

history--and hence, their rotation periods and shapes--may differ from those of main belt asteroids. Because the Trojans are faint ($V = 16-20$), only the light curve of 624 Hektor has been well-determined to date (Gehrels and Dunlap, 1969). CCD observations with the 0.9-m telescope at Cerro Tololo Interamerican Observatory during July 1986 have thus far yielded rotation periods and amplitudes for two L5 Trojans. The period of 2674 Pandarus is approximately 8.5 hours, while that of 1173 Anchises is approximately 11.6 hours. Both light curves have amplitudes of greater than 0.5 magnitude. These amplitudes, while not among the largest observed for all asteroids, are significantly larger than the mean values for main belt asteroids in the same size range reported by Burns and Tedesco (1979) and Dermott et al. (1984). A third Trojan for which data have been partially analyzed, 1208 Troilus, shows only slight variations over periods of up to six hours for four nights of observing. More precise calibration of night-to-night brightness variations and a period search algorithm will be used to analyze these data further.

* Visiting astronomer, Cerro Tololo Inter-American Observatory. We acknowledge the support of the MIT Undergraduate Research Opportunities Program.

21.05-T

M-class Asteroids Among the Near-Earth Asteroid Population

J. Gradie (Univ. Hawaii) and E.F. Tedesco (JPL/Caltech)

10 and 20 micron radiometry and broad band (0.36 to 0.86 micron) photometry of 1986 DA and 1986 EB were obtained during March and April 1986. The model albedos derived from the IR data combined with the visual flux data yield model visual geometric albedos of 0.13 ± 0.02 and 0.19 ± 0.02 and model diameters of 2.3 ± 0.1 and 2.0 ± 0.1 km, respectively. These albedos, together with the colorimetric data, establish that both objects belong to the M taxonomic class which makes them the first of this type to be found among the near-Earth asteroid population. This identification of M class objects among the near-Earth asteroids, together with previous detection of C and S class objects, establishes that all three of the most common main belt asteroid classes are represented among the Earth-crossing asteroid population. This strongly suggests that most, if not all, such objects have their origins among the main belt. The implied mineralogy of 1986 DA and 1986 EB, i.e., mostly nickel-iron metal, provides concrete examples of a near-earth source for the iron meteorites. The long cosmic-ray exposure ages of most iron meteorites (10^9 yrs) must be reconciled with the short lifetime (10^7 yrs) of objects in planet crossing orbits.

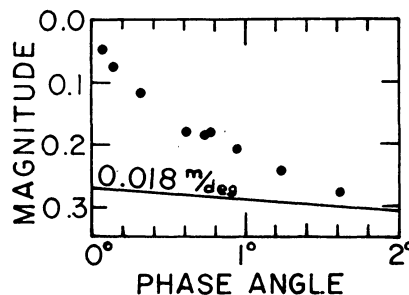
21.06

On the opposition effect of high albedo asteroids: 44 Nysa

A.W. Harris, J.W. Young (JPL/Caltech)

Theoretical studies of opposition effect suggest that it depends primarily on albedo (amplitude of effect) and surface porosity (phase angle range of effect). From past observational studies, authors have claimed, from one extreme, that all asteroids exhibit the same opposition effect (Scaltriti and Zappala, A.A. 83, 249, 1980), to the other, that one asteroid, 44 Nysa, has no opposition effect at all (Birch, et al., Icarus 54, 1, 1983). We present results of very precise photometry of several asteroids which exhibit "anomalous" opposition effects; that is, not all asteroids show the same effect. The figure below is a plot of absolute magnitude of 44 Nysa as a function of solar phase angle very near zero. A straight line with a slope of 0.018 mag/deg, the observed phase coefficient of Nysa at larger phase angle, is plotted for reference. Clearly, Nysa does have an opposition effect, which is, in fact, "anomalously" steep and narrow. This may indicate that the surface is unusually porous. The figure below represents preliminary reductions of observations through 5 August, 1986. A more complete phase curve will be presented at the

meeting, along with several other examples. This work was supported under contract from NASA.



21.07

Discovery of 1985 PA, a High-Inclination Apollo Asteroid

E. F. Helin (JPL/Caltech*), M. A. Barucci (ESA), and J.-L. Heudier (CERGA)

The International Near-Earth Asteroid Search (INAS), organized by the JPL Asteroid Search program, has led to the discovery of 1985 PA, an unusual Earth-crossing asteroid. Helin coordinated the joint observing program, which was conducted in France (CERGA 0.9m Schmidt) and California (Palomar 0.46m Schmidt). Helin and Barucci, in collaboration with Heudier, were present at the CERGA Schmidt while Helin's JPL Asteroid Search team (S. Singer-Brewster et al.) observed at Palomar in overlapping runs to provide mutual assistance and follow-up observations between the two facilities. As a consequence of the planned strategy, Helin and Barucci discovered 1985 PA, with an apparent discovery magnitude of $B = 16$, on 15 August 1985, with confirming observations from the CERGA and both Palomar Schmidts. As of August 1986, 1985 PA has been observed over an arc of more than 220 days, from which the following orbit was derived (Marsden, MPC 10697): $a = 1.41$ AU, $e = 0.30$, $i = 55.6^\circ$, $q = 0.986$ AU, $P = 1.68$ years. The absolute magnitude has been determined to be $B(1,0) = 16.5$, implying a diameter of about 2 ± 1 km. Photoelectric photometry was obtained by M. di Martino in Chile, who determined a lightcurve amplitude of nearly 1.5 magnitudes from a 4-hour span of observations, suggesting a highly irregular (non-spherical) shape. The high orbital inclination, large lightcurve variation, and relatively small orbit appear to suggest that this asteroid may be a large collision fragment from the inner main belt. Alternatively, the unusual orbit might be explained by one or more close encounters with Mars and/or Earth, as its orbit intersects the orbits of both planets. Further astrometric and physical observations of this asteroid during the current apparition are needed to establish its radiometric albedo, taxonomic classification, and rotational period.

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21.08

The Occultation of AG +20°1138 by 129 Antigone on 11 April 1985

L.H. Wasserman, R.L. Millis, O.G. Franz (Lowell Observatory)

The occultation of AG +20°1138 by 129 Antigone was a particularly unusual event in that it occurred near a stationary point of the asteroid. The resulting slow motion of the asteroid in the plane of the sky near the time of the event permitted excellent pre-occultation astrometry. Furthermore, the slow motion resulted in an unusually long event for such a small asteroid: The predicted maximum duration of the occultation was 84 seconds assuming the TRIAD diameter of 113 km. Observations of the occultation were made photoelectrically at three sites east of Pueblo, Colorado, using portable equipment developed at Lowell Observatory. Visual observations of this occultation were reported from two additional sites. Unfortunately, both visual observations suffer from large, unexplained shifts (6 and 16 seconds, respectively) with respect to the photoelectric data and have been rejected. A circular fit to the remaining photoelectric chords yields a diameter of 113.0 ± 4.2 km. The result agrees with the infrared diam-

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