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THE LIGHTCURVE AND PERIOD OF THE S TYPE MINOR PLANET 198 AMPELLA

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The minor planet (198) Ampella has its period of lightcurve variation determined to be 10.383 ± 0.001 hours. Three well-defined extrema are evident in the 0.22 ± 0.02 mag. amplitude lightcurve with other low-amplitude, order 0.01 m, structure indicated.

The minor planet 198 Ampella was selected for photometry after inspection of the list of photometric opportunities in Harris and Zappalà (1992). Exposures were obtained using a Kron-Cousins I band filter and a Thomson CSF 1024x1024 front illuminated CCD based camera system. The telescope employed was the 0.61-meter U.S. Naval Observatory Cassegrain located in downtown Washington, DC.

The following basic information is given about 198 Ampella in Tedesco (1989), and Tholen (1989): Tholen type S, H = 8.55 m, G = 0.373, U-B 0.41 m, B-V 0.88 m, albedo 0.19 ± 0.02%, diameter 58.7 ± 3.1 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 from 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 times of the phenomena (HJD). See Table I for an observing log.

The period determination was done using a modified Jurkevich method see Morris and DuPuy (1980). 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 10.383 ± 0.001 hour (0.43261 ± 0.00006 day) period.

The lightcurve indicates an unusual variation with three prominent extrema having a peak-to-peak amplitude of 0.22 ± 0.02 magnitude in the instrumental Kron-Cousin's I band. Structure is evident at the 0.01 m level as bumps. Figure 1 shows the phase versus normalized differential instrumental I magnitude lightcurve for 198 Ampella covering the February through March 1993 observing run. This type of multi-extrema variation is not unique among the minor planets, but is very well defined in this minor planet. At least one other fairly well observed object, (165) Loreley, has exhibited a similar type of three-extrema lightcurve variation, see Schober *et al.* (1988).

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Morris, S. and DuPuy, D. L. (1980). "A photoelectric study of three southern Delta Scuti stars". Publ. Astron. Soc. Pacific 92, 303-314.

Schober, H. J., Di Martino, M., and Cellino, A. (1988). "165 Loreley, one of the last large 'unknown' asteroids". Astron. Astrophys. 197, 327-330.

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Tedesco, E. F. (1989). "Asteroid magnitudes, UBV colors, and IRAS albedos and diameters". In

Table I. The 1993 observing log for 198 Ampella.

HJD - 2449000.0	Exposure (Sec.)	Phase Angle	Number of images
21.58561 - 21.68350	60	9.0	124
28.55515 - 28.71233	60	11.6	199
38.53744 - 38.65123	60	14.8	145
41.59142 - 41.70621	90	15.6	102
43.54183 - 43.70504	90	16.2	141
46.48791 - 46.60723	90	16.9	105
47.49071 - 47.66463	90	17.1	154
56.54543 - 56.62273	90	18.8	69
65.50195 - 65.58720	90	20.0	76

Asteroids II (R. P. Binzel, T. Gehrels, and M. S. Matthews, Eds.), pp. 1090-1138, Univ. Arizona Press, Tucson.

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

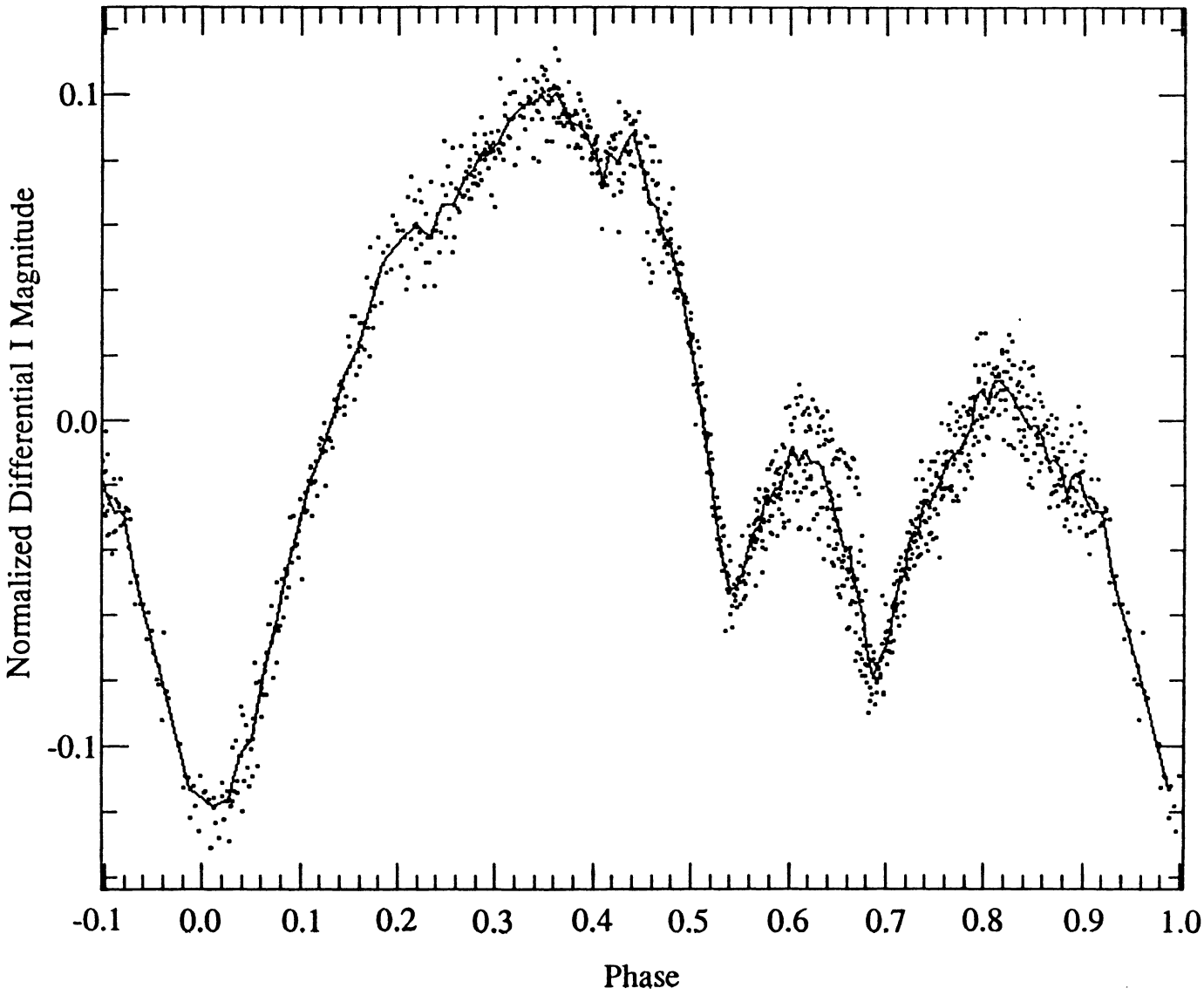

Figure 1. The phase versus normalized lightcurve for (198) Ampella determined from the following heliocentric ephemeris: Minimum (HJD) = 2449021.39073 + 0.43261 * E.

ASTEROID CLOSE APPROACHES

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(Received: 24 May Revised: 3 August)

A listing of 19 close approaches between pairs of asteroids and comet Kopf is presented. Three may be utilized to determine the masses of 1 Ceres, 4 Vesta, and 52 Europa. The Europa encounter occurs in October 1993.

As the asteroids travel about the Sun, they occasionally pass close to one another, or to a comet. If a small body passes close enough to a larger one, it may be possible to measure the mass of the larger body by the deflection induced on the smaller body's orbit. For asteroid encounters, amateur astronomers may like to observe two objects at once. Consequently, a survey was performed on my computer using 1987 elements to discover close asteroid and comet approaches.

My computer found 18 close approaches between asteroids and one close approach involving comet Kopf. The interval investigated was May 1993 through January 2001. Three of these will produce perturbations likely to be measurable by astrometric techniques, thus providing opportunities for new asteroid mass determinations. Each of these three are described in separate sections below. All 19 events identified are listed in Table I.

52 Europa and 124 Alkeste
October 21, 1993

Asteroids 52 Europa and 124 Alkeste will come within less than one million km of each other on October 21, 1993. This event may be of interest to amateur astronomers. Both asteroids will be overhead at sunrise during the event and will be within 0.7 deg. for several weeks. The relative encounter velocity is low at just 2.5 km/sec. Assuming that Europa has a density near 2.8 g cm^{-3} and is 312 km in diameter, then Alkeste will likely be deflected by 0.07 to 0.10 arcsec / year. Such a deflection is at the limit of astrometric precision for current star catalogs.

1 Ceres and 2933 Amber
January 10, 1996

The largest asteroid, 1 Ceres will come within 8 million km of 2933 Amber on January 10, 1996. This approach has a fair viewing geometry and both asteroids will be within 1.5 deg. of each other for about two months. Their relative encounter velocity will be 3.1 km/sec. Assuming that Ceres has a density of 2.7 g cm^{-3} and is 923 km in diameter, then Amber will likely be deflected by 0.15 arcsec / year.

4 Vesta and 17 Thetis
June 9, 1996

Two large asteroids, 4 Vesta and 17 Thetis will come within 2 million km around June 9, 1996 and will have a relative encounter velocity of 1.3 km/sec. This event has a rather favorable viewing geometry as the pair will rise at local sunset during the approach and should remain within one-half degree for a month. Assuming that Vesta has a density near 3.1 g cm^{-3} and is 501 km in diameter, then Thetis will likely be accelerated by 0.3 arcsec / year, providing the best astrometric opportunity identified. Notice that orbital calculations may be complicated by the fact that Thetis will pass close to 11 Parthenope seven months later.

TABLE I.
Asteroid Close Approaches

Date	Asteroid 1	Asteroid 2	Distance (AU)
1993 Oct 21	52	124	0.0054
1994 Apr 02	19	2481	0.0086
1994 May 20	128	2521	0.0036
1994 Jun 12	11	369	0.0104
1995 Jan 28	7	1651	0.0075
1995 Feb 26	194	1294	0.0014
1995 Sep 13	11	P/Kopf	0.0195
1996 Jan 10	1	2933	0.0538
1996 Jun 09	4	17	0.0108
1996 Aug 06	48	625	0.0017
1996 Nov 14	194	779	0.0025
1996 Dec 24	7	2346	0.0083
1997 Jan 01	128	267	0.0124
1997 Jan 04	11	17	0.0046
1997 Jan 27	704	1046	0.0054
1997 Dec 16	324	1051	0.0093
1999 Aug 24	16	2981	0.0050
2000 Dec 25	747	2252	0.0025
2001 Jan 18	375	861	0.0072

CALL FOR OBSERVATIONS OF ASTEROID 1620 GEOGRAPHOS

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In January 1994 a small U.S. spacecraft named Clementine will be launched to a lunar orbit. In May 1994, its orbit will be redirected to flyby the asteroid 1620 Geographos on 31 August 1994. The spacecraft payload includes an UV/Visible camera, near-infrared camera, and long wavelength IR camera. Geographos will become the third asteroid encountered and imaged by a spacecraft.

I have been asked by the NASA science team leader, Gene Shoemaker, and by Don Yeomans to try to secure groundbased lightcurves of Geographos so as to allow modeling of its shape and pole orientation for mission planning. The purpose of this "Call" is to interest as many observers and modelers as possible in this effort. Geographos was previously observed during a similar apparition in 1969, The rotation period is known to be 5.223 hours and the lightcurve amplitude can reach 2.0 magnitudes.

The table below summarizes the 1993 / 1994 apparition of Geographos. Lightcurve observations

which will optimize the modeling effort are needed over the greatest possible range in ecliptic longitude. The maximum longitude will occur in late November / early December and the minimum longitude will occur in early March. Additional lightcurves during January and February are also vitally needed for the shape and pole analysis.

Because of Geographos' faint apparent magnitude, CCD observations are recommended. All observations should be calibrated on the Johnson V magnitude system. A full ephemeris will be provided, upon request.

I am now compiling a list of collaborators for this project. If you expect to be able to make observations, please advise me of your observing plans so that we may attempt to optimize our coverage. In addition to the above address, I may be reached by electronic mail at: rpb@astron.mit.edu.

Asteroid 1620 Geographos

Date	Solar Elong	Phase Angle	Dec.	V Mag.	Ecliptic Longitude
1993 Oct. 1	82	36	+37	19.0	105
Nov 1	100	36	+39	18.5	116
Dec 1	120	30	+42	17.6	120
Dec 15	135	24	+45	17.0	119
1994 Jan 1	150	18	+48	16.5	112
Jan 15	155	18	+49	16.2	103
Feb 1	140	26	+45	16.4	93
Mar 1	108	45	+34	17.0	88
Apr 1	85	57	+24	17.3	95

ASTEROID NEWS NOTES

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One-hundred-sixty-two New Asteroids

Through the September 1 batch of Minor Planet Circulars, 162 asteroids were newly numbered since the last installment of News Notes, bringing the numbered total to 5655. Non-main-belt objects include:

(5495)	1972 RY3	Cybele
(5496)	1973 NA	Apollo
(5510)	1988 RF7	Mars crosser
(5511)	1988 TH1	L5 Trojan
(5558)	1989 WL2	Hungaria
(5577)	1986 WQ2	Hungaria
(5579)	1988 JL	Hungaria
(5585)	1990 MJ	Mars crosser
(5587)	1990 SB	Amor
(5590)	1990 VA	Aten
(5603)	1992 CE	Hilda
(5604)	1992 FE	Aten
(5620)	1990 OA	Amor
(5621)	1990 SG4	Mars crosser
(5626)	1991 FE	Amor
(5627)	1991 MA	Hungaria
(5637)	1988 RF1	L5 Trojan
(5638)	1988 TA3	L5 Trojan
(5639)	1989 PE	Hungaria
(5641)	1990 DJ	Mars crosser
(5642)	1990 OK1	Mars crosser
(5645)	1990 SP	Apollo
(5646)	1990 TR	Amor
(5648)	1990 VU1	L5 Trojan
(5649)	1990 WZ2	Mars crosser
(5652)	1991 CA2	L4 Trojan
(5653)	1992 WD5	Amor

New Asteroid Names

The last six months has witnessed an explosion in new asteroid namings, partly due to the deadline for the preparation of the second edition of Schmadel's book "The Names of Minor Planets". New names were drawn from many different categories, and include entertainers (2825) Crosby and (2829) Bobhope, the famous comedy duo of (2865) Laurel and (2866) Hardy (they just HAD to be in that order!), contemporary composer (2620) Santana, jazz pianist (3156) Ellington, author (3656) Hemingway, painter (3616) Glazunov, and famous scientists/philosophers (3587) Descartes, (3600) Archimedes, (5450) Sokrates, and (5451) Plato. Fictional characters were also represented with the famous trio of (5048) Moriarty, (5049) Sherlock, (5050) Doctorwatson; oddly, neither Conan nor Doyle are to be found among the asteroids, and although there is an Arthur, it wasn't named after the author. The site for the Asteroids, Comets, Meteors '93 meeting was honored with (5110) Belgirate, and the location of the 1908 near-impact was attached to (5471) Tunguska.

Several astronomers were honored with asteroid names, including the celestial mechanician (3105) Stumpff, noted textbook author and solar eclipse observer (5100) Pasachoff, cartographer (4648) Tirion who is known for his star atlas, and the discoverer of the Cepheid variable period-luminosity relation, (5383) Leavitt. Two members of the Spacewatch camera team are among the new names, namely (5040) Rabinowitz and electronics technician (5529) Perry.

Because 1979 VA is now known to be identical with comet P/Wilson-Harrington, the decision was made to give the then-unnamed asteroid (4015) the same name, despite the fact that it exceeds the normal sixteen character limit imposed on asteroid names. The names of the three discoverers of the parent comet of the Perseid meteors, (5005) Kegler, (5035) Swift, and (5036) Tuttle, were duplicated among the asteroids (recall that Comet Kegler was identified with Comet P/Swift-Tuttle following the 1992 recovery of the latter object).

Lastly, the highest numbered asteroid with a name is currently (5592) Oshima, while the lowest numbered asteroid without a name is (2418) 1971 UV.

Planet Crossing Asteroid Update

The pace of planet crossing asteroid discoveries remained fairly steady during the last six months. Of the 25 objects in the list below, 23 are entirely new discoveries, 1 is an accidental rediscovery, and 1 is a recovery.

The table below contains the principal provisional designation, orbit category, estimated diameter in kilometers, discovery or recovery date, discovery or recovery instrument, and the discoverer/recoverer or a representative member of the discovery or recovery team.

1993 OV1, a deep Mars crosser, was found independently on July 23 by Shoemaker, Shoemaker, and Levy.

In the pair discoveries department, we have two objects discovered on each of April 17, April 20, June 22, June 23, and July 16, as well as another pair discovered on the consecutive nights of February 17 and 18.

Second Transplutonian Object Discovered

Lightning struck twice for the team of David Jewitt and Jane Luu when they found a second transplutonian object on March 28 with the University of Hawaii's 2.24-m telescope and a 2048x2048 Tektronix CCD camera. The object, designated 1993 FW, was estimated to be a little fainter than magnitude 23 at the time of discovery. An assumed low albedo results in an estimated diameter of 280 km for this new discovery. So far, only seven astrometric observations spanning 50 days have been acquired for this new object, so the orbit solution still assumes a zero eccentricity. The resulting semimajor axis is 42.3 AU, placing it at a distance comparable to the first transplutonian object, 1992 QB1.

As with 1992 QB1, the orbital inclination is small, which could be an artifact of the observational method. The search has been conducted along the ecliptic, where high inclination objects spend relatively little time. Also, to minimize background field star contamination problems, the search has been conducted only where the ecliptic crosses the highest galactic latitudes, so it should come as no surprise that 1992 QB1 and 1993 FW are on opposite sides of the sky.

Third Transsaturnian Object Discovered

Joining (2060) Chiron and (5145) Pholus in the outer Solar System is now 1993 HA2. Being only magnitude 20 at the time of discovery, which was near perihelion, 1993 HA2 turns out to be the smallest of the three, with an estimated diameter of only 90 km, based on a low albedo. As for (5145) Pholus, the discoverer was David Rabinowitz, and the discovery instrument was the Spacewatch Camera on Kitt Peak.

So far, no prediscovery observations of 1993 HA2 have turned up, so don't expect the sort of nearly instant numbering and naming that Pholus experienced. The currently available orbit incorporates only 30 observations spanning 52 days. The best-fit semimajor axis is 24.9 AU, and the

1984 AJ	Apollo	1.5		Palomar 48	Kowal	== 1993 EA
1983 RB	Amor	2.4		Palomar 18	Shoemaker	
1993 DA	Aten	0.018	Feb 17	Spacewatch	Scotti	
1993 DC	Apollo	2.4	Feb 18	Spacewatch	Scotti	
1993 EA	Apollo	1.5	Mar 03	Spacewatch	Scotti	== 1984 AJ
1993 FS	Amor	0.38	Mar 25	Spacewatch	Gehrels	
1993 FW	Pluto crosser	280.	Mar 28	Mauna Kea	Jewitt	
1993 HA	Amor	0.38	Apr 17	Spacewatch	Gehrels	
1993 HC	Apollo	0.30	Apr 20	Spacewatch	Gehrels	
1993 HO1	Amor	2.4	Apr 20	UKST	McNaught	
1993 HK1	Mars crosser	12.	Apr 17	Palomar 18	Shoemaker	
1993 HA2	Uranus crosser	90.	Apr 26	Spacewatch	Rabinowitz	
1993 KA	Apollo	0.024	May 17	Spacewatch	Rabinowitz	
1993 KC	Mars crosser	2.4	May 20	Spacewatch	Gehrels	
1993 KH	Apollo	0.6	May 24	UKST	McNaught	
1993 KA2	Apollo	0.006	May 21	Spacewatch	Gehrels	
1993 MF	Amor	4.8	Jun 22	Palomar 18	Helin	
1993 MO	Amor	2.4	Jun 22	Palomar 48	Mueller	
1993 ME1	Mars crosser	3.0	Jun 23	Palomar 18	Helin	
1993 MG1	Mars crosser	8.	Jun 23	Palomar 18	Helin	
1993 OD	Mars crosser	8.	Jul 16	Palomar 18	Helin	
1993 OL	Apollo	3.0	Jul 23	Palomar 18	Shoemaker	
1993 OV1	Mars crosser	1.9	Jul 16	Palomar 18	Helin	
1993 PB	Apollo	2.4	Aug 13	Spacewatch	Scotti	
1993 QP	Amor	1.0	Aug 23	Palomar 18	Helin	

Observing teams:
T. Gehrels, J. V. Scotti, D. Rabinowitz
E. F. Helin, J. Alu, K. Lawrence, M. Nassir
D. C. Jewitt, J. X. Luu
R. H. McNaught, K. S. Russell
J. Mueller
C. S. Shoemaker, E. M. Shoemaker, D. H. Levy

eccentricity is a whopping 0.52, which puts the perihelion and aphelion distances at 11.9 and 37.9 AU, respectively. The orbital inclination is a modest 16 degrees. Perihelion passage has been estimated for 1992 June 4, so now is a good time to obtain physical observations, because the next perihelion passage will be 124 years later.

Fifty Lashes With a Wet Noodle

In the I-Should-Have-Known-Better department, it was pointed out to the writer that the name Smiley, which has been used informally by the discoverers of the other transplutonian object, 1992 QB1, has already been attached to asteroid (1613). In the last installment of News Notes, I commented that "Once the orbit is determined and the object finally numbered, it will prove interesting to see if this name is proposed for the minor planet." Of course, the discoverers could still propose the name, though it would be rejected because of the duplication. The discoverers are now aware of the problem, so it will prove interesting to see if some variation on the name is proposed for 1992 QB1.

Galileo At Ida

At the time of this writing, the Galileo spacecraft's encounter with the Koronis family member (243) Ida was just a few days ago. Real-time engineering data from the spacecraft indicated that the encounter took place as planned, though the success of the encounter must await the playback of the data, which will be agonizingly slow through the Low Gain Antenna. To determine whether the correct frame of the mosaic containing the asteroid image had been selected for playback first, a pair of lines from that frame have been played back already, and the asteroid has been seen. The rest of the frame will be retrieved slowly during September. Perhaps by the time you read this, the press release picture will be out.

FILAR MICROMETER ASTROMETRIC OBSERVATIONS

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(Received: 21 April Revised: 28 June)

The following asteroid were observed with a C-8 operating at f/6.3 and a filar micrometer. The Hubble guide star catalog on CD-ROM was the source for fixed star positions. "C" values in the O-C column were computed with the author's ephemeris program. This program includes planetary perturbations with a 10 day integration increment. Aberration corrections and topocentric corrections are also taken into account. Observed positions were computed from least squares analysis of the fixed stars to asteroid positions. The number of stars used for locations is given by #STAR in the table. These stars were used for a least squares analysis of the asteroid positions.

Two likely source of error are: The Hubble guide star catalog does not include proper motions; the time required to take a micrometer measurement is about 20 minutes, during which some asteroids move appreciably.

Observations, as summarized below, were made from the following location: 97° 5' 10" W longitude, 36° 42' 44" N latitude, Altitude 311 meters.

AST #	DATE	TIME utc	#STAR	RA h m s	Dec ° ' "	Std. Dev. RA"	Std. Dev. Dec"	O-C RA"	O-C Dec"
97	1992-Sep-23	0135	6	19 51 05	-14 39 23	5	4	+5	-5
375	1992-Sep-28	0220	5	20 33 34	-23 59 24	4	4	+3	+1
37	1992-Sep-28	0250	3	20 34 11	-21 36 56	3	.3	-4	+9
54	1992-Oct-21	0145	3	22 09 04	+00 46 11	2	1	+2	-7
134	1992-Oct-21	0210	4	23 10 23	+00 36 32	2	2	+1	-3
54	1992-Nov-16	0120	4	22 22 49	+01 37 16	6	5	0	-8
68	1992-Nov-16	0150	3	22 54 37	-13 59 32	2	2	+4	-2
23	1992-Nov-16	0220	4	23 23 07	-15 59 15	3	6	-9	+4
123	1992-Nov-16	0250	3	01 05 16	+17 54 04	1	6	+22	-2
118	1992-Nov-16	0315	4	01 39 59	+08 02 54	4	5	-8	+6

DATE	R.A. (2000) HR MIN	DEC. DEG MIN	MAG V	PHASE ANGLE
Minor Planet 12 Victoria				
1993 15	4 3.98	+22 49.5	10.74	16.6
25	3 57.38	+21 57.7	10.55	12.3
Nov 4	3 48.20	+20 53.4	10.35	7.3
14	3 37.58	+19 40.3	10.11	2.1
24	3 26.94	+18 24.8	10.24	3.2
Dec 4	3 17.64	+17 14.2	10.58	8.1
14	3 10.69	+16 15.3	10.87	12.3
24	3 6.62	+15 31.9	11.14	15.8

DATE	R.A. (2000) HR MIN	DEC. DEG MIN	MAG V	PHASE ANGLE
Minor Planet 21 Lutetia				
1993 Nov 14	6 43.23	+23 13.1	11.53	17.0
24	6 38.52	+23 29.6	11.33	13.5
Dec 4	6 30.79	+23 48.6	11.10	9.4
14	6 20.75	+24 7.3	10.86	4.8
24	6 9.51	+24 23.2	10.53	0.4
1994 Jan 3	5 58.46	+24 34.7	10.93	4.8
13	5 48.94	+24 41.9	11.23	9.2
23	5 41.91	+24 46.3	11.51	13.0

PHOTOELECTRIC PHOTOMETRY OPPORTUNITIES NOVEMBER - JANUARY

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The table below lists asteroids that come to opposition during the months of November through January which represent useful targets for photoelectric photometry observations. Observations are needed because the asteroid has either an unknown or ambiguous rotational period or because the asteroid will be observable at a very low phase angle. The table also includes asteroids which are candidates for shape and pole determinations or are targets for radar observations. 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. PHA indicates observations of the phase curve are desired because the asteroid will be at an unusually low phase angle, 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 in 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	
735 Marghanna	Nov 3	11.2	?	?	PER
391 Ingeborg	Nov 14	11.4	?	?	PER
12 Victoria	Nov 18	9.9	8.662	0.3	PHA
480 Hansa	Dec 13	11.8	?	?	PER
21 Lutetia	Dec 24	10.5	8.167	0.2	PHA
106 Dione	Jan 1	11.3	30?	0.2	PER
556 Phyllis	Jan 6	11.7	4.293	0.3	PHA
181 Eucharis	Jan 25	11.2	?	?	PER

Photoelectric Photometry Opportunities

DATE	R.A. (2000) HR	MIN	DEC. DEG	MIN	MAG V	PHASE ANGLE
Minor Planet 106 Dione						
1993 Nov 24	7	20.15	+25	27.6	12.02	14.7
Dec 4	7	16.22	+25	56.1	11.84	11.6
14	7	9.75	+26	27.0	11.65	8.0
24	7	1.37	+26	56.9	11.45	4.2
1994 Jan 3	6	52.01	+27	22.2	11.29	1.6
13	6	42.80	+27	40.7	11.54	4.7
23	6	34.85	+27	51.5	11.80	8.4
Feb 2	6	28.98	+27	55.5	12.04	11.7
Minor Planet 181 Eucharis						
1993 24	8	45.82	+ 4	49.1	11.85	15.1
1994 Jan 3	8	41.66	+ 5	46.3	11.64	11.5
13	8	35.45	+ 7	6.1	11.42	7.6
23	8	27.98	+ 8	44.6	11.24	4.2
Feb 2	8	20.27	+10	34.7	11.28	4.6
12	8	13.41	+12	27.6	11.51	8.1
22	8	8.34	+14	15.4	11.76	11.9
Mar 4	8	5.69	+15	52.1	12.00	15.2
Minor Planet 391 Ingeborg						
1993 Oct 5	3	39.48	+20	28.3	11.91	25.3
15	3	39.18	+16	0.9	11.66	19.6
25	3	34.76	+11	5.6	11.43	13.5
Nov 4	3	27.54	+ 6	10.0	11.30	8.7
14	3	19.31	+ 1	46.0	11.44	9.1
24	3	11.93	- 1	41.9	11.80	13.5
Dec 4	3	6.80	- 4	4.2	12.18	18.1
14	3	4.67	- 5	24.7	12.56	21.9
Minor Planet 480 Hansa						
1993 Nov 4	5	50.03	+15	47.9	12.48	16.5
14	5	45.67	+14	2.8	12.26	13.3
24	5	38.61	+12	15.0	12.04	9.6
Dec 4	5	29.55	+10	30.0	11.85	6.3
14	5	19.55	+ 8	54.4	11.80	5.6
24	5	9.85	+ 7	34.3	11.96	8.2
1994 Jan 3	5	1.60	+ 6	33.9	12.17	11.8
13	4	55.67	+ 5	54.5	12.39	15.2
Minor Planet 556 Phyllis						
1993 Nov 24	7	41.39	+23	16.7	13.13	20.3
1993 Dec 4	7	39.92	+23	0.0	12.89	16.9
14	7	34.86	+22	47.5	12.62	12.7
24	7	26.65	+22	37.5	12.34	7.7
1994 Jan 3	7	16.29	+22	27.4	12.01	2.3
13	7	5.30	+22	15.1	12.08	3.4
23	6	55.33	+22	0.0	12.40	8.7
Feb 2	6	47.80	+21	42.8	12.68	13.6
Minor Planet 735 Marghanna						
1993 Sep 25	3	9.14	+ 7	37.9	12.17	22.1
Oct 5	3	4.12	+ 8	59.9	11.95	17.3
15	2	55.28	+10	23.4	11.72	11.7
25	2	43.65	+11	46.7	11.47	5.6
Nov 4	2	30.89	+13	7.8	11.27	1.3
14	2	18.94	+14	25.1	11.73	7.0
24	2	9.44	+15	38.8	12.12	12.3
Dec 4	2	3.38	+16	50.2	12.48	16.7