

26,

1004 Belopolskya	Pilcher, 35	Aug 30-Sep 16	5
1005 Arago	Pilcher, 35	Aug 30-Sep 16	8
1015 Christa	Pilcher, 35	Oct 10-14	6
1028 Lydina	Pilcher, 35	Sep 17-22	6
1031 Arctica	Pilcher, 35	Oct 22-26	5
1042 Amazone	Pilcher, 35	Oct 13-21	4
1062 Ljuba	Pilcher, 35	Jan 18-25	5
1064 Aethusa	Pilcher, 35	Sep 14-17	7
1074 Beljawska	Pilcher, 35	Sep 19-24	6
1078 Mentha	Pilcher, 35	May 1-17	6
1086 Nata	Pilcher, 35	Dec 14-16	5
1104 Syringa	Pilcher, 35	Oct 13-22	6
1130 Skuld	Pilcher, 35	Sep 19-24	6
1140 Crimea	Pilcher, 35	Sep 16-22	6
1149 Volga	Pilcher, 35	Oct 14-21	4
1177 Gonnessia	Pilcher, 35	Nov 28-Dec 15	6
1214 Richilde	Pilcher, 35	Aug 30-Sep 15	6
1241 Dysona	Pilcher, 35	Aug 24-30	4
1242 Zambesia	Pilcher, 35	Nov 11-15	6
1263 Varsavia	Pilcher, 35	Oct 13-14	3
1269 Rollandia	Pilcher, 35	Dec 18-19	4
1304 Arosa	Pilcher, 35	Mar 26-Apr 3	6
1305 Pongola	Pilcher, 35	Feb 26-27	4
1323 Tugela	Pilcher, 35	Mar 26-Apr 3	6
1353 Maartje	Pilcher, 35	Sep 15-17	6
1409 Isko	Pilcher, 35	Nov 14-17	6
1458 Mineura	Pilcher, 35	May 25-26	4
1473 Ounas	Pilcher, 35	Aug 30-Sep 3	4
1567 Alikoski	Pilcher, 35	Dec 17-19	6
1734 Zhongolovich	Pilcher, 35	Nov 12-18	6

THE FUTURE OF POSITIONAL OBSERVATIONS

by R.G. Hodgson, Recorder

As Prof. Pilcher reported (above), Minor Planets Section observations of 313 different planets in 1979 failed to show any with large ephemeris errors. Are we to conclude positional observations are no longer needed?

Indeed not! There will always be need for precise positions based on photography to update and improve planet orbits, and even semi-accurate positions determined visually can serve to check ephemeris accuracy, something which will be needed for the next few years at least. Observers are urged to check carefully for significant magnitude errors and/or large amplitudes (say 0.5 magnitude or more) and telephone the Recorder (712-722-1513) if any are found. Pilcher's discoveries concerning 99 Dike, 267 Tirza, and 657 Gunlöd (next article) demonstrate what an alert observer can do. Remember also that large amplitudes may be observed only when their orientations are favorable, so several oppositions must be observed in order to settle the question with respect to a particular planet.

657 GUNLÖD - A MAIN BELT ASTEROID

WITH A LARGE AMPLITUDE LIGHTCURVE

by Prof. Frederick Pilcher

Illinois College, Jacksonville, Illinois 62650 USA

Abstract. The minor planet 657 Gunlöd was found by visual observation in February and March, 1980, to have a large amplitude lightcurve near 1^m0. The rotation period could not be uniquely determined but may be near 15^h or near 11^h.

In February and March, 1980, I included planet 657 Gunlöd in my continuing visual survey of minor planets with the Celestron 14 at the Walter H. Balcke Observatory, Illinois College, Jacksonville, Illinois, USA. All times given in this report are in UT and refer to the year 1980. All magnitudes were obtained visually by comparison with other asteroids with well-established magnitudes and reduced to the B photoelectric system. Errors are believed to be of order $\pm 0^m.3$, but changes of ± 0.2 could be detected readily. At no time during the investigation was Gunlöd much above the 15^m limit of the telescope. Due to poorer sky transparency at low altitude observations could be obtained on any one night only during a time interval of about 4 hours centered on transit.

After an initial failure to find the object Feb. 13.26, I observed minor planet 657 Gunlöd Feb. 17.27 near 14^m6, about the value listed in the ephemeris volume. As is my usual practice, I looked for Gunlöd again later in the same night to check for motion and thereby confirm my identification. But at Feb. 17.35 the object had disappeared, evidently fainter than 15^m0. The possibility of large lightcurve amplitude was immediately suggested. The following night I again found Gunlöd at Feb. 18.18, -14^m7, the motion since Feb. 17.27 being consistent with that predicted and rendering the identification highly probable. At Feb. 18.22 I possibly barely glimpsed Gunlöd near 15^m1. Repeated attempts to find Gunlöd every 20 to 30 minutes, alternating with observations of other asteroids in my program, from Feb. 18.24 to Feb. 18.32 all resulted in failure. Bad weather and increasing moonlight prevented additional observation in February.

On March 6.12 I again found Gunlöd, 14^m8. There was some hint of brightening to 14^m7 by Mar. 6.14; then Gunlöd faded, disappearing at 15^m0 about Mar. 6.21 and not seen again by Mar. 6.26 when increasing moonlight terminated observation. On this occasion motion between Mar. 6.12 and 6.21 was unmistakable and there could be no doubt about the correctness of the identification.

March 18 featured excellent weather and I again found Gunlöd Mar. 18.09, -15^m0. Thereafter it faded, last glimpsed -15^m2 Mar. 18.13, and remained invisible until Mar. 18.29 when it was again barely glimpsed -15^m1, its motion since Mar. 18.09 unmistakable and consistent with that predicted. On Mar. 18.31 I barely glimpsed Gunlöd for the last time as decreasing altitude in the southwest prevented further observation.

Negative efforts to observe Gunlöd were also recorded at 20 to 40 minute time intervals Mar. 15.14-15.29 and Mar. 19.10-19.23. It is not evident whether these failures were due to inferior sky conditions or to Gunlöd being near lightcurve minimum throughout the interval.

From the observations of Feb. 17 and 18 we can see that the rapidly fading part of the light curve was repeated at an interval of 22 ± 1 hours. With the usual assumption that the lightcurve variation is due to rotation of an elongated object, we can derive a rotation period which is an integer divisor of 44 ± 2

hours, that is near 44, 22, 15, 11, ... hours. Of the four nights on which positive observations were obtained, only Mar. 18 revealed both the rising and falling parts of the light curve, but as these were recorded 4 hours apart very long (22 or 44 hours) and very short (less than 11 hours) periods are both ruled out. Thus we conclude that the period of rotation is either 15 or 11 hours, with an uncertainty of 5%, but the available data are insufficient to distinguish between these two possibilities.

Variation of $0^m.4$ was positively measured. A consideration of light curve properties for highly elongated objects shows that the actual amplitude is probably much larger than this. Planets 433 Eros, 624 Hektor, and 1620 Geographos show broad maxima and deep but narrow minima as the cross sectional area of an elongated object presented to Earth only briefly lies at near its smallest value. Only near maximum was Gunlod within reach of the C14; this was followed by at least 3 hours of invisibility. Thus it appears that minimum was far below the $15^m.0$ to $15^m.1$ limit, probably $15^m.5$ or fainter, and the amplitude is near $1^m.0$ or possibly even larger.

In observations of over 900 main-belt asteroids I have never before encountered a rotational variation anywhere nearly this large. Only for Earth-approachers 433 Eros, 1620 Geographos, and 1978 CA have I seen such large variation. The most recent tabulation of light-curve parameters¹ shows no main belt asteroids with rotational amplitudes exceeding $0^m.8$ and very few exceeding $0^m.5$. Only non main-belt objects Eros, Geographos, and the Trojan 624 Hektor among asteroids with known lightcurves have amplitudes of 1^m or greater.

Planet 657 Gunlod is thus seen to have a larger amplitude lightcurve than known for any other main belt asteroid. The rotation period is much longer than that of any of the large amplitude non main belt asteroids mentioned above. Gunlod has a unique lightcurve and deserves further study. So large an amplitude makes Gunlod an excellent candidate for photographic or visual photometry, unlike most small-amplitude asteroids for which quality light curves can be obtained only photoelectrically. If the orbital and rotational poles are nearly 90° apart, as for some other large amplitude asteroids, then the amplitude might be much smaller at some future apparitions. David Bender, Jet Propulsion Laboratory, has privately distributed a tabulation of opposition circumstances 1980-1990 for over 2100 asteroids. His list shows that Gunlod will have another near-perihelion opposition 1984 Jan. 26 at aspect not too different from that in the 1980 opposition. A large amplitude light curve can be predicted again for early 1984, and observers able to reach $B = 15$ or fainter are strongly urged to plan a massive observational assault over several weeks to determine an accurate and definitive rotation period and amplitude.

REFERENCES

1. Tedesco, E. F., in *Asteroids*, ed. by T. Gehrels, U. of Ariz. Press, 1979, pp 1098-1107.

OBSERVER OF THE YEAR

In view of the fact that Ramon E. Fabré secured 1,237 positional observations of 198 different minor planets during the year 1978, the Recorder is happy to name him "Observer of the Year." The fact that his observations were made with telescopes of 20 cm aperture is an indication of what can be accomplished with that size instrument when it is in the hands of a dedicated person.

The Recorder would also like to commend Prof. Pilcher for his extensive observing work in 1978, and for his excellent positional observations report.

MINOR PLANET ROTATIONS 1978-1979

by Alain C. Porter and Derek Wallentinsen

The Photometry Division of the A.L.P.O. Minor Planets Section has received 25 observations in the past year. This is almost exactly the same number as was received in the year 1977-1978, but there is an encouraging difference: three of this year's light curves are photoelectric. We feel this is a sign of serious, long-term interest in the photometry program, and hope it will encourage other amateurs and college/university student groups to make contributions which can prove valuable, whether they are visual, photographic, or photoelectric.

This report covers observations made between January 13, 1978 and January 30, 1979, not discussed in the preceding report (cf. *MPS* 6, 19-20, 1978).

Table: The Observations

Planet Number	Observer							Planet Total
	RB	DH	GH	PK	TM	AP	BS	
4						6		6
9						2		2
12		2		2				4
21		1						1
42	1*							1
69							1	1
79			1					1
270						5		5
324					1*			1
354	1*							1
377							1	1
405		1						1
Observer Total	2	4	1	2	1	13	2	25

Observers

RB = Richard Binzel, St. Paul, Minnesota, U.S.A.

DH = David Hough, South Plainfield, New Jersey, U.S.A. (15 cm reflector)

GH = Guy Hurst, Northampton, England (26 cm reflector)

PK = Phillip Kirby, Springfield, Ohio, U.S.A. (15 cm reflector)

TM = Thomas McFaul, Hopewell Junction, New York, U.S.A.

AP = Alain C. Porter, Narragansett, Rhode Island, U.S.A. (15 cm reflector, 7x35mm binoculars (for Vesta only))

BS = Bruce Sumner, Perth, Australia (20 cm Celestron)

* Denotes photoelectric observation

PRIMARY RESULTS

4 Vesta

Porter made a series of observations of this object primarily to test his magnitude resolution. Vesta has a well known period of $5^h20^m31.9^s$ with an amplitude of 0.1 to 0.13 magnitudes (eg, Gehrels 1967). Such a tiny variation would be only marginally detectable to the naked eye. In fact, on only 2 of the nights were the light curves long enough, and the variation appreciable enough, to merit com-