error should be the sum of catalogue error of about 0.03 plus author's calibration averaged error of about 0.02 and phase coefficient assumption error of about 0.15 magnitudes for a total error of 0.20 magnitudes. Phase angles during the observations are shown in Table I.

Summary

Asteroid 773 was found to have a period of 6.7514 ± 0.0007 hours, an amplitude of 0.20 magnitudes and a reduced magnitude at zero phase angle of 9.20 ± 0.20 this opposition. Small systematic error was identified as yielding a period solution slightly less precise than expected.

Acknowledgements

Alan Harris provided an independent check of possible period solutions and recognized systematic error. Brian Warner also independently checked the period solution

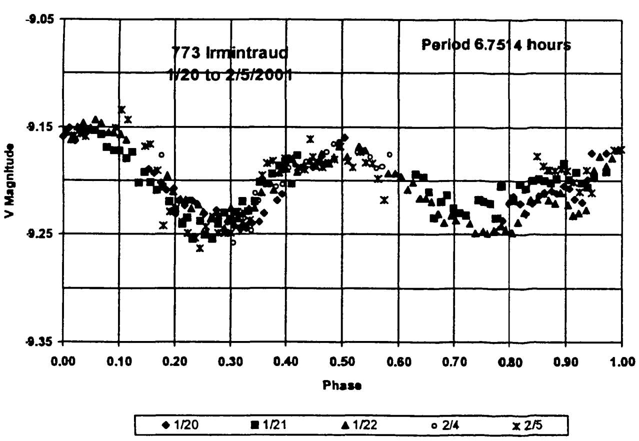

Figure 1. Photometric lightcurve for 773 Irmintraud during January-February 2001.

Table 1

Date	Phase angle
1/20	15.1
1/21	15.2
1/22	15.4
2/4	17.3
2/5	17.4

PHOTOMETRIC OBSERVATIONS OF THE MINOR PLANET 216 KLEOPATRA

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The peculiar minor planet 216 Kleopatra has been observed during 4 nights during its opposition of 1994. Differential photoelectric and CCD observations have revealed a two- maxima and minima light curve, characterized by a 5.386 ± 0.003 hours synodic rotation period and a 0.9 mag peak-to-peak amplitude.

The minor planet 216 Kleopatra is a well studied main-belt asteroid. It is a M-type object (Tholen 1989) with a 5.385 hours known rotation period (Harris 2000). The observed light curves (Lagerkvist et al 1987, and following updates) recorded amplitudes from 0.13 to 1.18 magnitude, and presented the double wave characteristics of rotation of the body. Recent radar observations have revealed a dumbbell-shaped object with overall dimensions of 217x94x81 km (Ostro et al 2000). The data presented in this paper are the results of observations performed to test a new photoelectric photometer. The selected object was 216 Kleopatra, a rather bright asteroid during its opposition of 1994.

Observations

Observations were carried out from the astronomical station of Chateau-Renard (Saint-Veran, French Alps; longitude: 6° 54' 24" E ; latitude: 44° 41' 52" N; altitude: 2930 m), a facility operated by professionals of Meudon and Nice observatories, and by Astroqueyras, an amateur association. The measurements were obtained by photoelectric photometry during two nights, September 6-7 and 7-8, 1994, for about 6 hours each night, but with a much larger number of data on the second night. In addition, some CCD measurements were obtained during three nights, September 4-5, 5-6 and 6-7, 1994. Table 1 gives the observational circumstances for 216 Kleopatra.

The photomultiplier (PMT) is a Hamamatsu R1463-01 (S20 cathode), maintained at a temperature of -11 C (within 0.5 C), and used a photon counting photometer placed at the Cassegrain focus of a 62 cm telescope, with a 46" diaphragm. In order to keep an approximative S/N ratio constant on the data acquisition itself, the observing cycle C1-Kleopatra-C2-Kleopatra-sky and again..., has been made with respective average series of 6, 15, 10, 15 and 3 integrations of 5 seconds. Kleopatra was observed twice a cycle so that the number of data would be sufficient on the final light curve to show its rapid variations.

The PMT photometer we have used has been optimized for precision on bright stars: it allows a permanent centering of the observed star in the diaphragm through a semi transparent mirror (Sareyan and Monnerot 1993). Of course this results in some constant light loss, so that we did not use any filter in the optical path to the PMT, in order to get higher light fluxes on Kleopatra and on the comparison stars. (The two used comparison stars