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CCD PHOTOMETRY OF 523 ADA

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The asteroid 523 Ada was observed on 4 different nights in 1996 February and March. The best synodic period derived from all these observations is 9.800 ± 0.002 hours with an instrumental V magnitude amplitude of 0.65 -0.70.

523 Ada was discovered by R.S. Dugan in January 1924. It is a main-belt asteroid with a 2.966 AU orbital semi-major axis and a 0.178 eccentricity (Williams 1989). IRAS observations yield a diameter of 36.7 ± 1.3 km and an albedo of 0.18 ± 0.01 (Tedesco 1989). We chose to observe 523 Ada because it has no known lightcurve or period determination, and it was well placed for viewing during the observation period.

Observations of 523 Ada were made as part of a Department of Physics cadet research project at the U.S. Air Force Academy Observatory (latitude = 39°00'24"N, longitude = 104°53'30"W, altitude = 2233 meters). A Photometrics (PM512) CCD camera attached to a 61-cm Cassegrain telescope was used to take ten minute exposures of the asteroid through a standard Johnson V-band filter on each night. Table I lists the UT date, phase angle (α), Earth-Ada distance (D_{earth}), Sun-Ada distance (D_{sun}), and number of observations for each night.

All images were processed using NOAO's IRAF package. In each frame, the instrumental magnitude of Ada and at least three comparison stars were measured. Differential magnitudes between the comparison stars and Ada were scaled to a common magnitude offset by evaluating the differential magnitudes between the comparison stars. These differential magnitudes were then combined using a weighted mean to the calculated magnitude error. Next, a rough calibration of the common magnitude offset for each night was determined by using the Hubble Guide Star Catalog magnitudes (Russell et al. 1990) of at least two of the comparison stars: 805:441 and 805:545 for February 16; 805:176 and 805:94 for February 22; 805:702, 805:716, 805:955, and 805:1182 for February 24; and, 808:908 and 808:1399 for March 22. Finally, these magnitudes were adjusted to common Earth-Ada and Sun-Ada distances (1 AU for both). To ensure that no variable star had been selected as a comparison star and that there were no photometric problems caused by cosmic rays, the differential magnitudes between comparison stars were also examined carefully. The scatter observed in these differential magnitudes were consistent with the calculated magnitude errors.

The synodic period of 523 Ada was calculated for all pairs of nights (except Feb 16 with Feb 22 because there was no overlap in the phases covered during those nights). We adjusted all times to account for the changing light travel time between Ada and Earth from night to night. The lightcurves were matched up vertically by setting a magnitude offset (due to systematic errors in the GSC magnitudes and phase effects), and then finally matched up horizontally by adjusting the synodic period. The error associated with each synodic period corresponds to the acceptable range of periods determined by visually examining the composite lightcurve. Assuming that Ada has a lightcurve with two equally spaced minima and maxima, the night of Feb 24 considered alone yields a synodic period of approximately 9.3 hours. With this and in consideration of the synodic period calculated between Feb 22 and Feb 24, the only viable synodic period is close to 9.85 ± 0.05 hours. Using all nights, the best synodic period was calculated to be 9.800 ± 0.002 hours. The composite lightcurve using this period (instrumental magnitudes scaled to Feb 16) is shown in Figure 1.

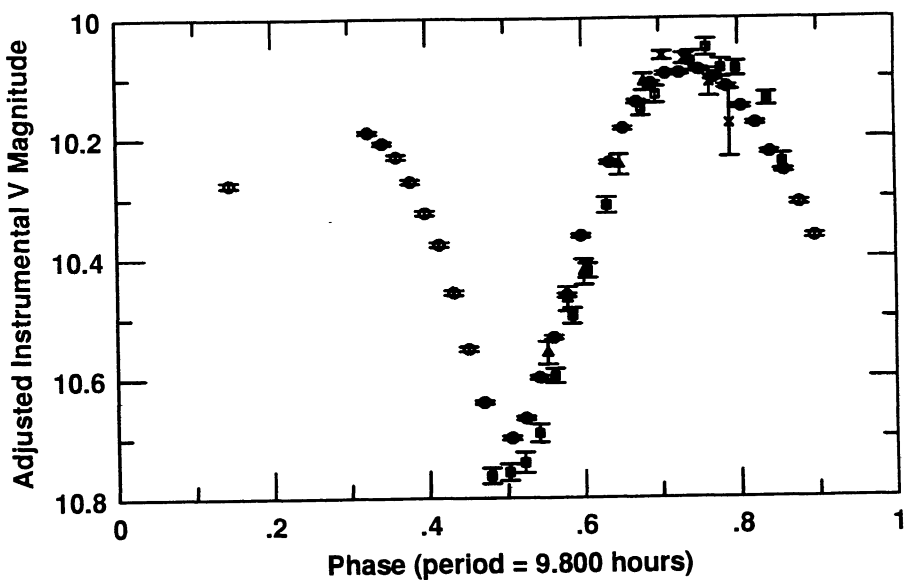

Figure 1. Composite lightcurve for 523 Ada based on 9.800 hour synodic period. 96 Feb 16 - triangles, 96 Feb 22 - x's, 96 Feb 24 - circles, 96 Mar 22 - squares. Zero phase = UT 96 Feb 15, 20:35:40. Lightcurve corrected for light travel time.

References

Russell, J.L., Lasker, B.M., McLean, B.J., Sturch, C.R., & Jenkner, H. (1990). "The Guide Star Catalog. II - Photometric and astrometric models and solutions". AJ 99,

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2059-2081.

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Williams, J.G. (1989). "Asteroid Family Identifications and Proper Elements". In *Asteroids II* (R. Binzel, T. Gehrels and M. Shapley Matthews, Ed.), pp. 1034-1072. University of Arizona Press, Tucson.

Table I. Observation Circumstances

UT Date	α(deg)	D_{earth}	D_{sun}	#exps
96 Feb 16	17.6	1.593	2.549	5
96 Feb 22	24.7	1.629	2.557	4
96 Feb 24	27.1	1.643	2.560	31
96 Mar 22	55.5	1.907	2.600	16

THE LIGHTCURVE AND PERIOD OF THE MINOR PLANET 193 AMBROSIA

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The minor planet 193 Ambrosia is found to have a photometric rotation period of 0.27420 ±0.00025 days (6.5807 ± 0.006 hours) and an amplitude in the Kron-Cousins I-band of 0.532 ± 0.013 mag.

The minor planet 193 Ambrosia was selected for photometry after inspection of the list of photometric opportunities in Harris and Zappalà (1995). A total of 592 CCD images 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-m U.S. Naval Observatory Cassegrain located in Washington, DC.

Very little basic information is known about Ambrosia. Tedesco (1989) gives only the IAU magnitude coefficients which are H = 9.80 and G = 0.014.

Our photometry was performed on flat-fielded images using the synthetic aperture photometry method of DAOPHOT, Stetson (1987). Nightly differential lightcurves were produced with respect to an ensemble of bright unsaturated stars in the CCD's 8 arc minute field-of-view to reduce random errors in the photometry. All observation times were reduced to the Heliocentric Julian Date of the phenomena (HJD). See Table I for the observing log.

The period determination was done using the phase-dispersion-minimization technique, 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 is the 0.27420 ± 0.00025 day (6.5807 ± 0.006 hours) period.

The I-band lightcurve indicates a peak-to-peak amplitude of 0.532 ± 0.013 mag. The estimated scatter of a single point was 0.009 mag. No points were filtered as outliers. See figure 1 for the lightcurve.

References

Harris, A. W. and Zappalà, V. (1995). "Asteroid photometry opportunities November - January", Minor Planet Bulletin 22, 45.

Stetson, P. B. (1987). "DAOPHOT: A computer program for crowded-field stellar photometry", Publ. Astron. Soc. Pacific 99, 191-222.

Stellingwerf, R. F. (1978). "Period determination using phase-dispersion-minimization", Astrophys. Journ. 224, 953.

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Table I. The 1995 observing log for 193 Ambrosia.

HJD - 2450000.0	Exposure (Seconds)	Phase Angle	Number of Images
63.4536 - 63.6241	90	14.5	150
68.4480 - 68.5849	60	15.8	164
69.4457 - 69.5885	60	16.1	177
107.4966 - 107.6166	90	27.1	101

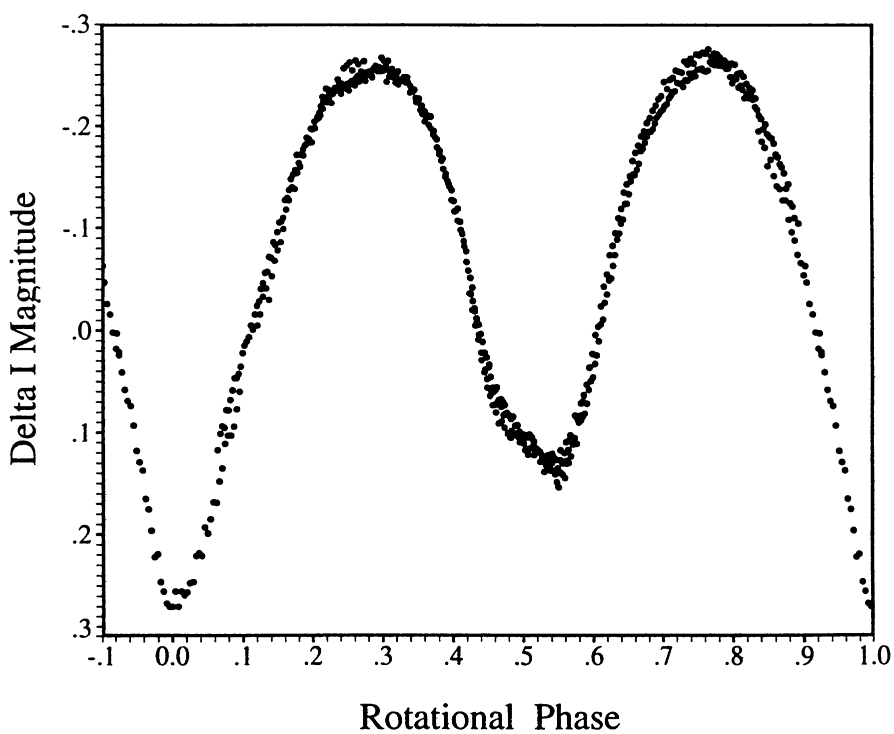

Figure 1. The instrumental I-band photometry rotational variation of 193 Ambrosia phase-folded using the period of 0.27420 days (6.5807 hours).

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PHOTOMETRIC OBSERVATIONS OF MINOR PLANET 212 MEDEA

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CCD photometry of asteroid 212 Medea was performed in April 1996 to determine its rotational period and lightcurve amplitude. The period was found to be 10.25 ± 0.07 hours and the amplitude was 0.11 magnitudes.

Introduction

Minor planet 212 Medea was chosen for observations because it was at opposition during clear skies and the 1996 version of "Ephemerides of Minor Planets" did not show rotation lightcurve results for it.

Observations

The asteroid was observed for seven evenings during April 1996. On most evenings, especially April 18, clouds developed after only a few hours of darkness precluding long runs. On the night of April 24 the autoguider lost the guide star and the situation was not noticed for an half hour causing a gap in the data. Eventually adequate lightcurve fragments were obtained.

Four minute exposures were taken at five minute intervals between mid-exposure through a V filter. The telescope was a 25-cm F4.5 Newtonian located in Corpus Christi Texas. The detector was a SBIG-ST6 CCD operating at –15 deg. C. All images were dark subtracted and flat fielded. Nightly calibration was made to six or more Hubble guide stars appearing in the field with the minor planet. Differential photometry was performed on each image using the same Hubble guide stare as reference stars. Each night's lightcurve was converted to reduced magnitude and the apparent midpoint of the lightcurve was plotted against the phase angle. The plot indicated some nightly calibrations were in error by up to 0.2 magnitudes. This was within the error the calibration software had estimated. The lightcurves from each night were shifted up or down slightly so that their midpoints would fit a reasonable plot of reduced magnitude to phase angle. A composite lightcurve (Figure 1), was constructed after converting the measurements to reduced magnitudes for zero phase angle.

Results of the first three nights observing suggested a period between seven and eleven hours. The final period solution of 10.25 hours is restrained by the many observations to within 0.07 hours. Other possible solutions were tested at 0.01 hour increments between 9.6 and 10.6 hours. Outside this range any other reasonable solution yields too few or too many maxima and minima cycles for a typical triaxial ellipsoid. Observational circumstances are noted in Table I. Because of the significant shifting of the nightly curves to correct for poorer than usual calibration the true value of the reduced magnitudes shown on Figure 1. could differ from those shown by 0.15 magnitude.

Results

The period was found to be restrained to within 0.07 hours of 10.25 hours and the amplitude of the lightcurve was determined to be 0.11 magnitudes.

References

Batrakov, Y. V. (1996). *Ephemerides Of Minor Planets for 1996.* Institute of Theoretical Astronomy, St. Petersburg, Russia

Table I. Observational Circumstances

DATE			RA			DEC			r	d	P.A.
96	4	9	13	9	5	-13	21	42	3.394	2.396	1.7
96	4	10	13	8	19	-13	17	30	3.395	2.396	1.6
96	4	16	13	3	50	-12	52	0	3.398	2.403	2.6
96	4	18	13	2	20	-12	43	3	3.400	2.408	3.2
96	4	24	12	58	7	-12	16	40	3.404	2.429	5.0
96	4	25	12	57	26	-12	12	17	3.405	2.434	5.3
96	4	26	12	56	47	-12	7	55	3.405	2.438	5.6

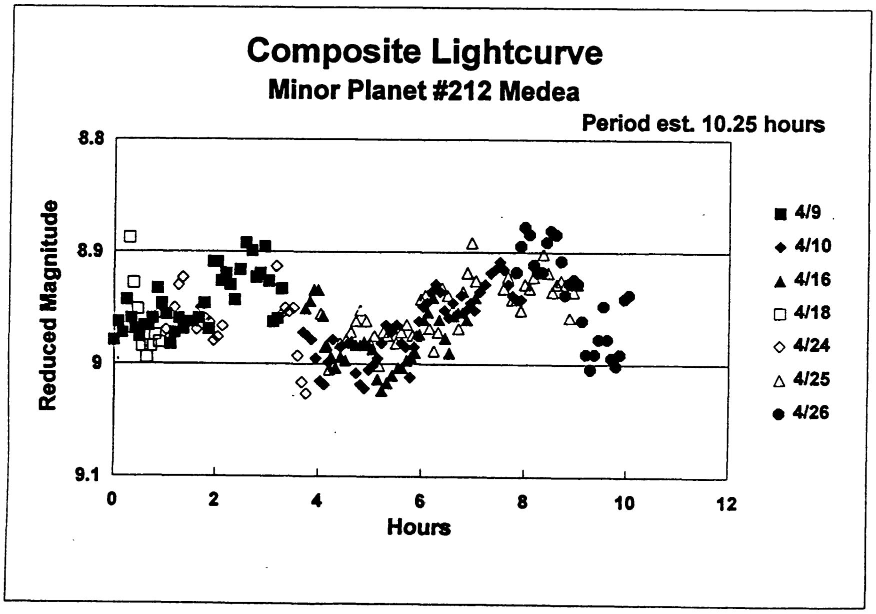

Figure 1. Lightcurve of asteroid 212 Medea during April 1996 based on a 10.25 hour period. The Y axis is reduced V magnitude for zero phase angle.

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THE LIGHTCURVE AND PERIOD OF THE C-TYPE MINOR PLANET 38 LEDA

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The minor planet 38 Leda is found to have a photometric (rotation) period of 0.5349 ± 0.0018 days (12.84 ± 0.04 hours) and an amplitude in the Kron-Cousins I-band of 0.155 ± 0.024 magn.

The minor planet 38 Leda was selected for photometry after inspection of the list of photometric opportunities in Harris and Zappala (1995). It was noted that 38 Leda was one of the lowest numbered minor planets without a known rotation period. A total of 1,422 CCD images 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-m U.S. Naval Observatory Cassegrain located in Washington, DC.

The following basic information is given about 38 Leda in Tedesco (1989) and Tholen (1989): Taxonomic type C, H = 8.31, G = 0.054, U–B = 0.41, B–V = 0.72, albedo 0.058 ± 0.002, estimated diameter 120 ± 2 km.

The photometry was performed on flat-fielded images using the synthetic aperture photometry method of DAOPHOT, Stetson (1987). Nightly differential lightcurves were produced with respect to an ensemble of bright unsaturated stars in the CCD's 8 arc minute field-of-view to reduce random errors in the photometry. All observation times were reduced to the heliocentric julian dates of the phenomena (HJD). See Table I for the observing log.

The period determination was done using the phase-dispersion-minimization technique, Stellingwerf (1978). Plot 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 is the 0.5349 ± 0.0018 day (12.84 ± 0.04 hours) period.

The I-band lightcurve indicates a peak-to-peak amplitude of 0.155 ± 0.024 magn. The estimated scatter of a single point was 0.017 mag. Five points were statistically filtered as outliers. See figure 1 for the lightcurve.

References

Harris, A. W. and Zappalà, V. (1995). "Asteroid photometry opportunities August-October", Minor Planet Bulletin 22, 37.

Stetson, P. B. (1987). "DAOPHOT: A computer program for crowded-field stellar photometry", Publ. Astron. Soc. Pacific 99, 191-222.

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Tholen, D. J. (1989). "Asteroid taxonomic classifications", In *ASTEROIDS II* (R. P. Binzel, T. Gehrels, and M. S. Mathews, Eds.), pp.1139-1150, Univ. Arizona Press, Tucson.

Table I. The 1995 USNO observing log for 38 Leda.

HJD - 2450000.0	Exposure (Seconds)	Phase Angle	Number of Images
37.4668 - 37.6044	60	11.8	174
39.4505 - 39.5856	30 & 45	12.5	166
41.4558 - 41.7246	90	13.2	214
42.4481 - 42.5498	90	13.6	83
44.4442 - 44.6237	90	14.2	158
56.4462 - 56.6489	90	17.8	178
59.4439 - 59.6487	80	18.6	200
61.4386 - 61.6372	60	19.1	249

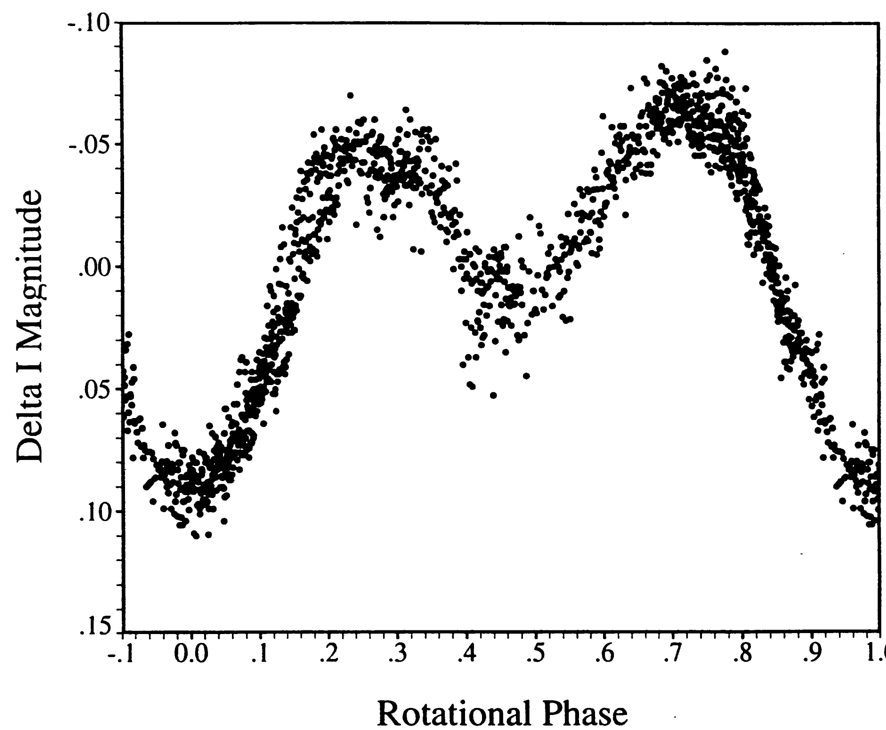

Figure 1. The instrumental I-band rotational lightcurve of 38 Leda phase-folded using the peric 0.5349 days (12.84 hours).

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INSTRUCTIONS FOR AUTHORS

The *Minor Planet Bulletin* is open to papers on all aspects of minor planet study. Theoretical, observational, historical, review, and other topics from amateur and professional astronomers are welcome. The level of presentation should be such as to be readily understood by most amateur astronomers. The preferred language is English. All observational and theoretical papers will be reviewed by another researcher in the field prior to publication to insure that results are presented clearly and concisely. It is hoped that papers will be published within three months of receipt.

The *MPB* will not generally publish articles on instrumentation. Persons interested in details of photoelectric instrumentation should join the International Association of Amateur and Professional Photoelectric Photometers (IAPPP) and subscribe to their journal. Write to: Dr. Arnold M. Heiser, Dyer Observatory, 1000 Oman Drive, Brentwood, TN 37027. The *MPB* will carry only limited information on asteroid occultations because detailed information on observing these events is given in the *Occultation Newsletter* published by the International Occultation Timing Association (IOTA). Persons interested in subscribing to this newsletter should write to: Craig and Terri McManus, 2760 SW Jewell Ave., Topeka, KS 66611-1614.

Manuscripts

All manuscripts should be typed double-spaced and should be less than 1000 words. Longer manuscripts may be returned for revision or delayed pending available space. Manuscripts should consist of the following: a title page giving the names and addresses of all authors (editorial correspondence will be conducted with the first author unless otherwise noted), a brief abstract not exceeding four sentences, the text of the paper, acknowledgments, references, tables, figure captions, and figures. Please compile your manuscripts in this order.

In most cases, the number of tables plus figures should not exceed two. Tables should be numbered consecutively in Roman numerals, figures in Arabic numerals. We will typeset short tables. Longer tables must be neatly typed, single-spaced, on white paper with a very black ribbon to allow direct reproduction. Figures should be drawn on white paper with black ink. Labeling should be large enough to be easily readable. If possible, please supply figures at actual size. Tables and figures intended to occupy one-half page width should be 8.6 cm wide; two-thirds page width, 11.7 cm, and full-page width, 17.8 cm. Size your tables and figures to fit in two-thirds or one-half page width whenever possible. Limit the vertical extent of your figures as much as possible. In general they should be 9 cm or less.

References should be cited in the text such as Harris and Young (1980) for one or two authors or Bowell et al. (1979) for more than two authors. The reference section should list papers in alphabetical order of the first author's last name. The reference format for a journal article, book chapter, and book are as follows:

Harris, A.W., and Young, J.W. (1980). "Asteroid Rotation Rates III: 1978 Results". Icarus 43, 20-32.

Bowell, E., Gehrels, T., and Zellner, B. (1979). "Magnitudes, Colors, Types, and Adopted Diameters of the Asteroids". In *Asteroids* (T. Gehrels, Ed.), pp 1108-1129. Univ. Arizona Press, Tucson.

Wood, F.B. (1963). *Photoelectric Astronomy for Amateurs*. Macmillan, New York.

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Authors with access to Apple Macintosh or IBM compatible computers are *strongly* encouraged to submit their manuscripts on diskette or by electronic mail. Files must be saved as ASCII text files and a printed version of the file must accompany the diskette. Please label the diskette with the author's name and the type of computer (Mac, PC). When time permits, proofs of articles will be sent to authors. Submit two complete copies of the manuscript and the original tables and figures to: Dr. Richard P. Binzel, MIT 54-410, Cambridge, MA 02139, USA (Internet: rpb@astron.mit.edu).

ASTEROID NEWS NOTES

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Two-hundred-fifty-eight New Asteroids

Through the July 30 batch of Minor Planet Circulars, 258 asteroids were newly numbered, breaking the 7000 level, and bringing the numbered total to 7100. Non-main-belt objects among these include:

(6847)	1977 RL	Mars crosser
(6859)	1991 CZ	Hungaria group
(6870)	1992 OG	Hungaria group
(6874)	1994 JO1	Mars crosser
(6901)	1989 PA	Hungaria group
(6909)	Levison	Mars crosser
(6911)	Nancygreen	Hungaria group
(6924)	1993 TP	Cybele group
(6984)	1994 AO	Hilda group
(6996)	Alvensleben	Cybele group
(6997)	3104 T-3	L5 Jupiter Trojan
(6998)	3108 T-3	L5 Jupiter Trojan
(7002)	1971 OV	Mars crosser
(7025)	1993 QA	Apollo
(7027)	1993 XT	Hilda group
(7066)	1993 HA2	Centaur
(7079)	1986 RR	Mars crosser
(7087)	1991 TG4	Hungaria group
(7088)	1992 AA	Amor
(7092)	1992 LC	Apollo
(7096)	1992 VM	Mars crosser

Note the numbering of a third Centaur, (7066) 1993 HA2, which joins the other two numbered Centaurs, (2060) Chiron and (5145) Pholus.

New Asteroid Names

During the past six months, three hundred fourteen asteroids received names. A significant fraction of these were announced at the Asteroids, Comets, Meteors '96 meeting, which many of the honorees were attending. In fact, the closing speaker quipped that scientists attend the ACM series of meetings because there is a ten percent chance they'll have an asteroid named after them!

Included among the new names are those of French artists (6676) Monet and (6677) Renoir. Science fiction authors were also well represented with (4923) Clarke and (5020) Asimov. In what the writer believes is a first, an asteroid was named for a cartoonist, (3524) Schulz, the creator of the Peanuts comic strip.

Other notable persons honored include (5811) Keck, named after the chairman of the Keck Foundation that was instrumental in funding the construction of the twin Keck 10-m telescopes on Mauna Kea, and (6401) Roentgen, on the occasion of the centennial of his discovery of x-rays.

The site for the European Southern Observatory's Very Large Telescope led to

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(6836) Paranal, while a computer database called the Set of Identifications, Measurements, and Bibliography of Astronomical Data led to (4692) SIMBAD.

The most imaginative new name, in the opinion of the writer, was derived from the eighteenth anniversary of the Texas Star Party: (4932) Texstapa.

The highest numbered asteroid that is also named is currently (7001) Noether, while the lowest numbered asteroid that remains unnamed jumped from (2418) 1971 UV (now named Voskovec-Werich) all the way up to (3081) 1971 UP. The number of unnamed asteroids decreased for a change, dropping from 1846 to only 1790. The number of asteroids with names jumped from 4996 to 5310.

Planet Crossing Asteroid Update

The rate of near-Earth asteroid discoveries declined slightly after the photographic surveys by Shoemaker et al. and Helin et al. with the 18-in Schmidt telescope on Palomar were discontinued. Helin's project is now back in operation, utilizing a CCD-based system on Haleakala, which is a 10,000-ft mountain on the Hawaiian island of Maui. The project's name is NEAT, which stands for Near Earth Asteroid Tracking, and it is responsible for a relative increase in the recent discovery rate.

The discoveries of some of the more shallow Mars crossers are not routinely annnounced on the Minor Planet Electronic Circulars, and the discoverer information does not appear in the Minor Planet Circulars, which explains the blank entries in the table. The Spacewatch observing team currently consists of T. Gehrels, J. Montani, and J. Scotti.

1996 JA1 passed a mere 0.00303 astronomical units from Earth on May 19. It's the largest such object to pass that close, being an estimated 100 by 150 meters in size (the entry in the table above is based on a default albedo of 0.12, though spectral observations suggest a Vesta-like surface composition, which would imply a higher albedo and smaller size).

Spaceguard Foundation Established

On 1996 March 26, the Spaceguard Foundation became official. Currently hosted by the Instituto di Astrofisica Spaziale of the Italian National Research Council, the Foundation's purpose is to promote the discovery and study of asteroids that might collide with the Earth. Members of the Board of Directors currently include Andrea Carusi (Italy), Syuzo Isobe (Japan), Brian Marsden (United States), Karri Muinonen (Finland), Eugene Shoemaker (United States), and Duncan Steel (Australia), which demonstrates the international scope of the Foundation. The sole Trustee is currently Arthur C. Clarke, whose book "Rendezvous With Rama" describes the effects of an asteroid collision with the Earth, and the resulting Spaceguard project, from which the Foundation took its name. On 1996 March 20, the Council of Europe adopted a resolution endorsing the formation of the Spaceguard Foundation. Although the initial membership consists primarily of professional astronomers, non-professional members are not excluded. For more information about the Spaceguard Foundation and how to become a member, point your web browser to the URL:

`http://www.mi.astro.it/SGF/`

The following web sites mirror the above site. Please use the one closest to you.

Europe
`http://www.brera.mi.astro.it/SGF/`

Japan
`http://ceres.crl.go.jp/SGF/INDEX.html`

USA
`http://cfa-www.harvard.edu/~marsden/SGF/`

Object	Category	Diam km	Date	Location	Discoverer
1996 DC2	Mars crosser	1.5	Feb 26	Siding Spring	McNaught et al.
1996 EN	Apollo	1.9	Mar 15	NEAT	Helin et al.
1996 EO	Apollo	0.6	Mar 15	NEAT	Helin et al.
1996 EV2	Mars crosser	3.0	Mar 14	Peking	Zhu
1996 EO12	Mars crosser	3.0	Mar 13	Spacewatch	
1996 FS1	Apollo	0.30	Mar 17	Spacewatch	Scotti
1996 FT1	Apollo	0.06	Mar 19	Spacewatch	Scotti
1996 FG3	Apollo	0.8	Mar 24	Siding Spring	McNaught et al.
1996 FO3	Amor	0.30	Mar 24	Siding Spring	McNaught et al.
1996 FQ3	Amor	0.24	Mar 26	NEAT	Helin et al.
1996 FR3	Apollo	1.5	Mar 26	NEAT	Helin et al.
1996 GQ	Apollo	0.10	Apr 11	Spacewatch	Montani
1996 GT	Apollo	0.8	Apr 11	Spacewatch	Montani
1996 GD1	Apollo	0.24	Apr 15	Spacewatch	Scotti
1996 GL9	Mars crosser	0.30	Apr 13	Spacewatch	
1996 GF17	Apollo	0.48	Apr 15	ESO	Debehogne
1996 HN	Amor	0.19	Apr 19	Spacewatch	Scotti
1996 HW1	Amor	3.0	Apr 23	Spacewatch	Gehrels
1996 JG	Apollo	0.48	May 08	Siding Spring	McNaught et al.
1996 JA1	Apollo	0.24	May 14	Catalina	Spahr
1996 KE	Amor	0.6	May 19	NEAT	Helin et al.
1996 KV	Mars crosser	1.2	May 19	Spacewatch	
1996 KV1	Pluto crosser	280.	May 21	Mauna Kea	Jewitt
1996 KW1	Pluto crosser	280.	May 22	Mauna Kea	Jewitt
1996 KX1	Pluto crosser	140.	May 22	Mauna Kea	Jewitt
1996 KY1	Pluto crosser	180.	May 16	Mauna Kea	Jewitt
1996 LW	Mars crosser	0.48	Jun 09	Spacewatch	
1996 ME	Mars crosser	1.9	Jun 16	Spacewatch	
1996 MG	Mars crosser	1.0	Jun 17	Spacewatch	
1996 MO	Apollo	0.8	Jun 23	Spacewatch	Gehrels
1996 MQ	Amor	0.048	Jun 24	Lincoln Lab	Weber et al.
1996 MR	Mars crosser	1.9	Jun 22	NEAT	Helin et al.
1996 MS	Mars crosser	1.5	Jun 22	NEAT	Helin et al.
1996 PA	Mars crosser	2.4	Aug 05	Siding Spring	Garradd
1996 PC1	Apollo	0.30	Aug 11	Siding Spring	Watson

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ASTEROID PHOTOMETRY OPPORTUNITIES NOVEMBER-JANUARY

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The table below lists asteroids that come to opposition during the months of November through January that represent useful targets for photoelectric or CCD photometry observations. Observations are typically needed because the asteroid has either an unknown or ambiguous rotational period. The table gives (in order of opposition dates) the asteroid number and name, opposition date, opposition V magnitude, the rotational period (in hours), the estimated lightcurve amplitude (in magnitudes), and the designation PER if observations are needed to determine the rotational period. AMB implies that previous period determinations have given ambiguous results and these alternate periods are listed in the table. RAD indicates the asteroid is a planned radar target, and MOD denotes an asteroid at a critical longitude for shape and pole modeling. Question marks are used to denote uncertain or unknown values. An outline of recommended observing procedures is given in *MPB* 11, No. 1, page 7. Also recommended is the book *Solar System Photometry Handbook* published by Willmann-Bell. Ephemerides for all of the asteroids in the table are included in this issue. Finder charts for some of these asteroids may appear in the *Minor Planet Observer.* For information on this publication, contact: Brian D. Warner, Box 818, Florissant, CO 80816.

Asteroid	Opp'n Date	Opp'n V Mag	Per	Amp	
503 Evelyn	Nov 21	11.8	?	?	PER
478 Tergeste	Dec 4	11.8	15?	?	PER
127 Johanna	Dec 16	11.8	12?	?	PER
481 Emita	Dec 23	11.5	?	?	PER

Asteroid Photometry Opportunities

DATE	R.A. (2000) HR	MIN	DEC. DEG	MIN	MAG V	PHASE ANGLE
Minor Planet 127 Johanna						
1996 Nov 8	6	7.51	+31	41.3	12.59	15.8
18	6	3.36	+32	27.1	12.37	12.7
28	5	56.13	+33	8.7	12.15	9.1
Dec 8	5	46.44	+33	41.4	11.93	5.6
18	5	35.43	+34	0.9	11.82	4.0
28	5	24.55	+34	5.8	11.97	6.6
1997 Jan 7	5	15.23	+33	57.6	12.18	10.3
17	5	8.58	+33	40.5	12.39	13.8
27	5	5.19	+33	19.1	12.60	16.8
Minor Planet 478 Tergeste						
1996 Oct 29	5	7.28	+19	36.8	12.56	13.5
Nov 8	5	2.76	+18	40.8	12.34	10.3
18	4	56.05	+17	40.4	12.11	6.6
28	4	47.85	+16	38.2	11.87	3.0
Dec 8	4	39.08	+15	38.0	11.86	3.0
18	4	30.81	+14	43.9	12.08	6.7
28	4	23.97	+13	59.5	12.29	10.4
1997 Jan 7	4	19.24	+13	27.2	12.50	13.6
17	4	17.01	+13	7.7	12.69	16.3
Minor Planet 481 Emita						
1996 Nov 18	6	35.87	+27	2.7	12.23	16.5
28	6	31.22	+28	4.6	12.00	12.6
Dec 8	6	23.41	+29	7.0	11.77	8.1
18	6	13.35	+30	4.0	11.54	3.9
28	6	2.44	+30	50.2	11.57	3.9
1997 Jan 7	5	52.32	+31	23.1	11.84	8.1
17	5	44.40	+31	43.2	12.11	12.3
27	5	39.65	+31	53.4	12.37	16.0
Feb 6	5	38.43	+31	57.1	12.62	18.8
Minor Planet 503 Evelyn						
1996 Oct 9	4	12.58	+18	16.4	13.13	17.8
19	4	10.53	+18	22.0	12.87	14.7
29	4	5.46	+18	23.1	12.60	10.8
Nov 8	3	57.78	+18	20.1	12.30	6.3
18	3	48.32	+18	14.1	11.95	1.4
28	3	38.35	+18	7.4	12.10	4.0
Dec 8	3	29.25	+18	3.0	12.36	8.9
18	3	22.23	+18	4.6	12.59	13.4
28	3	18.10	+18	14.6	12.81	17.2

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