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CCD PHOTOMETRY OF MINOR PLANET 729 WATSONIA

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Lightcurve measurements of minor Planet 729 Watsonia obtained at Roach Motel Observatory reveal a lightcurve period of 16.71 ± 0.01 hours with an amplitude of 0.22 magnitude.

Photometry of 729 Watsonia was a collaborative effort between Roach Motel Observatory and Santana Observatory (Minor Planet Observatory Code 646). Roach Motel Observatory (Minor Planet Code 856) is located at 33°59.83 North 117°26.73' West in Riverside CA. Roach Motel Observatory is so named because of the uninvited guests that check in but do not check out. The 200 square foot roll off roof observatory houses a Meade 12" LX-200 SCT combined with an F/6.3 focal reducer. Three Pentium computers are used for minor planet location and data reduction with telescope and CCD control. The instrument used is a SBIG ST-8 CCD camera with the JMI electronic focuser.

All images at Roach Motel Observatory were acquired using pixels binned to 18-micron size (medium resolution) using the scripting part of the Connections program developed by Brian Warner. Scripting is a feature of Connections that gives the telescope and CCD camera a pre-written set of commands in sequential order. This allows the telescope and camera to be operated without the observer present. Connections has unique scripting capabilities. Not only does it perform the usual scripting functions of slewing to an object and taking an image, it will also internally synchronize on a bright star, as well as automatically focus the telescope periodically during the night. This compensates for focusing shift due to dropping temperatures and contraction of the telescope tube. Therefore, all of the telescope operation and CCD imaging at Roach Motel Observatory were automated while the observer was resting for the next day of work. Photometry was completed using the Canopus Program, also developed by Brian Warner.

J.H. Metcalf discovered Watsonia on February 9, 1912. It is a main belt Minor Planet with a semi major Axis of 2.76 AU, eccentricity of 0.096 and inclination of 18.07 degrees.

Robert Stephens initially selected the target Watsonia. When Stephens had to unexpectedly leave town on business, he made a request of the author to take images of Watsonia. In a collaborative effort between Roach Motel and Santana observatories, Watsonia was observed on seven nights from June 3rd to 10th of 2000. A total of 349 images were taken of which 319 were used for data reduction. Images were rejected due to slight star trailing or poor signal to noise ratio from possible cloud cover. Images taken at Santana Observatory were 30 seconds in length, while images taken at Roach Motel Observatory were 120 seconds in length. All images were flat fielded and dark subtracted. Over 90% of the lightcurve was covered and several portions of the lightcurve overlapped reducing the probable error of the period of rotation. The derived period for the data shown in Figure 1 is 16.71 ± 0.01 hours with an amplitude of 0.22 magnitude. This is the first photometry completed of a Minor Planet at Roach Motel Observatory.

Acknowledgments

Many thanks to Brian Warner for his continuing help and guidance, and for the development of the software programs "Connections" and "Canopus". Also, a very special thanks to Robert Stephens for his contribution to the construction and evolution of Roach Motel Observatory.

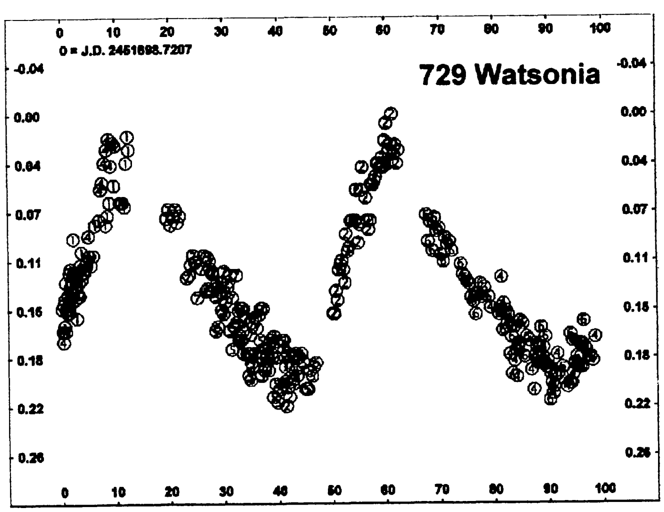

Figure 1. Lightcurve of 729 Watsonia based on a period of 16.71 hours.

CCD PHOTOMETRY OF THE MARS-CROSSER ASTEROID 2099 OPIK

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Photometric observations of the small Mars-crossing asteroid 2099 Opik were made in 1998, on November 7 and 9, at Pianoro Observatory (Italy). The lightcurves display a most likely period of 9.3 h. This solution, however, is not unambiguous. There is also another possible period of 10.3 h. The amplitude is about 0.7 magnitudes.

Taking advantage of its almost best possible conditions, some photometric observations of 2099 Opik were made at Pianoro. The Observatory (MPC Code 610) is located at 180 metres above sea level, seventeen kilometres from the town of Bologna (Italy). The purpose of this investigation was to search for the rotational period of the asteroid. Unfortunately the unfavourable meteorogical situation made it impossible to get further data for greater precision.

The Observatory uses a 25 cm MEADE LX 200 Schmidt-Cassegrain f/6.3 with a focal reducer which yields a focal ratio of f/4.4. It is equipped with a 14-bit CCD Camera HiSIS22, Chip Kodak Kaf 0400 of 768x512 pixels, each pixel measuring 9x9 microns. For this investigation it was binned to produce 384x256 pixels, each 18x18 microns. The resulting image scale is about 3.4 arcsec/pixel.

On November 7, 1998 13 observations were made for the duration of one minute each, at ten-minute intervals. The range of instrumental magnitudes was from 14.6 to 15.1. On November 9, 1998 17 observations were taken using the same procedure. The range of instrumental magnitudes was from 14.9 to 15.4. All the images were shot with a yellow Wratten 8 filter and dark frames and a flat fields were used. The Win-MiPS program by C. Buil (version 1.50 1994-95) was used for photometry reduction. This program uses aperture photometry.

On November 7, the asteroid's magnitude was calculated using the average of five reference stars with a magnitude similar to the asteroid's. In the second night of observation it was not possible to use the same stars, owing to the fast movement of the target. However, it was verified that the magnitude of one of the reference stars of the first night's field – calculated with the five reference stars of the second night's – had the same range of magnitude (within ± 0.05) as resulting from the USNO Catalog. So the data from both nights are reliably on the same magnitude scale, even if relative. The reference stars were taken from the USNO A2.0 Catalog, and they were chosen among those with lower measured residuals. The lightcurves were corrected for light-time travel, the magnitudes reduced to unit geo, heliocentric distances and the same phase angle. The plots (see Figures 1 and 2, AVE program by R. Barbera) show that it is possible to obtain two slightly different rotational periods.

The most likely period is 9.3 h, but this solution, alas, is not unambiguous: there is also another possible period of 10.3 h. Unfortunately the result of this photometric research on 2099 Opik is thus dubious, however the data obtained constrain the period to a relatively narrow interval and they might be useful in case of further investigation.

Dr. Petr Pravec of the Ondrejov Observatory, Asteroid Photometry Coordinator for the ALPO Minor Planet Section, was involved in this project and gave his assistance to the author in the checking and reading of the results. Many thanks to him for his encouragement and suggestions in the treatment of this analysis.

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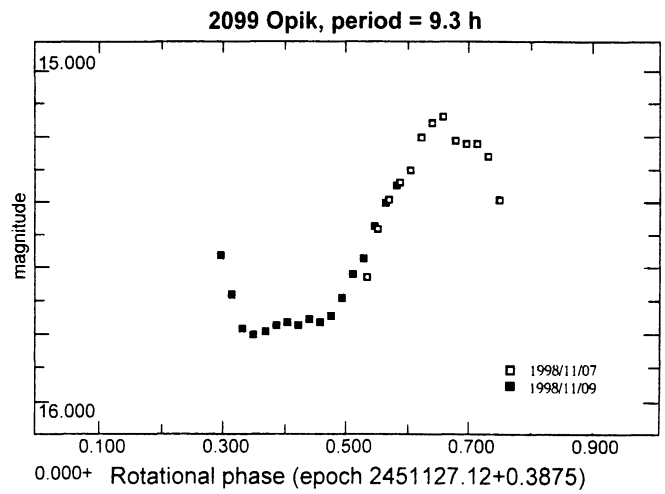

Figure 1

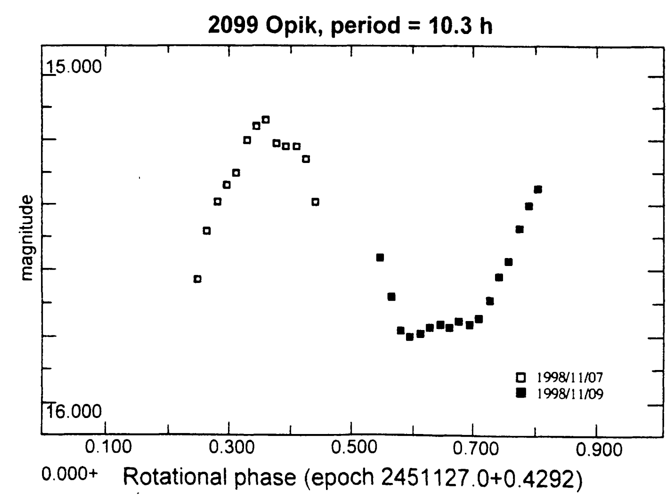

Figure 2

THE MINOR PLANET OBSERVER: PROGRESS

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It was gratifying to get the third quarter edition of the *Minor Planet Bulletin* a few months back and see so many asteroid lightcurves. I don't propose to take credit for this, though I was fortunate enough to help in some small way with most of those who submitted papers. A cheerleader does not win the game; it is the player on the field who achieves ultimate success but those on the sidelines can still take some pride in the team's victories.

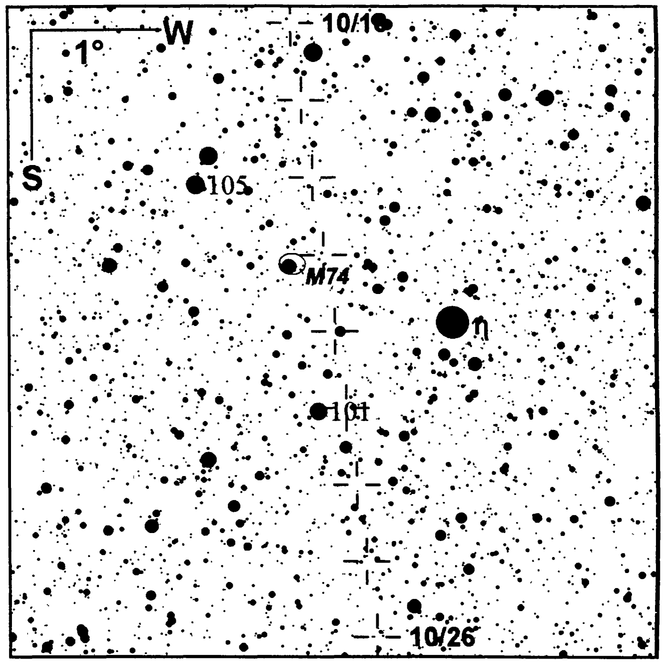
There are signs this trend will continue following the Minor Planet Amateur-Professional Workshop 2000 in Alfred, NY, this past June. It was a very successful meeting with special congratulations going to Roy Tucker who served as chairman and Drs. David DeGraff and John Stull of Alfred University who were hosts. There was a fair amount of discussion about photometry and lightcurve work that would indicate that these pages might soon sprout lightcurves.

A quick check shows there's no less than 150 asteroids reaching their brightest in 2000 October through December that have no established periods or have a period that needs checking. That's just from a pool of numbered asteroids reaching a maximum brightest of at least 15m more than a week from a full moon. There's still no lack of work!

A significant point made during the Alfred conference was the use of filters and reducing observations to a standard system. Using filters has the disadvantage of reducing the limiting magnitude that one can work but many advantages such as being able to combine observations with other observers and establishing phase coefficients, among others. For the very adventurous and sufficiently equipped, there's the possibility of helping to determine an asteroid's class by measuring the object's brightness through several filters.

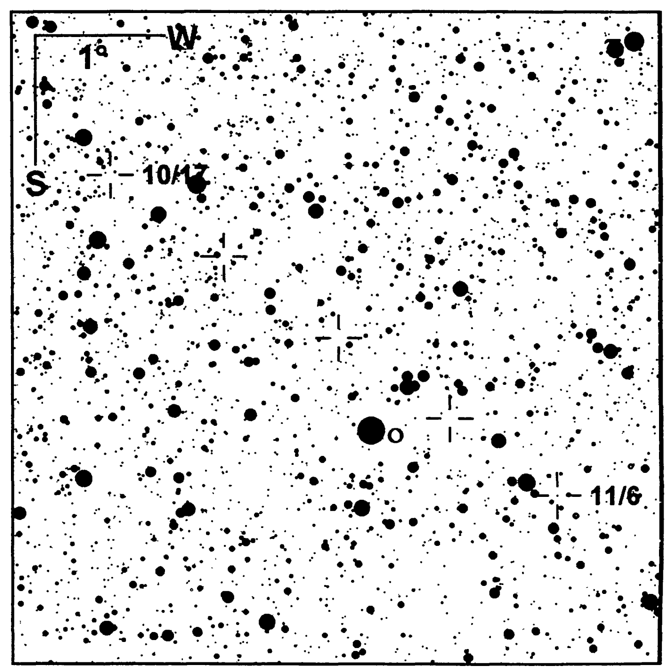
On the "home-front", the 20-inch is finally doing some legitimate work again. Two more lightcurves have been determined and, for the first time in nearly a year, I made some astrometric observations. Being out of practice I was victim to some of the common mistakes, e.g., bad times, measuring the wrong target and so on. It's easy to forget that even the "simplest" scientific research requires constant care and attention.

Since the 20-inch cannot yet be fully remotely controlled via software for astrometry, I must stay near the computer during a run. That has allowed progress on a different front: my piano playing. If you remember from the first of the year, I vowed to devote more time to getting back to learning how to play. As always, one thing or another kept getting in the way but now I have the perfect excuse to be in the same room with the instrument: it's in the same room as the telescope computer. Far more than relearning the tricks of astrometry, relearning scales, arpeggios, and – more important – which key on the piano corresponds to that black splotch on the paper is proving a difficult task. With the long winter nights, I'll have plenty of time to practice *and* to observe. Clear Skies!



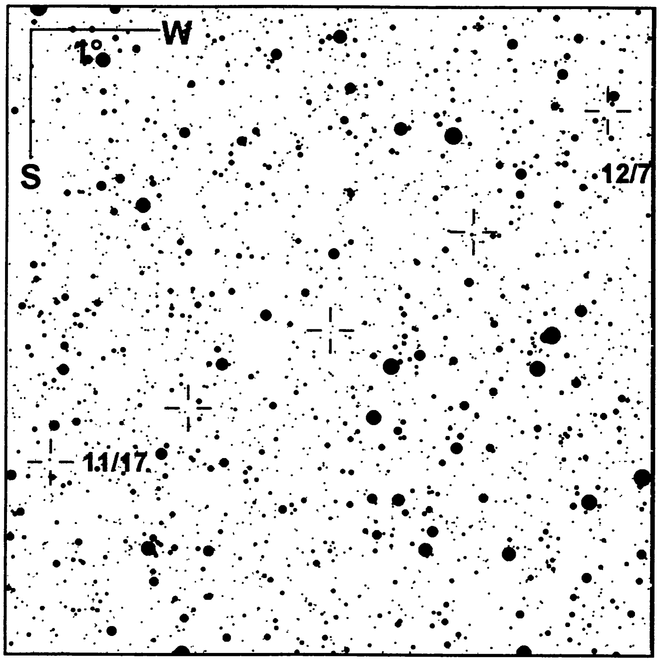
391 Ingeborg. Note that the chart interval is **2 days** and the near miss with M74. Max Wolf discovered Ingeborg in 1894 November. Based on brightness alone, this would be a good "beginners" target. Whether or not the lightcurve is an easy one is what's to be determined.

Date	RA2000	Dec2000	RA1950	Dec1950	M	PA	E
10/17	1 37.01	+18 15.1	1 34.30	+17 59.9	10.7	5.6	171
10/22	1 35.24	+15 16.7	1 32.56	+15 01.3	10.6	3.1	175
10/27	1 33.66	+12 20.9	1 31.01	+12 05.5	10.8	4.8	172
11/01	1 32.46	+ 9 33.4	1 29.83	+ 9 18.0	11.0	8.2	166
11/06	1 31.80	+ 6 58.9	1 29.18	+ 6 43.5	11.2	11.7	160



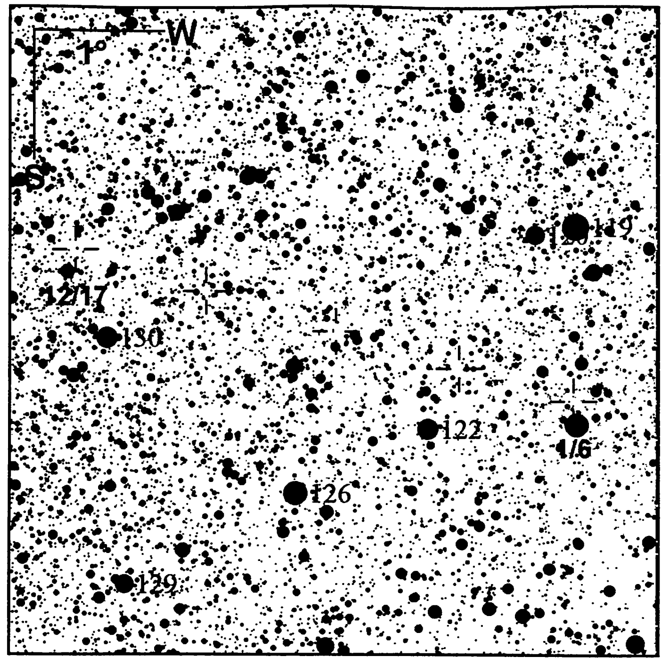
1309 Hyperborea. Named after a region of ancient Greece, Hyperborea was discovered by G.N. Neujmin in 1931 October. It is an unclassified asteroid with a size of about 32 km. Omicron Piscium is near chart center.

Date	RA2000	Dec2000	RA1950	Dec1950	M	PA	E
10/12	1 57.02	+11 43.2	1 54.35	+11 28.5	14.4	4.2	168
10/17	1 53.59	+11 06.9	1 50.92	+10 52.2	14.2	2.2	174
10/22	1 50.03	+10 29.6	1 47.37	+10 14.8	14.0	0.3	179
10/27	1 46.44	+ 9 52.0	1 43.80	+ 9 37.1	14.2	1.9	174
11/01	1 42.95	+ 9 15.0	1 40.31	+ 9 00.0	14.3	4.0	168



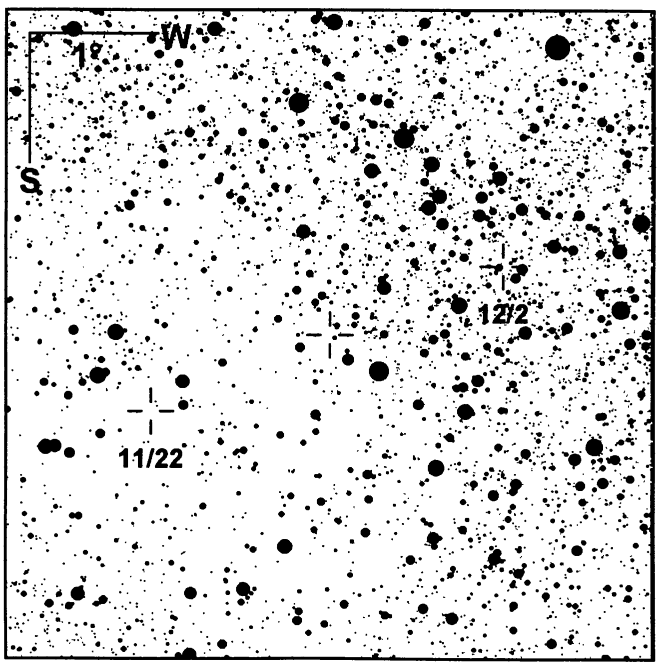
1362 Griqua. Griqua is a type CX asteroid of about 32 km size. Discovery was by C. Jackson in 1935 July. The name, like many of Jackson's discoveries, is out of South Africa; in this case, it's a tribe of people north of the Orange River.

Date	RA2000	Dec2000	RA1950	Dec1950	M	PA	E
11/17	4 31.14	-17 10.1	4 28.90	-17 16.5	14.2	17.1	141
11/22	4 26.68	-16 45.4	4 24.43	-16 52.1	14.2	16.5	142
11/27	4 22.10	-16 09.6	4 19.83	-16 16.6	14.2	16.2	143
12/02	4 17.58	-15 22.9	4 15.29	-15 30.2	14.3	16.2	142
12/07	4 13.29	-14 26.2	4 10.99	-14 33.7	14.3	16.4	142



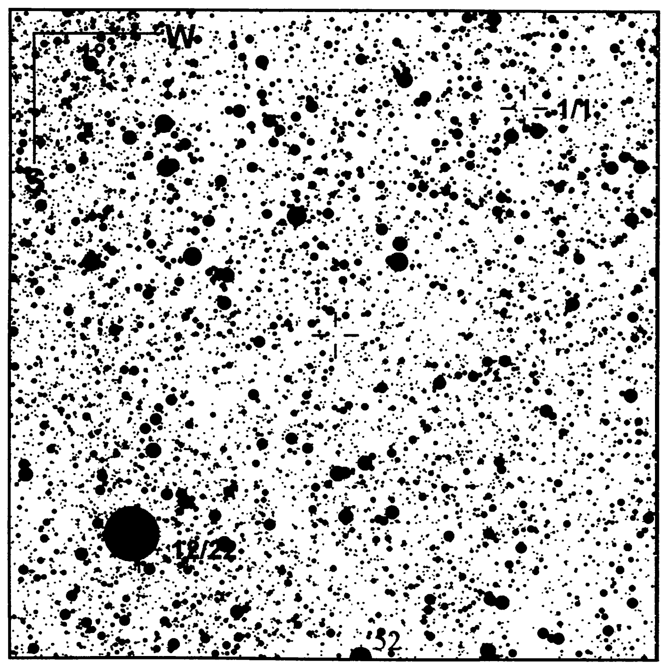
643 Scheherezade. With luck, it won't take a thousand nights to discover this asteroid's lightcurve story. A find of A. Kopff (1907 September), Scheherezade is a type EMP asteroid of 70 km size. The field is in eastern Taurus.

Date	RA2000	Dec2000	RA1950	Dec1950	M	PA	E
12/17	5 48.49	+18 25.0	5 45.56	+18 24.1	14.2	1.7	175
12/22	5 44.22	+18 05.9	5 41.29	+18 04.7	14.2	2.1	173
12/27	5 40.03	+17 47.7	5 37.11	+17 46.1	14.3	3.6	168
01/01	5 36.04	+17 30.4	5 33.13	+17 28.6	14.4	5.3	163
01/06	5 32.35	+17 14.5	5 29.44	+17 12.4	14.5	7.0	157



965 Angelica. Named after discoverer J. Hartmann's wife, Angelica was found in1921 November. It's about 32 km in size and is unclassified. It's high declination should allow long runs for northern observers – if the weather cooperates.

Date	RA2000	Dec2000	RA1950	Dec1950	M	PA	E
11/17	3 40.16	+30 43.8	3 37.06	+30 34.1	12.7	5.1	168
11/22	3 33.68	+31 24.6	3 30.58	+31 14.5	12.6	5.1	168
11/27	3 27.18	+32 00.8	3 24.08	+31 50.4	12.7	6.3	165
12/02	3 20.91	+32 32.3	3 17.81	+32 21.5	12.8	8.2	161
12/07	3 15.10	+32 59.4	3 11.99	+32 48.3	12.9	10.3	156



1963 Bezovec. Betelgeuse (lower left) makes an easy starting point for finding the 24 km Bezovec, which was named after a Slovakian mountain following discovery by L. Kahoutek in 1975 February. The rich field of the Orion sky might make this an interesting challenge.

Date	RA2000	Dec2000	RA1950	Dec1950	M	PA	E
12/17	6 00.99	+ 5 43.7	5 58.32	+ 5 43.6	12.9	9.3	162
12/22	5 54.95	+ 7 16.8	5 52.25	+ 7 16.3	12.8	8.2	164
12/27	5 48.84	+ 8 57.2	5 46.11	+ 8 56.3	12.8	8.4	163
01/01	5 42.93	+10 42.8	5 40.16	+10 41.4	12.9	9.8	161
01/06	5 37.46	+12 31.2	5 34.65	+12 29.5	13.0	12.0	156

COLLABORATIVE ASTEROID PHOTOMETRY OF THREE MAIN BELT ASTEROIDS

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Overcoming the 24 hour commensurability of the Earth's rotation for mid-latitude observatories requires multiple sites widely separated in longitude. We report a collaborative lightcurve investigation between Thornton Observatory in the United States and Flarestar Observatory in Malta (separated in longitude by 119 degrees). Asteroid (565) Marbachia was determined to have a most likely period of 5.084 ± 0.005 hours and an amplitude of 0.22 mag. Asteroid (442) Eichsfeldia was found to have a period of 11.871 ± 0.004 hours with an amplitude of 0.38 mag. Asteroid (509) Iolanda exhibited a period of 12.306 ± 0.003 hours with an amplitude of 0.35 mag. Unraveling the near 24-hour commensurabilities for (442) and (509) demonstrates the value of the widely spaced longitude collaboration.

The Observatories and Equipment

Thornton Observatory is located in Thornton, Colorado, at an elevation of 5530'. Since 1997, the observatory, operating as Minor Planet Center observatory code 713, has been performing asteroid astrometry and the related photometry. Details of the observatory equipment may be found in Koff (2000).

Flarestar Observatory is located in San Gwann, Malta at an altitude of 300 feet. In 1999, Flarestar started operation as Minor Planet Center observatory code 171 and has been performing asteroid astrometry. The observatory employs a 25cm Meade Schmidt-Cassegrain telescope mounted on an LXD 650 German equatorial mount with a Computer Drive System. For photometry and astrometry the telescope is set to operate through an f/3.3 focal reducer, yielding an effective focal length of 660mm and an f-ratio of f/2.6. The imaging CCD camera is a Starlight Express HX516 and was used at full resolution of 660X500 square pixels of 7.4 microns each. This 16-bit camera uses the SONY ICX084AL interline chip. The resulting image scale is 2.33"/pixel, which fits well to the average seeing conditions at the site. All images were unguided and unfiltered. Peak response for the CCD stands at 550nm. That is situated very near the V band.

Procedure

Targets were selected based on their magnitude and position in the sky, to maximize the length of time they would be observable, particularly under the restricted sky visibility of Thornton Observatory. Targets were selected for which no lightcurve data had been previously reported (Harris, 1997).

The images were obtained in unfiltered light. The differential photometry was measured using the program "Canopus" by Brian Warner, which uses aperture photometry. Magnitudes were calculated using reference stars from the LONEOS catalog. The same reference stars were used for each individual asteroid, but comparison stars differed from night-to-night due to movement of the asteroid. This system does not permit calculation of absolute magnitudes, and has the potential for night-to-night variation in the calibration.

Lightcurves were prepared using "Canopus" based on the method developed by Dr. Alan Harris (Harris et al, 1989). This program allows compensation for night-to-night comparison star variation by manually shifting individual night's magnitude scales to obtain a best fit. Such adjustment is especially necessary when combing data from two observatories using cameras with different spectral sensitivities.

This investigation enjoyed the ongoing support and advice of Dr. Petr Pravec of the Ondrejov Observatory in the Czech Republic.

Observations and Results

(565) Marbachia

Marbachia was observed initially by Thornton Observatory on March 1, 2000. Initial results indicated a period near 6 hours, which would make a lightcurve difficult to obtain from one location. Assistance was requested from Flarestar Observatory, with which Thornton had an ongoing working relationship.

Observations from Thornton were made on 4 nights during the period from March 1, 2000 to March 9, 2000. A total of 94 images were taken, of which 83 were usable. Exposure times at Thornton these investigations were four minutes each. Images were taken at 10-minute intervals. Dark frames and flat fields were used to calibrate each image.

At Flarestar, observations were made on two nights, on March 3-4, 2000 and March 7-8, 2000. A total of 29 images were made, of which 24 were usable. Exposure times and intervals were variable. Images were not calibrated with dark frames or flat field frames.

Figure 1 shows the resulting lightcurve. The zero point of the curve is J.D. 2451604.6959. The period was determined to be 5.084 hours ± 0.005 hours, with an amplitude of 0.22 ± 0.03. The period was confirmed by Dr. Pravec as the most probable. However, Dr. Pravec notes that there is another solution at 4.59 hours which cannot be ruled out. Within the instrumental system, the mean measured magnitude was 12.94.

(442) Eichsfeldia

Building on the experience from the collaboration on (565), a lightcurve investigation was begun for (442) Eichsfeldia, as a collaborative effort from the outset. The asteroid was observed on 9 nights beginning on March 27, 2000 and ending on April 28, 2000. A total of 96 usable images were taken on three nights from Flarestar, followed by 153 usable images taken on 6 nights from Thornton. Images were obtained in unfiltered light. Exposure times at Thornton for this investigation were four minutes each. Images were taken at 10-minute intervals. Dark frames and flat fields were used to calibrate each image. At Flarestar, exposure times were 80 seconds at four-minute intervals. Images were dark subtracted.

Figure 2 shows the resulting lightcurve. The zero point of the curve is J.D. 2451631.4364. The period was determined to be 11.871 hours ± 0.004 hours, and Dr. Pravec found the solution to be unique. The amplitude of the curve is 0.38 ± 0.03. The mean measured instrumental magnitude was 12.40.

The period of the lightcurve is such that, from any one observatory, the curve shifts only 15.6 minutes per day. Thus, one observer would have to observe this object for 46 days to see one complete cycle, with no overlap. This effect is evident in Figure 2, by noting that each observatory examined roughly 70% of the asteroid, even though the observations covered a period of 32 days.

(509) Iolanda

With two successful collaborative lightcurves completed, a lightcurve investigation was begun at Flarestar Observatory of asteroid (509) Iolanda. Thornton Observatory stood by to assist as needed. The asteroid was observed from Flarestar on 3 nights beginning on May 4, 2000 and ending on June 6, 2000. A total of 118 usable images were taken. Observations were unfiltered. Exposure times were 80 seconds. Images were taken at 6-minute intervals. Dark frames were used to calibrate each image, and, in addition, flat fields were used for image calibration on the June 1 and June 6, 2000 observations.

It became apparent that the period of this object was near 12 hours, and Thornton Observatory took up observation of the object on June 8, 2000. 25 usable observations were made, each of four minutes exposure. The interval between observations was 10 minutes. All images were calibrated with dark frames and flat fields. Images were unfiltered.

Figure 3 shows the resulting lightcurve. The zero point of the curve is J.D. 2451669.3948. The period was determined to be 12.306 hours ± 0.003 hours, and Dr. Pravec found the solution to be unique. The amplitude of the curve is 0.35 ± 0.03. The mean measured instrumental magnitude was 12.86.

This lightcurve, as was the case with (442), would have been difficult to determine from one observatory, due to the proximity of the period to 12 hours. Again, the collaboration of two observatories made the determination practical.

Acknowledgments

Many thanks to Dr. Petr Pravec of Ondrejov Observatory for his help and support of the Thornton Observatory/Flarestar Observatory lightcurve project. Thanks also to Brian Warner for his continuing work on the program "Canopus", which has made it possible for amateurs to analyze and share lightcurve data.

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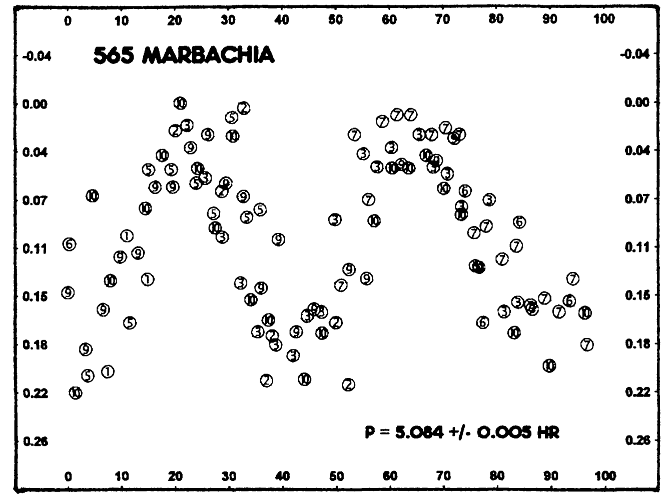

Figure 1. Lightcurve of (565) Marbachia, based on a period of 5.084 hours ± 0.005 Hours. Ordinate is relative magnitude. Curves 1 (3/3/2000), 2 (3/4/2000), 5 (3/8/2000), and 6 (3/7/2000) are Flarestar observations. Curves 3 (3/7/2000), 7 (3/9/2000), 9 (3/1/2000) and 10 (3/4/2000) are Thornton observations.

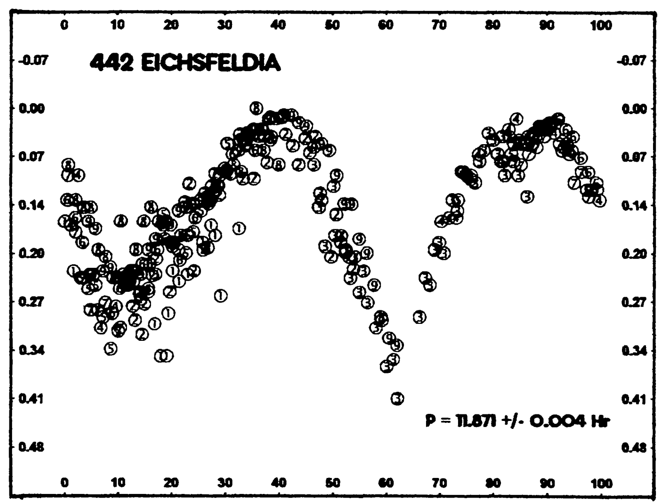

Figure 2. Lightcurve of (442) Eichsfeldia, based on a period of 11.871 hours ± 0.004 Hours. Ordinate is relative magnitude. Curves 1 (3/27-28/2000), 2 (4/6-7/2000) and 3 (4/22-23/2000) are Flarestar observations. Curves 4 (4/2/2000), 5 (4/8/2000), 6 (4/12/2000), 7 (4/14/2000), 8 (4/25/2000) and 9 (4/28/2000) are Thornton observations.

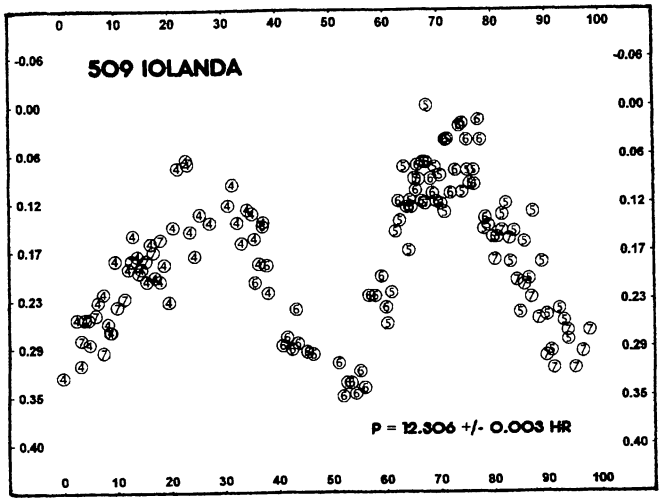

Figure 3. Lightcurve of (509) Iolanda, based on a period of 12.306 hours ± 0.003 hours. Ordinate is relative magnitude. Curves 4 (5/4-5/2000), 5(6/1-2/2000) and 6 (6/5-6/2000) are Flarestar observations. Curve 7 (6/8/2000) is Thornton observations.

EDITOR'S NOTE:

The authors and Dr. Pravec are to be especially congratulated for their international collaborative effort yielding otherwise unobtainable results. It is hoped that this will be the first of many such collaborations within the Minor Planets Section.

OPPORTUNITIES FOR OBSERVATIONS OF MINOR PLANETS HAVING CLOSE APPROACHES WITH (1) CERES, (2) PALLAS, (4) VESTA

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It is proposed to observe some small minor planets having close approaches with (1) Ceres, (2) Pallas, (4) Vesta during the next two years. These observations can be of use for improving the mass values of these large asteroids.

Close approaches of minor planets with each other give important opportunities for determining the mass of the larger minor planet from its perturbing influence on the smaller body. In the paper (Hilton et al. 1996), the motion of minor planets with numbers from 1 to 4589 over the time interval from 1950 January 1 to 2017 July 16 has been analyzed. The authors have found 135 approaches for 21 of the most massive minor planets with other ones within distances less or equal to 0.05 au.

Since the time when the work of Hilton and his co-authors was completed the number of minor planets with well-determined orbits has tripled. Recently in the course of investigation of minor planets with numbers greater than 4583 I found a number of close approaches of these planets with Ceres, Pallas and Vesta. Some of these results are presented in Table I. Most entries included in the table are close to the present epoch. Among them one can see very interesting cascades of approaches by bodies (such as 7859 and 10325) with commensurable mean motions.

Readers are invited to take part in observations of perturbed minor planets during their next oppositions and later on. It should be taken in mind that due consideration must be given to the precision of observations. The required precision of positional observations is on the order of few tenth of arcsecond.

More detailed information and near-oppositional ephemerides can be obtained at e-mail addresses: 1136@ita.spb.su,kom@quasar .ipa.nw.ru

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Perturbing asteroid	Perturbed asteroid	Date of close approach	Minimal distance (au)	Nearest oppositions	Brightness in opposition
1	7859	1992 4 11.0	.051		
1	7859	1996 11 17.0	.024		
1	7859	2001 6 24.0	.037	2001 07 09.1	17.2
1	7859	2006 1 30.0	.043	2006 08 20.6	16.7
1	8182	2001 5 6.0	.054	2001 07 09.6	16.3
1	9605	2001 4 23.0	.052	2001 07 08.7	18.3
1	9973	1968 12 25.0	.027		
1	9973	2001 3 18.0	.028	2001 07 10.1	17.4
1	9990	2001 1 10.0	.038	2001 07 13.2	16.6
1	11353	2001 2 25.0	.039	2001 07 11.2	16.8
1	13924	2000 7 27.0	.030	2001 07 18.4	16.4
1	13953	2000 5 11.0	.012	2001 06 24.1	17.7
1	14389	2001 1 6.0	.004	2001 07 18.3	16.3
1	14440	2001 1 11.0	.032	2001 07 13.1	17.2
1	14493	2000 9 15.0	.058	2001 09 01.5	15.6
2	4971	2000 7 18.0	.024	2001 05 31.3	16.7
2	13662	2000 7 6.0	.033	2001 07 19.2	17.2
2	13719	2000 6 19.0	.043	2001 08 01.2	16.6
4	343	2000 10 7.0	.039	2000 07 22.1	14.6
				2002 02 11.2	14.3
4	2190	2002 5 12.0	.030	2001 11 27.5	15.8
4	4789	1956 11 3.0	.029		
4	4789	2000 5 25.0	.024	2000 07 17.3	15.9
				2002 01 23.9	16.6
4	7023	2000 3 28.0	.052	2000 07 22.3	15.1
				2001 12 09.1	16.6
4	10325	1998 1 6.0	.051		
4	10325	2001 8 24.0	.029	2001 12 01.3	17.2
4	10325	2005 4 13.0	.023	2004 09 26.5	17.9
4	10325	2008 11 29.0	.042	2008 11 01.4	17.7

PHOTOMETRY OF 201 PENELOPE FROM CHILE AND ITALY

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Photometric observations of minor planet (201) Penelope were made at Las Campanas Observatory (Chile) on February 20, 2000 UT, using the 40-inch Swope telescope with the Site #1 CCD camera and a V-band filter, and at Serafino Zani Astronomical Observatory (Lumezzane, Italy) on March 4/5 21, 2000, using a 16-inches Ritchey-Chretien telescope with a Kaf400 CCD and a V-band filter. The obtained lightcurve for the known 3.747 hour period shows an amplitude of 0.55 ± 0.02; this asteroid can display a lightcurve amplitude from 0.15 mag. to 0.73 mag.

Introduction

The object 201 Penelope, discovered by J. Palisa (Pola) on 1879 August 7 (Pilcher,1979), is a metal rich M-type main belt asteroid (Tholen 1989). Its lightcurve can display a large amplitudes (as high as 0.73 mag.) and short period of rotation (3.747 hours) that it would be modeled as an elongated tri-axial ellipsoid or a nearly-contact binary. Changes in the spectral type of the asteroid from M type to B-G (presence of hydraded silicates) was observed by Busarev et al. (1995) following its rotation phase; this minor planet may be the product of a low velocity collision of an M type asteroid with a primitive hydraded body. Surdej et al. (1983) determined the 2 maxima and minima and observed a small hump at the rotational phase 0.3.

Observations from Las Campanas Observatory, Chile

Photometric observations were made at Las Campanas Observatory located in Chile (Latitude –29° 0' 12", Longitude 70° 42' 6") by Joanna Gonzalez Morecchio, Marco A. Avila Elchiver and Francisco J. Larrain Wicha, students at the Andes-Carnegie astronomy summer school, supported by Carnegie Institution of Washington and Fundacion Andes, under agreement of Franck Marchis. We used the 40-inch Swope telescope with the Site #1 CCD (http://www.lco.cl/lco/manuals/direct_ccd/ccd_manual99.html) camera and a V-band filter. Observations cover the period from 1:56 UT to 7:59 UT of 2000 February 20, with a short break (due to technical problem), from 6:10UT to 7:18UT. The duration between images was around 50 seconds; each image has an integration time of 20 seconds. Universal Time is synchronized with Greenwich time every day and one can expect an error less than 4 seconds on these measurements. 340 images have been reduced and analysed with IRAF software using the procedures recommended by Binzel (1983). Observed relative magnitudes were plotted against the rotational phase assuming the previously known 3.747 hours rotation period. A computer program (BLANID, written by A. Gaspani) was used to fit a curve through the photometric measurements. This fit is shown in Figure 1 as a solid line, dots are observational data.

Observations from Lumezzane, Italy

Photometric observations were made at Serafino Zani Astronomical Observatory located in Lumezzane (Italy) by L. Cocca, C. Cremaschini, S. Foglia and G. Pizzetti, using a Ritchey-Chretien telescope of 16-inches of aperture, and a SETI Kaf400 CCD camera with Johnson V-band filter as the detector. Observations cover the period from 2000 March 4, 22:09 UT to 2000 March 5, 1:59 UT. The duration between images was 2 minute; each image was 10 second long. A DCF-77.5 kHz radio signal receiver was used to determine Universal Time. Images were measured with CCDIMG software (Pizzetti 1999) using the procedures recommended by Binzel (1983). Observed relative magnitudes were plotted against the rotational phase assuming the previously known 3.747 hours rotation period. We also applied a BLANID data processing indicated in Figure 2 as a solid line.

Results

Obtained lightcurves are very similar: lightcurve obtained from Las Campanas shows a primary maximum M1 at phase 0.132 and secondary maximum M2 at phase 0.629 (0.10 magn. fainter than M1). Minima, located at the rotational phase 0.399 (m1) and 0.867 (m2), are at the same flux. Lightcurve obtained from Lumezzane shows a primary maximum M1 at phase 0.129 and secondary maximum M2 at phase 0.636 (0.10 magn. fainter than M1). In this case minima, located at the rotational phase 0.378 (m1) and 0.871 (m2), are not at the same flux.

It is clear that both lightcurves show a "little hump" near the phase 0.500. If we compare our lightcurves with Surdej et al. (1983)'s one, we noticed that our hump is located at a symmetric position in reference to the first minima m1. Assuming a bifurcated shape for this asteroid, we may interpret this anomaly as an effect of eclipse between the two components. A Jacobian ellipsoid shape model of the asteroid based upon these observations will be soon available on the web page of the Institut de Mécanique Céleste (http://www.bdl.fr).

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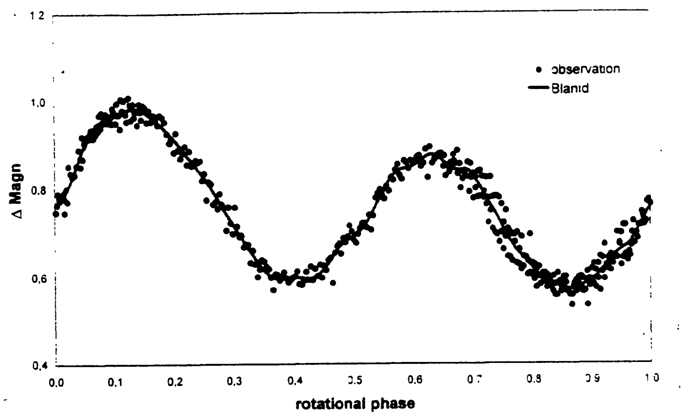

Figure 1: Rotational lightcurve of 201 Penelope obtained from Las Campanas Observatory.

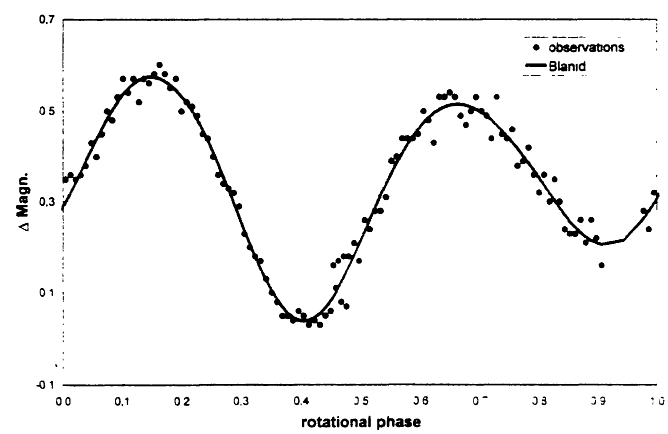

Figure 2: Rotational lightcurve of 201 Penelope obtained from Lumezzane

LIGHTCURVE PARAMETERS FOR 1582 MARTIR

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A lightcurve for 1582 Martir was measured in 2000 May at the Palmer Divide Observatory, located near Colorado Springs, CO. The period was found to be 15.757h ± 0.005h with an amplitude of 0.40m ± 0.03m.

The goal of the Palmer Divide Observatory asteroid photometry program is to measure the lightcurves of as many asteroids as possible. Initial targets are chosen by checking the list of lightcurves maintained by Dr. Alan Harris (Harris 1999). If possible, two targets per night are chosen since the control software allows the telescope to "bounce" between the targets. This maximizes the amount of time that data is being gathered. To help assure the targets remain near the center of the field, the position of each is re-computed before the telescope is moved to it and, approximately every hour, the telescope is moved to a nearby star of magnitude 3 to 7 where an automatic process centers the star and updates the telescope computer's pointing. At least two nights are dedicated to the initial run for every target. Depending on the preliminary analysis of the lightcurve data from those two nights, additional runs are allocated as necessary to assure full coverage of the lightcurve with no significant gaps, if possible. Asteroids with periods approaching and exceeding 24 hours are often, but not always, eliminated from further studies and marked for follow-up at another time or an appeal is made via the Collaborative Asteroid Lightcurve Link (http://www.MinorPlanetObserver.com/astlc/default.htm) to have other observing stations take part in a joint effort.

Commercially available software, Canopus, is used to measure the images. This program semi-automatically measures the magnitudes of comparison stars and the asteroid for each image and then stores the data for use in a Fourier analysis program. The original FORTRAN code of this program was supplied by Dr. Alan Harris (Harris et al, 1989) and converted to Delphi Pascal. If the data from a single night appears to cover at least a quarter of the period or more, an "eyeball estimate" based on a plot of the raw data is used to help narrow the possibilities when using data from two or more nights.

In Canopus, several stars of higher accuracy photometry, such as those from the LONEOS catalog from Lowell Observatory (Skiff), are measured to establish a relationship between the total pixel intensity of a given star vs. its catalog magnitude. The LONEOS catalog is not a set of standard stars but they are of higher accuracy and includes magnitudes in several common bands, thus allowing stars of near solar (and asteroid) color to be used. The LONEOS field is selected to be as near as possible to the target field.

In some cases, stars within the target field are used to establish this relationship. The difficulty here is that it is not usually easy to determine the color of stars in the field since the information is not in the Hubble Guide Star and USNO A2.0 catalogs. While the results under these circumstances are usually similar to when using a LONEOS or like set of stars, a preferred method would be to shoot the target field in both V and B or R to establish which stars are solar colored and should be used to set the relationship. Afterwards, if necessary or desired, observations can be made without filters to improve the signal-to-noise ratio of the data. Once the proper filters have been acquired, this method will be used for future observations at the Palmer Divide Observatory.

The observations for the accompanying lightcurve were obtained with a 0.5m f/8.1 Richey-Chretien telescope. A common focal reducer used on commercial Schmidt-Cassegrain telescopes was used to bring the f-ratio down to f/4.6. The lenses from the reducer were placed in a custom-built mount that allowed the separation between the optics and CCD chip to be nearer the 105mm required for maximum reduction With the SBIG ST-8 used for imaging, this provided a field of approximately 19x13 arcminutes. The CCD was operated at 2x2 binning, or 18um pixels, yielding a resolution of 1.5 arcseconds per pixel. The temperature was set to −10°C. The camera could have been run colder but this setting can be obtained year around, and so is chosen to keep some consistency in the program images. Dark frames and flat fields were applied before the images were measured to reduce the effects of noise, pixel-to-pixel variations and, as a result of the reducer, significant vignetting. Exposures were unguided, forty seconds in duration, and taken at regular three minute intervals.

1582 Martir

Martir is an asteroid of approximately 37km size whose spectral classification has not been determined. The asteroid was discovered by M. Itzigsohn at La Plata on 1950 June 15. It is a main-belt asteroid, favoring the outer reaches with a semi-major axis of 3.16 AU, eccentricity of 0.12, and inclination of 11.6°. Approximately 200 observations were acquired over three nights, 2000 May 5, 10, and 21. The period was found to be 15.757h ± 0.005h with an amplitude of 0.40m ± 0.03m. The 16-day period between the first and last sessions represents approximately 24 revolutions, thus allowing a slightly better than usual precision to be reported.

Acknowledgements

Thanks go to Dr. Alan Harris of the Jet Propulsion Laboratory for making available the source code to his Fourier analysis program.

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Skiff, Brian A. (2000). "LONEOS Catalog", Lowell Observatory FTP site, anonymous login:

```
ftp://ftp.lowell.edu
Login Name: anonymous
Password: <your e-mail address>
cd pub/bas/starcats
get loneos.phot.gz
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Be sure to set the mode to Binary.

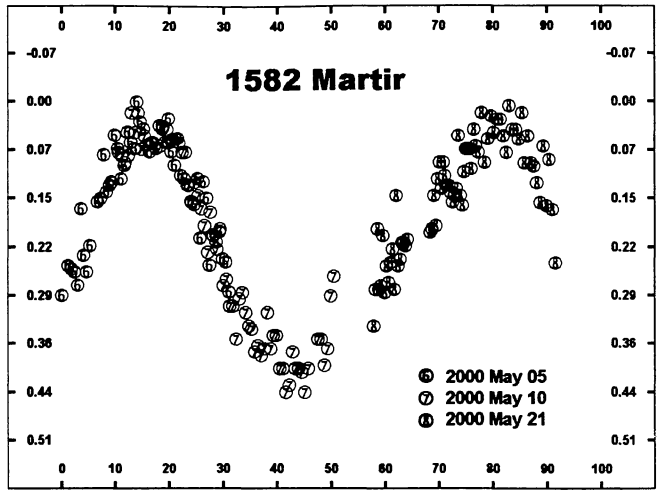

Figure 1. The phased lightcurve for 1582 Martir. The magnitudes are against a reduced common "zero point". The period was found to be 15.757h ± 0.005h with an amplitude of 0.40m ± 0.03m

ROTATIONAL PERIODS AND LIGHTCURVES OF 891 GUNHILD AND 1017 JACQUELINE

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As part of a lightcurve photometry program, the lightcurves of two main belt asteroids were measured at Santana Observatory. 891 Gunhild was determined to have a rotational period of 7.93 ± 0.01 hours and an amplitude of 0.18 magnitude. 1017 Jacqueline was determined to have a rotational period of 7.87 ± 0.01 hours and an amplitude of 0.7 magnitude.

Observations of 891 Gunhild and 1017 Jacqueline were made at Santana Observatory in Rancho Cucamonga, California. The observatory has a 28cm (11 inch) Schmidt-Cassegrain telescope combined with a focal reducer providing a F/7 focal length. The instrument attached is a SBIG ST-9E CCD camera.

Telescope and camera control was done using BDW Publishing's Connections 2000 program. This program controls the GOTO functions, tracking, synchronizing on nearby SAO stars, and automatic focusing necessary for the system to run unattended.

Minor Planets are sometimes selected for observation by referring to "Asteroid Photometry Opportunities" published each quarter in the Minor Planet Bulletin. Targets are selected within the limiting magnitude of the system, considering asteroids for which lightcurves have already been determined according to the list maintained by Dr. Alan Harris.

Data reductions and lightcurves were prepared using BDW Publishing's Canopus program, which was developed from Dr. Alan Harris' Fourier Analysis program (Harris et al, 1989).

891 Gunhild

Gunhild was discovered May 17, 1918 by M. F. Wolf. It is a main-belt asteroid with a semi-major axis of 2.86 AU, eccentricity of 0.026 and inclination of 13.54 degrees.

Gunhild was observed on four nights from April 27 to May 2, 2000. Images were taken unfiltered for 180 seconds and were flat fielded and dark subtracted. A total of 219 images were taken, of which 190 were usable. Unusable images typically resulted from excess trailing or the asteroid being too close to a star to measure. Because the rotational period is almost evenly divisible into 24 hours, the same portion of the lightcurve was being observed each night. Still, observations covering about 75 percent of the lightcurve were obtained revealing a classically shaped double maximum/minimum light curve. The derived period displayed in Figure 1 is 7.93 ± 0.01 hours and an amplitude of 0.18 magnitude.

1017 Jacqueline

Jacqueline was discovered February 4, 1924 by B. Jekhovsky. It is a main-belt asteroid with a semi-major axis of 2.60 AU, eccentricity of 0.077 and inclination of 7.94 degrees.

Jacqueline was observed on five nights from May 4 to 10, 2000. Images were taken unfiltered for 120 seconds and were flat fielded and dark subtracted. A total of 158 images were taken, all of which were usable. Because the rotational period is almost evenly divisible into 24 hours, the same portion of the lightcurve was being observed each night. Still, observations covering about 95 percent of the light curve were obtained revealing a classically shaped double maximum/ minimum light curve. The derived period displayed in Figure 2 is 7.87 ± 0.01 hours and an amplitude of 0.70 magnitude.

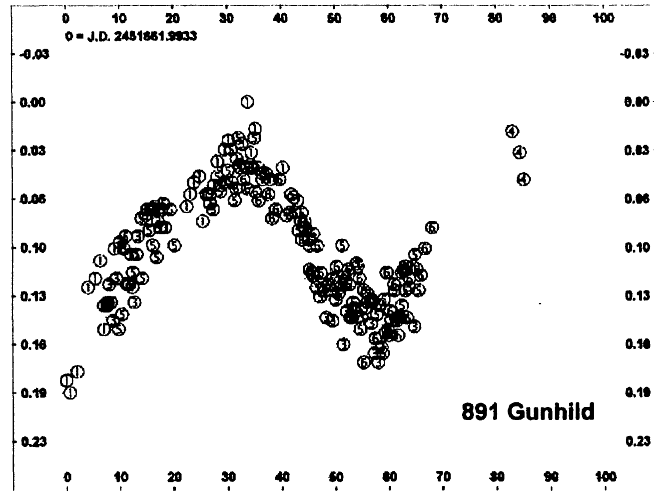

Figure 1. Lightcurve of 891 Gunhild based on a period of 7.93 ± 0.01 hours.

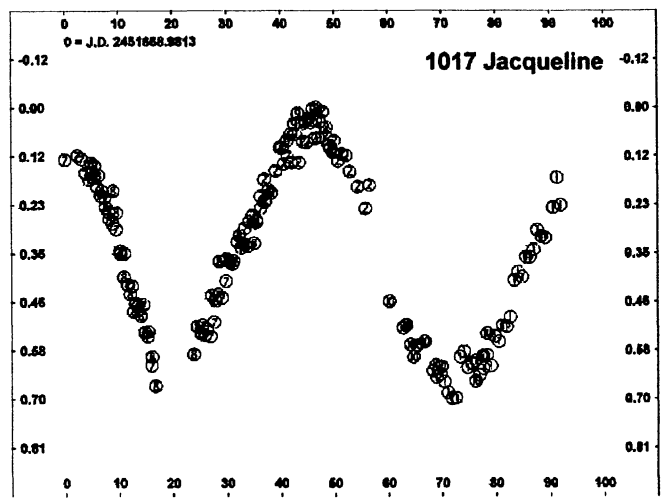

Figure 2. Lightcurve of 1017 Jacqueline based on a period of 7.87 ± 0.01 hours.

Acknowledgements

Many thanks to Brian Warner for his continuing help and guidance, and for his continuing development of the software programs 'Connections 2000' and 'Canopus' which makes it possible for amateurs to automatically gather the data, measure and analyze the light curves.

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THE ROTATION PERIOD OF 699 HELA CORRECTED

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For 699 Hela we present an unambiguous and reliable synodic rotation period of 3.396 hours, correcting an earlier published aliased value. The problem of aliasing of lightcurve periods is explained, with means of guarding against their appearance suggested.

Often in the process of obtaining lightcurves of minor planets short intervals of observation are separated by much longer intervals in which no data could be obtained due to weather or unavailability of telescope time. In these cases it may not be possible to determine the exact number of rotational cycles between the widely separated data sets. Several different periods may satisfy the observational data almost equally well. This problem can arise even for lightcurves on successive nights, and is especially severe when the period has a commensurability with the Earth's 24 hour period. The incorrect periods appearing among these are called aliases.

In 1982 E. Bowell, Lowell Observatory, informed one of the authors (FP) that planet 699 Hela had a short period near 3.6 hours and large amplitude around 0.7 magnitudes. This seemed ideal for visual photometry, and in addition to one photoelectric run by R. P. Binzel at McDonald Observatory and two by M. Watt at Lowell Observatory, FP made a large number of visual lightcurves so that an unusually large interval of 71 days was covered by the data. On this basis Pilcher (1983) published a period of 3.6557 ± 0.0002 hours. In the years following publication Pilcher began to doubt the reliability of this period, believing he may have miscounted one-half cycle each day. The opportunity to check this suspicion came at the very favorable apparition of 699 Hela in September, 1999, when additional photometric lightcurves were made by Brian D. Warner (BDW) and Vittorio Goretti (VG).

Two unfiltered CCD observing runs were made by BDW on UT 1999 September 14 and 17, with the 25-cm telescope at the Palmer Divide Observatory. The amplitude was only 0.17 magnitude at the 1999 aspect. Fourier analysis yielded a period of 3.3987 ± 0.002 hours, demonstrating that the original published period was indeed an alias. Figure 1 presents the composite lightcurve of these two nights.

One of us (VG) made two additional lightcurves measurements with a 25 cm Schmidt-Cassegrain + CCD with a V filter on UT 1999 September 21 and 29. These are shown, light time corrected, in Figures 2 and 3, respectively.

In Table I below the original data of the 1982 paper are presented again, and to these the corrections in the original data analysis are added. The observer code, observed extremum, and its light time corrected observed 1982 ET, are presented in respective columns 1, 2, and 3. Columns 4 and 5 state respectively the rotation cycle number for assumed 3.6557 hour period, and the O-C (observed minus computed) residual of the observed time. By adding 0.5 rotation cycles for each day after the first observation June 13.355, rotation cycle numbers for a 3.3966 hour period are obtained and presented in column 6. Column 7 then presents the O-C for this assumption. The residuals for this assumption are somewhat smaller than for the alias period. The least squares data reduction is best satisfied by a synodic period of 3.3966 ± 0.0002 hours.

Table II below provides analogous data for the 4 nights in September 1999 by BDW and VG. Observer code, observed extremum, and its light time corrected observed 1999 ET, are presented in respective columns 1, 2, and 3. The longitude span between the two observers shows that a 3.6557 hour period is untenable; the combined data can be satisfied only with a synodic period whose least squares value is 3.3957 ± 0.0006 hours.

The 1982 data set is entirely by observers in central North America, for which not even the 71 day time interval of observation could unambiguously distinguish the number of unobserved cycles from

Table I. 1982 lightcurve extrema of 699 Hela, light time corrected

1982 ET Observer Code	Extremum	light time corrected	Assumed P=3.6557h Rotation Cycle	O-C	Assumed P=3.3966h Rotation Cycle	O-C
B	Max	Jun 13.355	0.00	.000d	0.00	+.002d
B	min	13.384	0.25	-.009	0.25	-.004
W	Max	19.299	39.00	+.003	42.00	+.002
P	min	Jul 13.173	195.75	+.001	210.75	-.006
P	Max	13.211	196.00	+.001	211.00	-.004
P	min	13.250	196.25	+.002	211.25	.000
P	Max	13.288	196.50	+.002	211.50	+.002
P	Max	16.256	216.00	.000	232.50	-.002
P	min	17.283	222.75	-.001	239.75	-.001
P	Max	17.319	223.00	-.003	234.00	.000
P	min	17.361	223.25	.000	234.25	+.007
P	min	18.131	228.25	+.009	245.75	-.002
P	Max	18.166	228.50	+.006	246.00	-.002
P	min	18.204	228.75	+.006	246.25	.000
W	Max	19.225	235.50	-.001	253.50	-.005
W	min	19.261	235.75	-.004	253.75	-.004
W	Max	19.297	236.00	-.006	254.00	-.003
W	min	19.337	236.25	-.004	254.25	+.001
W	Max	19.370	236.50	-.009	254.50	-.001
W	min	19.407	236.75	-.010	254.75	+.001
W	Max	19.442	237.00	-.013	255.00	.000
P	Max	24.187	268.00	+.010	285.00	+.004
P	min	24.222	268.25	+.007	228.75	+.004
P	Max	24.263	268.50	+.010	289.00	+.005
P	Max	25.248	275.00	+.005	296.00	.000
P	min	25.285	275.25	+.004	296.25	+.001
P	Max	25.325	275.50	+.005	296.50	+.006
P	Max	Aug 21.129	451.50	+.002	486.00	-.005
P	min	21.167	451.75	+.001	486.25	-.003
P	Max	21.204	452.00	.000	486.50	-.001
P	min	21.243	452.25	+.001	486.75	+.003
P	Max	21.281	452.50	+.001	487.00	+.005
P	Max	24.171	471.50	-.003	507.50	-.006
P	min	24.206	471.75	-.006	507.75	-.006
P	Max	24.246	472.00	-.004	508.00	-.002
P	min	24.285	472.25	-.003	508.25	+.002

Observer code: B: R. P Binzel, photoelectric photometry at McDonald Observatory. P: F. Pilcher, visual photometry with the 35 cm telescope at the Walter H. Balcke Observatory, Illinois College, Jacksonville, Illinois. W: M. Watt, photoelectric photometry at Lowell Observatory.

2000MPBu...27...56P

one night to the next and allowed the one half cycle per day error to arise. By contrast the 1999 data set involved observers in North America and Europe. With observations at widely varying fractions of a day, the alias period was definitively ruled out, and only a period near 3.396 hours is allowed.

The 3.3966 ± 0.0002 hour period was found at a large amplitude, near equatorial aspect. The 3.3957 ± 0.0006 hour period was found at a small amplitude, near polar aspect. These data show that 699 Hela has a large obliquity. At near equatorial aspect for a large obliquity object the synodic and sidereal periods are nearly the same, whereas at near polar aspect they have a greater difference. We therefore suggest that the 3.3966 hour period is closer to the sidereal, with the caution that additional lightcurves are required to verify this suggestion.

Every method of lightcurve analysis, including Fourier series analysis of every point in a precision photoelectric lightcurve, introduces alias periods when long intervals exist in which no observations are available. To eliminate these, the authors request a cooperative program by observers in widely spaced longitudes around the Earth. Most alias periods will be eliminated immediately by such a procedure, for which the data for 699 Hela in 1999 are an outstanding example. We recommend that target objects for this cooperative program include those published quarterly in MPB in the ASTEROID PHOTOMETRY OPPORTUNITIES by Petr Pravec and Alan W. Harris, and large lightcurve objects found in the MAP program and announced by e-mail by Lawrence Garrett.

References

Pilcher, F., (1983). MPB 10, 18-20.

Table II. 1999 lightcurve extrema of 699 Hela, light time corrected

Observer Code	Extremum	1999 ET light time corrected	Assumed P=3.3957h Rotation Cycle	O-C
W	Max	Sep 14.146	0.00	-.003d
W	min	14.182	0.25	-.002
W	Max	14.222	0.50	+.002
W	min	14.258	0.75	+.003
W	Max	14.288	1.00	-.002
W	min	14.322	1.25	-.004
W	Max	17.121	21.00	+.001
W	min	17.159	21.25	+.003
W	Max	17.189	21.50	-.002
G	Max	21.795	54.00	+.006
G	min	21.817	54.25	-.008
G	Max	21.861	54.50	+.001
G	min	21.899	54.75	+.004
G	Max	29.782	110.50	-.001
G	min	29.819	110.75	.000
G	Max	29.852	111.00	-.002
G	min	29.890	111.25	-.001

Observer code: W: B. D. Warner, CCD photometry with a 25 cm telescope at Colorado Springs, Colorado, USA. G: V. Goretti, CCD photometry with a 25 cm f/4 Schmidt Cassegrain at Pianoro, Italy.

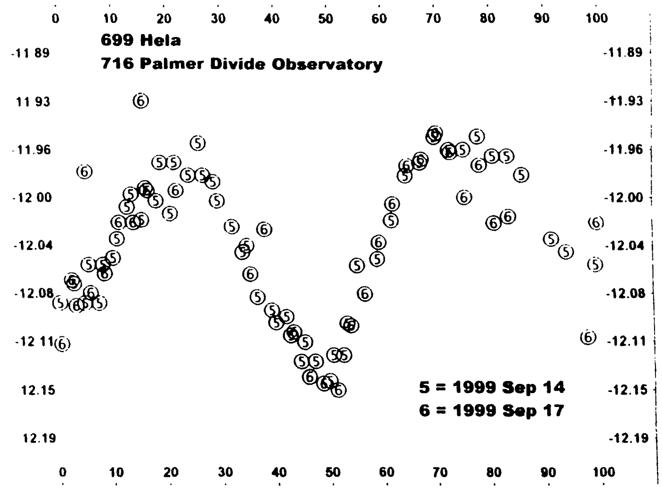

Figure 1.

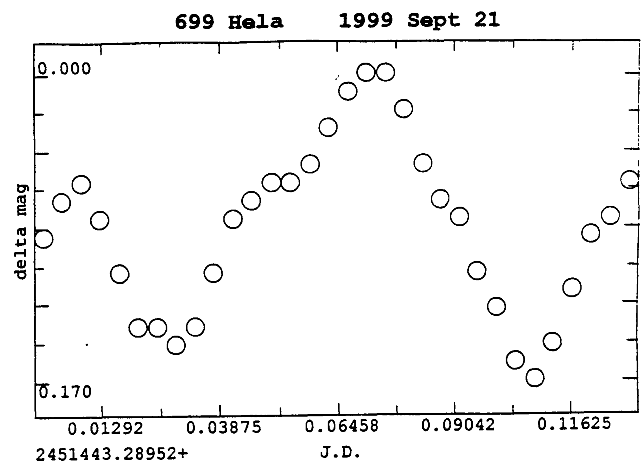

Figure 2.

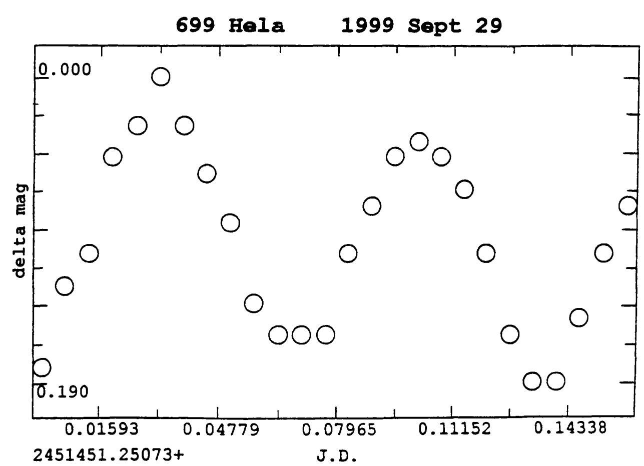

Figure 3.

ASTEROID PHOTOMETRY OPPORTUNITIES OCTOBER-DECEMBER 2000

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The increasing interest in asteroid lightcurve observations we see during several past months is encouraging. In order to avoid an unnecessary duplication of coverage of some asteroids and/or to obtain better results, we recommend observers to coordinate their efforts via the Collaborative Asteroid Lightcurve Link (CALL; http://www.MinorPlanetObserver.com/astlc/default.html). We also point out that a correct and careful analysis of the observations is a necessary part of the lightcurve work. If you are uncertain about reliability and/or significance of your result, contact us.

In the Table below, we present a list of suitable photometric targets for the October-December 2000 period. Most of the objects have been selected from a more extensive list prepared by Brian Warner. We selected objects with the predicted V<13 in opposition and unknown or not reliably established periods. The periods for 372 Palma and 162 Laurentia are only slightly uncertain but we included the asteroids because favorable occultation events are predicted for them on August 7 and December 25, respectively. Lightcurve observations would mainly be of value to establish the rotation phase at the instant of occultation. A promising occultation event is predicted for 752 Sulamitis on November 20. Since the period of this asteroid is not reliably established yet, its lightcurve observations would be useful even if no occultation is actually recorded. The period of 172 Baucis may be as long as about 2 days, according to unpublished observations by Ziegler. Note that a lightcurve with a period close to 12 h (like that of 162 Laurentia) is difficult to observe from a single longitude and coordinated observations from two stations at fairly different longitudes are quite useful. A similar collaboration is useful also for observations of other, longer period lightcurves. Photometrists interested in fainter asteroids are encouraged to check the full list on the CALL.

Asteroid	Opp'n Date 2000	Opp'n V	Per [h]	Ampl	Rem.
391 Ingeborg	Oct 19	10.7	~16	0.22	PER
151 Abundantia	Oct 22	12.6			PER
363 Padua	Oct 27	12.3	>10	>0.3	PER
372 Palma	Oct 30	10.9	8.58	0.13	OCC, PER
374 Burgundia	Nov 3	12.6			PER
965 Angelica	Nov 18	12.6			PER
172 Baucis	Nov 20	11.9	>16	>0.23	PER
207 Hedda	Nov 21	12.6			PER
162 Laurentia	Dec 18	12.5	11.87	0.28	OCC, PER
752 Sulamitis	Dec 20	12.6	~10	~0.04	PER, OCC
1963 Bezovec	Dec 20	12.8			PER
539 Pamina	Dec 24	12.7		0.2	PER
479 Caprera	Dec 25	12.3			PER
696 Leonora	Dec 28	12.4			PER

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 CCD 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 (email: heiser@astro.dyer.vanderbilt.edu). 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.

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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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* * * * *

The deadline for the next issue (28-1) is November 1, 2000. The deadline for issue 28-2 is February 1, 2001.