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MAGNITUDE ALERT PROJECT (MAP)

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Revised: 14 February)

In order to increase the number of observations of asteroids having potential magnitude errors, I propose a new magnitude announcement program called the Magnitude Alert Project (MAP). Under the current system, observers who discover magnitude errors have no mechanism for rapid reporting. Instead, their discoveries appear in the Minor Planets Section General Report during the following year. Usually, only the person who spots the error contributes a magnitude estimate.

An announcement program can distribute an alert on magnitude discrepancies immediately to a mailing list of observers, who can then plan their observations accordingly. Not only can this increase the numbers of magnitude estimates, but estimates can potentially be made over a much longer period of time. Alerts will NOT mention what the suspected magnitude error is, in order to avoid bias. Hopefully, MAP will allow observers who have considered this type of visual project too difficult, a chance to observe asteroids thought to be beyond the limit of their telescope.

The MAP program will consist of two parts: internet and mail announcement systems. The ALPO homepage will feature an article on the latest asteroids suspected to be in error. An e-mail announcement from myself to the mailing list will direct attention to the site. The address of the ALPO Homepage is: http://www.lpl.arizona.edu./alpo/

Alerts via the postal system will require observers to send me self-addressed stamped postcards. Observers who would like to join this project should write or mail me at the address above. Please include information about yourself, magnitude limit, and telescopes used.

CCD PHOTOMETRY OF 169 ZELIA

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(Received: 21 October
Revised: 2 December)

CCD observations were made of the main belt asteroid 169 Zelia in July 1995. The observations are most consistent with a period of 13.27 hours, although the previously measured period of ~16 hours cannot be ruled out. The amplitude of the lightcurve is 0.13 ± 0.02 magnitudes.

Introduction

The object 169 Zelia is an S type main belt asteroid (Tholen 1989) which is believed to have a diameter of 38 km (Xu et al. 1995). Previous photometry has indicated that Zelia has a period of approximately 16 hours (Harris et al. 1992).

Observations

The observations reported here were made at Mount John University Observatory (MJUO) at Lake Tekapo in the Southern Alps of New Zealand. The facility is operated by the Physics Department at the University of Canterbury. The instrument used was a 24-inch Ritchey-Chretien telescope made by Boller and Chivens with a Compuscope CCD 1600 CCD camera as the detector. The camera was used in low resolution mode, giving effectively 768 x 512 pixels, each pixel being approximately 0.5 arcseconds across. The camera was cooled thermoelectrically.

Data were collected on the nights of 1995 July 22, 24, 25, and 28. The telescope was in use at the time for gravitational lensing observations by the MOA project, but the University of Auckland generously allowed observations of Zelia at times when conditions were not suitable for observing the faint objects in the gravitational lensing program. Therefore, all the data were taken in conditions of poor seeing or thin cloud.

In order not to interfere with other observations it was necessary to make the exposures as short as possible. Each image was 90 seconds long, and unfiltered. The duration between images varied between 15 and 30 minutes. DAOPHOT software (Stetson 1987) was used to model point spread functions for the objects in the frames and produce a magnitude for the asteroid with respect to a comparison star in the frame plus three other check stars.

Poor conditions such as thickening cloud or increasing wind prevented any one run of observations from being longer than 8 hours. The sessions on July 24 and 25 were only 4 and 5 hours long, respectively. In total 66 successful exposures of Zelia were taken.

Results

Lightcurves were plotted for the data taken on the four nights. The relative magnitudes from night to night were uncertain, as the magnitudes of the comparison stars were not known, and the poor conditions precluded standard photometric calibration.

An offset was added to the magnitude data for the different nights in order to facilitate comparison of the lightcurves. The minima from each different observing run were offset to the same arbitrary magnitude. The data were then loaded into software which searches for periods in time series data using the Jurkevich method written by A.C Gilmore (Gilmore, personal communication). Likely periods were identified at 0.553 days (13.27 hours) and 0.675 days (16.20 hours).

A model of the rotation period was prepared using Microsoft Excel software. This was used to plot a composite lightcurve of the data for the periods of 13.27 and 16.20 hours. The resulting graphs are shown in Figures 1 and 2 respectively. While there is some coherence to the composite curve of Figure 2, the fit is somewhat better for the 13.27 hour period.

Discussion

The composite lightcurve shows interesting features. In particular, one of the minima shows a brief increase, which may indicate an unusual shape or shadowing effects for this object. The amplitude of the lightcurve is measured on two separate occasions, as both a peak and a trough were seen in the lightcurve on the nights of July 22 and 28. For July 22 the difference between the highest and lowest point measured was 0.132 magnitudes, while on July 28 it was 0.131 magnitudes. Given an estimated error in the photometry of 2 percent, a reasonable estimate of the amplitude of Zelia's lightcurve is 0.13 ± 0.02 magnitudes.

Conclusion

The asteroid 169 Zelia was measured using the technique of CCD photometry during July 1995. The resulting lightcurves show interesting features. The observations are consistent with a period of 13.27 hours, although a longer period of approximately 16 hours as suggested by Harris et al. cannot be ruled out. The amplitude of the lightcurve is 0.13 ± 0.02 magnitudes. Further measurements of this asteroid would be worthwhile, as the period of the lightcurve is not established beyond ambiguity.

Acknowledgments

Thanks are due to Alan Gilmore for supplying information about Zelia, ephemerides for the observations and a copy of PSEARCH, his period searching software. Shane Stanley assisted with plotting the data. The CCD equipment was purchased with a grant from the New Zealand Lotteries Commission, and upgraded by the University of Auckland. The telescope time was provided courtesy of the Universities of Auckland and Canterbury.

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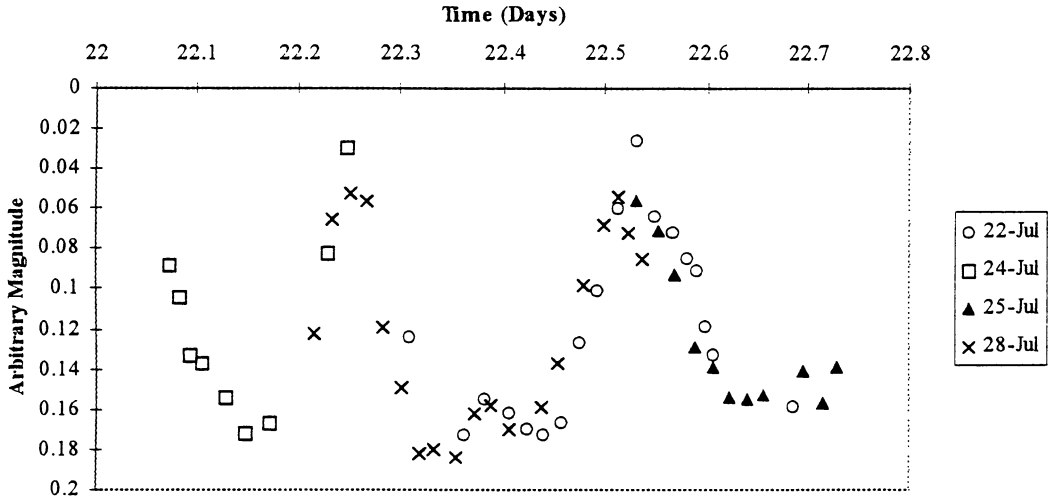

Figure 1. Composite lightcurve for 169 Zelia based on a 13.27 hour period.

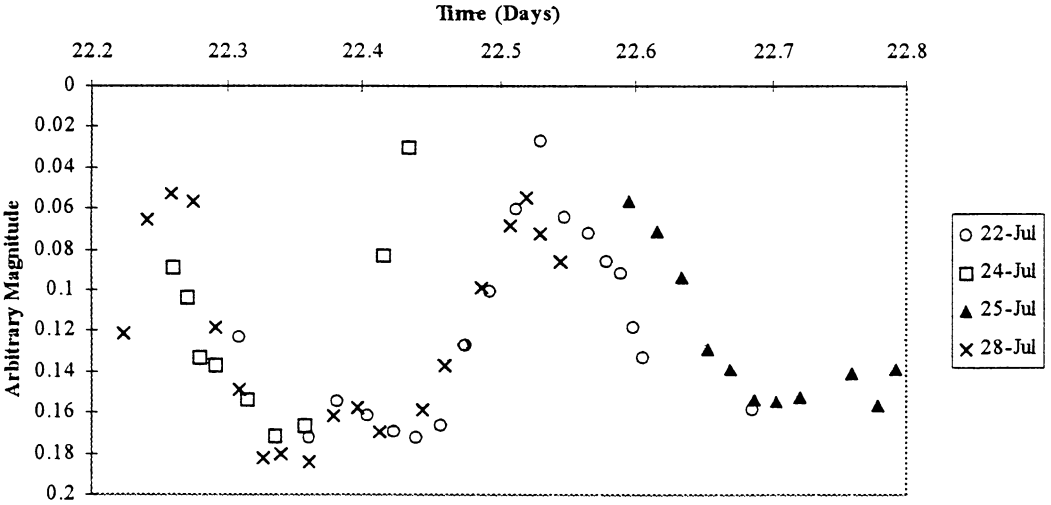

Figure 2. Composite lightcurve for 169 Zelia based on a 16.20 hour period.

PHOTOELECTRIC PHOTOMETRY OF 22 KALLIOPE

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Photometric observations of asteroid 22 Kalliope were made on December 16, 1996 from Serafino Zani Astronomical Observatory located in Lumezzane (Italy) using a 40-cm Ritchey-Chretien telescope with a 1P21 single-channel photometer. The observed 0.3 magnitude amplitude in the visible band is consistent with the previously known range of 0.04 to 0.30.

On 1996 December 16, photoelectric photometry measurements of minor planet 22 Kalliope were made by the authors from Serafino Zani Astronomical Observatory, located in Lumezzane (Italy). The instruments used were an f/8 Ricthey-Chretien telescope of 40-cm of aperture, and a 1P21 single-channel UBV photometer. A DCF-77.5 KHz radio signal receiver was used to determine Universal Time. We utilized four calibration stars from the Arizona-Tonanzintala Catalogue (1965). The star GSC 1840:1088 was used as a photometric comparison.

Observations of the minor planet were made using the procedures recommended by Binzel (1983). We compare our results to parameters listed in *Ephemerides of Minor Planets for 1996*. We observed from 0:07 UT to 02:40 UT on 1996 December 16 and covered about two-thirds of the known 4.148 hour rotational period. For our data reduction we used the following parameters:

H=6.45, g=0.21, B-V=0.69.

Observed V(1,0) magnitudes were plotted against rotational phase assuming the previously known 4.148 hours rotation period. The lightcurve is shown in Figure 1, where zero rotational phase corresponds to 23 hours UT on 1996 December 15. The observed amplitude is consistent with the previously known range of 0.04 to 0.30.

We wish to thank Dr. R.P. Binzel for valuable suggestions.

References

"Arizona-Tonanzintala Catalogue, 1965" Sky & Telescope 30, 25

Binzel, R.P. (1983). "Photometry of Asteroids." In *Solar System Photometry Handbook*, Willmann-Bell Inc.

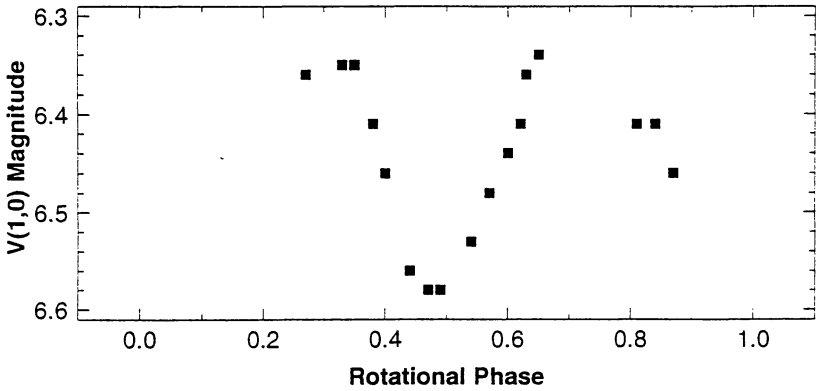

Figure 1: Rotational lightcurve of 22 Kalliope in the V-band of UBV system as determined through photoelectric observations.

LAWRENCE GARRETT TO BECOME ASSISTANT RECORDER OF THE MINOR PLANETS SECTION

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I welcome Lawrence Garrett to become Assistant Recorder of the Minor Planets Section of the ALPO. The full definition of his role and the distribution of duties between him and myself is expected to evolve over time. Initially Lawrence Garrett will utilize his e-mail competence to facilitate rapid electronic distribution to and among Minor Planets Section members of matters related to minor planets, and to communicate observations and information in need of quick attention. He will write a series of articles for both the Minor Planet Bulletin and the ALPO homepage, as these services improve over time, and will be available for consultation by any individual members who may need personal help with these electronic services.

CALL FOR OBSERVATIONS

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Observers who have made visual or photographic measurements of positions of minor planets in calendar 1996 are encouraged to report them to this author on or before April 15, 1997. This will be the deadline for receipt of reports which can be included in the "General Report of Position Observations for 1996," to be published in *MPB* Vol. 22, No. 3.

Observers who contribute precise photographic or micrometric positions are requested to pay careful attention to the precision of their measurements. The *Minor Planet Bulletin* will continue to publish reasonably good astrometry generally accurate to 10 arcseconds or better, but henceforth we must require a reliable statement of the standard deviation of the observation set. Individual researchers then can decide whether a particular set of observations meets their needs. The number of reported significant digits should not exceed the standard deviation of the data set. Random errors of measurement can be determined by remeasuring a random sample of photographic positions several times. Some grasp of the systematic errors on a photograph can be obtained by measuring and reducing the positions of some catalog stars along with the minor planet images. The reduced positions can then be compared with those in the catalog. Alternatively, every catalog star on the photograph can be used in a least squares reduction scheme, and the residuals in the star positions should be indicative of the expected residuals in the minor planet positions.

THE ROTATIONAL PERIOD OF 176 IDUNA

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The rotational period for 176 Iduna is found to be 11.289 ± 0.006 hours with a lightcurve amplitude of 0.35 magnitudes.

Minor planet 176 Iduna was discovered in 1877 by C.H.F. Peters. It is a G-type asteroid with an estimated diameter of 125 km (Asteroids II database).

Photometric observations of 176 Iduna were carried out at the Ole Romer Observatory, University of Aarhus, with a 50-cm Cassegrain telescope equipped with a 1024x1024 CCD. The asteroid was observed in an R filter during the three nights 5-6, 10-11 and 24-25 October 1996. The first two nights were of fine quality, the last one was poor. The ephemerides were calculated from data given in EMP (Batrakov, 1995).

For the analysis presented here, we reduced a total of 114 CCD frames. Aperture photometry was performed on the CCD frames for the asteroid and comparison stars in the field, and from this the relative magnitude for the asteroid was obtained. The lightcurve displayed two minima on the first night and one on the second. This situation made it possible to distinguish between the minima and correlate the minimum on the second night. This correlation made a period determination possible. The third night's lightcurve served as a confirmation and improvement on the overall lightcurve.

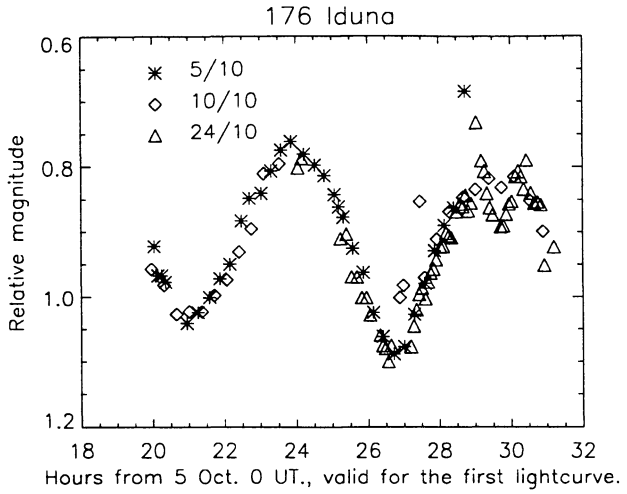

Figure 1. Composite lightcurve for minor planet 176 Iduna. No light time corrections have been applied.

We found the best fit value of the rotational period to be 11.289 ± 0.006 hours, where the composite lightcurve is shown in Figure 1. The amplitude of the lightcurve is 0.35 magnitudes. On the lightcurves there is some dispersion in the measurements, most likely due to clouds or the disturbance from daybreak.

Acknowledgments

We would like to thank Leif Kahl Kristensen, University of Aarhus, for support and advice. The photometry was performed using the image handling system IMSYS, written by Bjarne Thomsen, University of Aarhus.

References

Batrakov, Yu. V., 1995, *Ephemerides of minor planets for 1996.*

ASTEROID PHOTOMETRY OPPORTUNITIES MAY-JULY

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The table below lists asteroids that come to opposition during the months of May through July 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.

Now that many amateur and other small observatories have CCD capabilities, much fainter targets are accessible to them. Therefore, we have included a selection of fainter targets, down to opposition magnitude 15. Our emphasis among these fainter targets is to reach to the smallest size bodies possible within that magnitude limit. Thus the objects listed tend to be inner-belt asteroids, or even Mars or Earth-crossing objects, at unusually favorable oppositions. To achieve this, we filter the list of all oppositions to include those objects with H (absolute) magnitude >14.0 (roughly <5 km in diameter), but opposition V magnitude <15.0, and then further eliminate any objects for which adequate observations have already been made. Our criteria for the brighter objects remains the same: opposition V magnitude <12.0 and that the period is unknown, very uncertain, or ambiguously determined. We have dropped low phase angle as a criterion for inclusion, as it seems no one has responded to past listings suggesting phase relation observations.

In the current table, we call attention to 3671 Dionysus (1984 KD), which may have the shortest rotation period known (2 hours). In its discovery apparition, the period was ambiguously determined, as 2.4 hours, or maybe only 2.0 hours. It is very important to resolve this ambiguity, since a period of 2.0 hours would indicate that the asteroid is in a state of tension from centrifugal force, and therefore a monolithic body, rather than a "rubble pile" of loose pieces. The date given in the table is the time of closest approach to the Earth, 0.11 AU. However it is almost as bright and more favorably placed for observation a month earlier, from about May 30 to June 10.

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	
259 Aletheia	May 9	11.7	25?	0.2	PER
596 Scheila	Jun 3	11.7	?	?	PER
3671 Dionysus	Jul 6	14.9	2.4 or 2.0	0.2	AMB
106 Dione	Jul 10	11.8	15 or 30	>0.2	PER
3145 WalterAdams	Jul 11	15.0	?	?	PER
783 Nora	Jul 25	11.7	>24	>0.2	PER

Asteroid Photometry Opportunities

DATE	R.A. (2000) HR	MIN	DEC. DEG	MIN	MAG V	PHASE ANGLE
Minor Planet 106 Dione						
1997 Jun 6	19	46.26	-25	18.2	12.58	11.2
16	19	41.48	-25	46.8	12.37	8.5
26	19	34.83	-26	17.3	12.15	5.4
Jul 6	19	26.81	-26	46.6	11.91	2.3
16	19	18.17	-27	11.9	11.90	2.5
26	19	9.77	-27	31.0	12.09	5.8
Aug 5	19	2.45	-27	43.0	12.26	9.0
15	18	56.91	-27	48.0	12.42	11.9
Minor Planet 259 Aletheia						
1997 Apr 7	15	39.28	- 8	5.9	12.26	12.7
17	15	34.73	- 7	49.2	12.06	9.7
27	15	28.21	- 7	34.2	11.85	6.4
May 7	15	20.36	- 7	24.0	11.68	3.9
17	15	12.04	- 7	21.7	11.72	4.7
27	15	4.15	- 7	29.5	11.89	7.8
Jun 6	14	57.52	- 7	48.6	12.08	11.1
16	14	52.76	- 8	19.3	12.27	14.1
Minor Planet 596 Scheila						
1997 Apr 27	17	15.99	-20	6.2	12.79	16.1
May 7	17	12.15	-20	58.8	12.56	12.7
17	17	5.51	-21	54.7	12.32	8.5
27	16	56.71	-22	51.5	12.04	4.0
Jun 6	16	46.76	-23	46.4	11.83	1.0
16	16	36.93	-24	37.4	12.16	5.7
26	16	28.46	-25	23.7	12.42	10.1
Jul 6	16	22.31	-26	6.0	12.66	14.0
Minor Planet 783 Nora						
1997 Jun 16	20	29.99	- 7	40.9	12.84	23.0
26	20	30.51	- 8	10.1	12.56	18.8
Jul 6	20	27.83	- 9	10.5	12.26	13.7
16	20	22.55	-10	40.9	11.97	8.1
26	20	15.82	-12	34.2	11.74	3.9
Aug 5	20	9.19	-14	38.2	11.94	7.0
15	20	4.24	-16	39.5	12.26	12.5
25	20	2.17	-18	26.9	12.58	17.6
Minor Planet 3145 Walter Adams						
1997 Jun 6	19	46.87	-22	58.8	16.48	20.8
16	19	45.69	-22	19.7	16.13	16.2
26	19	40.69	-21	41.1	15.75	10.7
Jul 6	19	32.64	-21	1.9	15.33	4.4
16	19	23.02	-20	21.3	15.14	2.6
26	19	13.84	-19	39.9	15.47	9.4
Aug 5	19	7.04	-18	59.5	15.75	15.7
15	19	4.00	-18	21.7	16.02	21.2
Minor Planet 3671 Dionysus						
1997 May 17	13	34.20	+26	30.4	15.77	42.8
27	13	13.41	+23	39.0	15.54	51.8
Jun 6	12	52.01	+17	47.7	15.29	61.7
16	12	28.42	+ 7	33.5	15.05	72.6
26	11	56.84	- 9	33.9	14.87	84.0
Jul 6	11	2.84	-34	28.3	14.89	92.5
16	9	15.93	-57	4.1	15.07	92.0
26	6	36.69	-64	57.3	15.29	84.3
Aug 5	4	40.17	-62	53.6	15.50	74.7

THE MINOR PLANET BULLETIN (ISSN 1052-8091) is the quarterly journal of the Minor Planets Section of the Association of Lunar and Planetary Observers. The Minor Planets Section is directed by its Recorder, Prof. Frederick Pilcher, Department of Physics, Illinois College, Jacksonville, IL 62650 USA. The *MPB* is edited by Dr. Richard P. Binzel, MIT 54-410, Cambridge, MA 02139 USA (Internet: rpb@astron.mit.edu). Dr. Robert A. Werner, JPL MS 301-150, 4800 Oak Grove Drive, Pasadena CA 91109 USA (Internet: bob.werner@jpl.nasa.gov), produces the *MPB*. Derald D. Nye serves as the Distributor.

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* * * * *

The deadline for the next issue (24-3) is May 1, 1997. The deadline for issue 24-4 is August 1, 1997.