THE MINOR PLANET BULLETIN

BULLETIN OF THE MINOR PLANETS SECTION OF THE ASSOCIATION OF LUNAR AND PLANETARY OBSERVERS

VOLUME 14, NUMBER 4, A.D. 1987 OCTOBER-DECEMBER

INDEX TO UNPUBLISHED LIGHTCURVE DATA

Richard P. Binzel
Planetary Science Institute
2030 E. Speedway Blvd.
Tucson, AZ 85719

(Received: 29 June Revised: 1 August)

An index to unpublished asteroid lightcurve data is given. The purpose of this list is to foster collaboration among observers so that improved results can be obtained.

An informal working group on Asteroid Shapes and Pole Positions met during the November 1986 Division of Planetary Sciences (DPS) conference in Paris. Participants noted that when performing period, shape, and pole solutions for an asteroid, all of the available data should be utilized. In many cases, however, researchers are unaware that colleagues have additional unpublished data.

The listing published here now fills that need by indexing unpublished lightcurve data. Researchers interested in a particular data set should contact the person listed to inquire about collaboration in deriving results. Such collaboration is especially encouraged now in light of the March 1988 Asteroids II conference and book which will produce the most up-to-date listing of asteroid physical properties. New results should be reported to C. -I. Lagerkvist, A. Harris, or V. Zappalá as soon as possible.

The index follows a simple 35 column format:

Col 1-4: Minor planet number.

Col 6-10: Month/Year of the observations. In many cases the observations extend over several months. Only one month is listed here for each observer.

Col 12-21: 10 character last name of primary observer or the contact person for information requests.

Col 23-35: codes which give some information on the data set. One or more codes may be specified.

- E Extensive data set from two or more nights.
- M Modest data set from one or two nights.
- L Limited data set consisting of only a few observations on one night.
- K Data are photographic measurements.
- V Data are visual estimates.
- R Data are relative photometry and are not calibrated to the Johnson UBV magnitude system.
- T Data are thermal infrared measurements.
- P= Preliminary period estimate. This value is for information only and should not be used or referenced without permission of the observer.
- A= Preliminary amplitude estimate. This value is for information only and should not be used or referenced without permission of the observer.

Contributors to this index (and their affiliations) include: A. Barucci and R. Burchi (Teramo Obs.), R. Binzel (PSI), P. Birch (Perth Obs.), E. Bowell and S. Bus (Lowell Obs.), M. Di Martino (Torino Obs.), M. Fulchignoni (Rome Univ.), A. Harris (JPL), R. Harvey, J. Lambert, F. Melillo, J. Piironen (Finnish Meteorological Inst.), F. Pilcher (Illinois Coll.), M. Poutanen (Finnish Geodetic Inst.), S. Weidenschilling (PSI), and W. Wisniewski (U. Ariz.). D. Tholen (U. Hawaii) also reports that partial lightcurve data exist for many asteroids in the Eight-Color Asteroid Survey (Zellner et al. 1985, Icarus 61, 355) and persons interested in particular objects should inquire about possible lightcurve data.

MP #	Mo/Yr	Contact	Comments
1	11/84	Piironen	M
	3/86	Melillo	M R
2	10/80	Lambert	M
3	1/80	Harris	E
5	2/83	Weidensch	E A=0.25
	3/83	Di Martino	E
	3/83	Harris	L
	9/85	Birch	M
	2/87	Weidensch	L A≥0.16
6	9/80	Lambert	M
	12/84	Harris	L
	5/86	Fulchignon	E
7	6/83	Harris	E
	12/84	Harris	L
8	6/80	Harris	E
	5/83	Harris	M
	10/84	Harris	E
	11/84	Piironen	L
	4/86	Melillo	M R
9	2/80	Harris	E
	7/81	Birch	E P=5.0 A=0.3
	3/84	Harris	M A=0.05
	7/85	Birch	M
	11/86	Birch	M
10	3/77	Bowell	E
	4/83	Birch	M
	8/84	Harris	E
	10/85	Harris	L
11	6/81	Poutanen	M
	9/85	Di Martino	E
12	9/82	Harris	M
	12/86	Di Martino	E
14	8/85	Birch	M
	9/85	Di Martino	E
16	3/82	Harris	L
	12/85	Fulchignon	M
	5/87	Weidensch	E
17	7/81	Poutanen	M
	9/85	Birch	M
	9/85	Di Martino	M
18	7/81	Binzel	E
	8/81	Poutanen	L
19	6/81	Poutanen	M
	10/82	Harris	M
	10/82	Millis	R
	11/86	Di Martino	E
20	10/83	Harris	M
	4/85	Harris	L
	8/86	Fulchignon	E
21	10/85	Di Martino	E
22	1/87	Di Martino	E
24	12/79	Harris	E
26	5/83	Harris	M
	9/84	Harris	M
	12/85	Fulchignon	E
27	3/84	Harris	M
28	9/81	Poutanen	L
29	5/85	Harris	L A=0.10
	8/86	Fulchignon	E
30	1/87	Wisniewski	E A=0
	1/87	Birch	M
	3/87	Binzel	L
31	4/80	Harris	L
	10/83	Harris	L
32	11/83	Harris	L
	3/85	Di Martino	E
33	10/85	Harris	L
34	5/83	Harris	M
37	12/80	Harris	M
38	1/83	Harris	L
39	5/86	Fulchignon	E
41	4/85	Harris	M A=0.15
	4/85	Di Martino	E
	9/86	Fulchignon	M
42	8/86	Harris	M
	8/86	Di Martino	M
43	1/84	Harris	E A=0.3
	8/85	Harris	M
	8/85	Birch	M
	2/87	Weidensch	E A=0.14
	3/87	Di Martino	E
44	6/82	Weidensch	M
	8/86	Harris	E
45	3/82	Harris	L
	11/84	Piironen	L
	11/84	Birch	M P=5.7 A=0.4
	1/86	Di Martino	E
46	11/82	Harris	M
47	9/84	Harris	M
49	1/84	Harris	E P=10.36 A=0.1
50	7/86	Harris	L
51	9/83	Harris	E
	1/85	Weidensch	M A=0.10
	1/85	Di Martino	E
52	1/83	Harris	L
	8/86	Fulchignon	E
57	6/81	Harris	E
	10/86	Harris	L
59	9/85	Di Martino	E
60	7/78	Schober	E
	12/79	Harris	E
	1/84	Birch	E P=? A=0.1
62	7/81	Poutanen	M
64	1/79	Di Martino	E
	7/81	Poutanen	M
	8/81	Harris	M
65	10/84	Barucci	E
	2/87	Weidensch	M A=0.09
	3/87	Binzel	M
69	6/81	Poutanen	M
70	8/80	Harris	M
71	8/80	Harris	E
72	7/81	Harris	E P=8.1 A=0.15
73	5/84	Weidensch	M A=0.8 P=13?
75	9/80	Lambert	M
	10/80	Harris	L
76	10/81	Harris	E P=9.8 A=0.1
	10/81	Lagerkvist	E
77	11/80	Harris	E
	9/84	Harris	L
78	10/80	Harris	E
	10/84	Harris	L
80	10/83	Harris	M
83	2/82	Weidensch	M A=0.2
	10/84	Piironen	E
84	4/84	Harris	L
	10/85	Weidensch	M A=0.1 P>8
	10/85	Harris	L
85	10/86	Fulchignon	M
87	8/84	Di Martino	E
	9/85	Di Martino	M
	2/87	Weidensch	E
88	6/81	Harris	L
	1/84	Harris	E A=0.1
	8/86	Fulchignon	M
90	3/87	Binzel	M
93	3/80	Harris	M
	11/82	Harris	E
	2/84	Harris	M
	5/85	Harris	M
	10/86	Harris	E
96	2/80	Harris	M
99	4/81	Harris	L
101	8/80	Harris	E
	7/84	Harris	L
102	9/81	Poutanen	M
106	10/81	Harris	M
107	2/81	Harris	E
	9/85	Di Martino	M
	2/87	Weidensch	E
108	3/84	Harris	L
	7/86	Di Martino	M
	8/86	Barucci	M
109	12/80	Harris	E
112	8/76	Bowell	E P=15.7 A=0.3?
114	7/80	Harris	L
	9/81	Poutanen	L
115	3/87	Di Martino	E
117	9/85	Di Martino	E
119	5/84	Weidensch	M A≥0.24 P≥12
121	12/84	Piironen	L
125	9/81	Poutanen	M
126	9/86	Harris	M
127	11/82	Harris	M P=12? A=0.2
129	7/86	Fulchignon	E
130	7/80	Harris	E
	12/81	Birch	E P=5.3 A=0.3
131	6/83	Harris	L
134	10/80	Harris	E
	10/80	Lambert	L
135	8/81	Harris	E P=8.40
	9/85	Di Martino	M
	10/85	Fulchignon	E
138	2/84	Harris	E P=10.10 A=0.4
	5/85	Harris	M A=0.15
139	2/83	Weidensch	M A=0.2 P=20.9
	2/83	Harris	L
141	9/86	Harris	M P=20? A=0.2
144	12/80	Harris	E
146	12/80	Harris	E
	4/82	Harris	E P=18.6 A=0.16
148	7/81	Poutanen	M
149	10/81	Harris	M P=long A>0.35
153	8/84	Di Martino	E
	9/85	Di Martino	M
154	3/80	Harris	M
	11/83	Harris	L A=0.
156	2/81	Harris	M
159	2/81	Harris	M
160	10/82	Harris	M P=5.58 A=0.1
161	11/80	Harris	L
162	11/84	Piironen	L
163	1/81	Harris	E
165	7/81	Poutanen	L
	7/81	Harris	E
	1/84	Di Martino	M
166	10/82	Harris	L
169	9/81	Poutanen	L
172	3/80	Harris	L
	5/84	Weidensch	L A>0.2 P>16
173	8/86	Fulchignon	E
178	10/81	Harris	M P=12.3 A=0.15
182	7/81	Harris	E
187	5/82	Harris	E P=10.65 A=0.3
188	7/84	Harris	M A=0.3
189	7/81	Harris	L
	4/84	Harris	L
190	7/86	Di Martino	E
191	7/81	Harris	L
192	9/85	Di Martino	M
	9/85	Harris	L
	9/86	Fulchignon	E
201	9/80	Lambert	E P=3.7 A=0.6
	9/80	Harris	L
	2/87	Weidensch	M A=0.6
202	5/85	Harris	L A=0.08
204	6/83	Weidensch	M A=0.25 P=14.1
208	4/85	Harris	L
211	12/80	Harris	E
212	10/82	Harris	L
213	6/86	Harris	E P=7.87 A=0.1
	7/86	Di Martino	E
216	9/80	Lambert	M
	9/80	Harris	L
	10/80	Lambert	M
	12/85	Di Martino	E
	12/85	Fulchignon	M
	2/87	Weidensch	M A=0.85
218	8/80	Harris	E
219	9/81	Harris	E P=long A>0.2
225	5/82	Weidensch	M A=0.3 P=8.8
	10/83	Weidensch	L A≥0.15
	3/87	Di Martino	M
226	6/80	Harris	L
230	3/80	Harris	E
	7/81	Harris	E
	1/83	Di Martino	M
	12/83	Harris	E
	4/84	Harris	L
	9/85	Harris	L
233	3/87	Di Martino	E
236	1/81	Harris	E
	10/84	Harris	M
	11/84	Di Martino	E
241	12/86	Di Martino	E
248	12/84	Piironen	L
250	3/83	Weidensch	E A=0.5 P=5.05
	4/84	Weidensch	M A=0.15
258	8/80	Harris	E
259	5/86	Harris	L
	6/86	Weidensch	M A≥0.15 P=8.2
261	12/79	Harris	E
266	9/82	Harris	L
269	7/84	Harris	L
	8/84	Di Martino	E
275	4/85	Harris	L
	8/86	Barucci	E
276	10/84	Piironen	E
279	9/85	Di Martino	E
284	8/80	Harris	E
287	1/85	Weidensch	M A=0.2
288	4/82	Harris	E P=1150. A>0.6
	1/86	Weidensch	M
289	9/85	Di Martino	E
308	1/86	Di Martino	E
317	9/81	Poutanen	M
	9/81	Harris	E P=8.16 A=0.67
325	10/81	Harris	M P=6.7 A=0.14
329	6/86	Weidensch	M A=0.25 P=22?
326	10/81	Harris	L
334	8/76	Bowell	E P=6.13 A=0.25
	2/82	Weidensch	M A=0.2
	5/83	Weidensch	M A=0.7
	8/84	Di Martino	E
335	6/81	Harris	E
337	10/84	Barucci	E
338	8/81	Harris	L
	8/81	Lagerkvist	M
344	11/84	Piironen	M
346	8/80	Harris	E
	12/81	Harris	L
347	6/83	Harris	M P=4.06 A=0.12
352	12/86	Harris	L
354	12/85	Birch	M
	2/87	Weidensch	E A=0.10
360	1/86	Di Martino	E

MP #	Mo/Yr	Contact	Comments
361	3/87	Di Martino	M
	4/87	Binzel	M
369	8/84	Di Martino	E
372	6/82	Weidensch	M A=0.15
	9/83	Weidensch	E A=0.16 P=16.7
	9/83	Di Martino	E
375	11/82	Harris	M
	1/84	Harris	M A=0.15
376	9/83	Weidensch	M A≥0.2
	7/86	Harris	L
379	9/81	Poutanen	L
	10/81	Harris	M
387	5/81	Harris	M
	3/85	Harris	L
388	10/80	Harris	E
392	10/82	Harris	L
393	7/86	Harris	M
402	3/85	Harris	L
403	3/84	Harris	L
405	6/86	Harris	E
407	1/86	Weidensch	E A=0.45 P=44
419	10/80	Harris	E
	4/83	Birch	M
	2/87	Weidensch	M A≥0.14 P>24
420	9/85	Di Martino	E
423	11/82	Harris	L
	2/84	Weidensch	M A=0.12
	4/85	Di Martino	E
	6/86	Weidensch	L A≥0.1
429	10/81	Harris	E P=13.6 A=0.2
432	9/80	Harris	M
433	9/81	Poutanen	M
	11/81	Harris	E
	8/86	Harris	E
434	9/82	Harris	M
435	8/86	Harris	E P=4.60 A=0.45
	8/86	Barucci	E
449	12/81	Harris	L
458	10/83	Birch	M
472	12/83	Birch	E P=8.1 A=0.3
	3/85	Harris	L
474	8/83	Harris	E P=8.57 A=0.7
475	11/85	Pilcher	E V A>0.5
478	11/80	Harris	M
482	7/81	Harris	L
483	7/86	Di Martino	E
487	5/84	Weidensch	M A=0.1 P=18?
488	4/80	Harris	M
489	4/84	Weidensch	M A≥0.4 P=9?
508	10/84	Piironen	E
510	10/84	Piironen	E
511	7/83	Harris	E
512	9/81	Harris	E P=5.93 A=0.12
517	9/81	Poutanen	M
519	9/82	Harris	E P=17.97 A=0.4
521	7/84	Harris	L
530	7/86	Di Martino	E
532	1/82	Di Martino	E
	2/82	Weidensch	M A≥0.15
	2/87	Binzel	M
534	3/87	Binzel	M
537	5/84	Weidensch	M A≥0.15 P=20?
	9/85	Di Martino	E
539	8/81	Poutanen	L
556	11/81	Harris	M
558	4/80	Harris	L
	7/81	Harris	L
560	12/81	Harris	L

MP #	Mo/Yr	Contact	Comments
566	1/84	Harris	E P=12 A=0.05
579	11/83	Weidensch	E A=0.28 P=16.5
584	7/81	Harris	E P=5.07 A=0.16
	11/85	Harris	L
	2/87	Weidensch	M A=0.25
588	9/85	Di Martino	E
593	1/81	Harris	E
594	4/87	Wisniewski	M P=4.9 A=0.2
606	10/81	Harris	L
	9/85	Harris	L
618	5/84	Weidensch	L A≥0.14
622	11/81	Harris	M P=48 A=1.5
636	10/84	Piironen	E
657	1/84	Harris	M
674	3/80	Harris	M
	5/81	Harris	M
	3/85	Harris	M
678	11/86	Harris	M P=11.75 A=0.3
683	11/82	Weidensch	M A≥0.12
	10/83	Weidensch	M A≥0.15
	2/84	Weidensch	E A=0.20 P=8.6
	7/86	Di Martino	M
685	11/83	Harris	L P=long A=0.4
686	8/84	Harris	E P=6.3 A=0.3
695	7/81	Harris	E P=14.2 A=0.35
704	7/84	Harris	L
712	10/80	Harris	E
717	11/84	Piironen	M
718	4/84	Harris	L
720	3/87	Binzel	M
721	9/85	Di Martino	E
725	9/85	Di Martino	E
726	12/81	Harris	L
739	2/81	Harris	M
746	9/81	Poutanen	M
772	5/83	Harris	L
776	5/81	Harris	E
779	6/81	Harris	E P=11.16 A=0.1
788	6/86	Weidensch	M A≥0.15 P>15
797	11/83	Harris	L P=5. A=0.5
849	6/81	Harris	E P=4.1 A=0.3
852	10/82	Harris	E P=4.611 A=0.3
863	1/80	Harris	L
870	7/81	Poutanen	M
	7/81	Harris	M
886	9/84	Harris	L
895	10/83	Di Martino	M
915	8/84	Di Martino	E
925	9/80	Harris	M
945	2/81	Harris	M
951	11/82	Harris	L
980	8/80	Harris	E
981	11/83	Harris	L
984	12/84	Piironen	L
1010	12/84	Piironen	L
1013	4/86	Weidensch	M A=0.45 P=6
1029	3/87	Binzel	M
1036	10/85	Harris	E P=10.3 A=0.4
	10/85	Burchi	E
1056	8/85	Harris	M P=15.05 A=0.7
1061	12/86	Pilcher	M V A>0.5
1071	11/83	Harris	L
1072	11/83	Harris	L P=5. A=0.3
1073	9/85	Pilcher	L V
1090	2/86	Wisniewski	E P=2.8 A=0.2
1122	12/83	Harris	L P=long
1139	9/86	Wisniewski	M P=long
1168	10/83	Weidensch	M A≥0.38 P=11.4

MP #	Mo/Yr	Contact	Comments
1180	4/87	Binzel	L
1188	9/85	Harris	M P=3.5 A=0.6
	9/85	Di Martino	E
1204	9/82	Harris	M P=7.90 A=0.5
1220	4/85	Binzel	M P=long
1223	3/87	Binzel	M
1284	10/85	Harris	M P=10. A=0.15
1322	6/87	Wisniewski	M P=4 A=0.3
1331	12/84	Piironen	L
1341	12/84	Piironen	L
1367	10/85	Wisniewski	E P=long A=0.4
1392	8/84	Di Martino	E
1429	9/82	Harris	L
1431	10/84	Pilcher	M V A>0.5
1537	11/83	Harris	L A=0.
1583	9/85	Di Martino	E
	9/86	Wisniewski	L
1593	7/81	Poutanen	L
	7/81	Harris	M P=long
1620	2/83	Weidensch	M A=1.0
	3/83	Tedesco	T
	3/83	Birch	E P=5.2 A=1.8
1627	7/85	Harris	E P=4.80 A=0.53
1644	1/81	Harris	M
1665	11/81	Harris	L
1675	11/83	Harris	M P=5.3 A=0.22
1687	2/84	Harris	M P=6.5 A=0.6
1781	11/84	Piironen	L
1808	11/83	Harris	L P=4.0 A=0.1
1860	9/85	Di Martino	E
1863	3/82	Harris	L
1865	11/80	Harris	E
1866	12/85	Harris	L P=2.4 A=0.1
1902	4/87	Binzel	M
1915	3/81	Harris	L
1943	6/85	Weidensch	L A≥0.15
2017	5/87	Wisniewski	E P=3.0 A=0.5
2049	3/86	Wisniewski	M P=long
2060	12/86	Bus	E P=5.91 A=0.09
2085	2/84	Harris	M P=32? A=0.5
2201	6/83	Weidensch	M A≥0.8 P=long
2253	6/87	Wisniewski	M P=6
2382	3/86	Wisniewski	M P=long
2449	3/86	Wisniewski	M
2450	4/87	Binzel	M
2642	6/87	Wisniewski	M P=7.3 A=0.5
2663	1/85	Harvey	L V A>0.5
2697	11/83	Harris	L
2769	4/87	Binzel	M
2830	4/80	Harris	L
3102	9/81	Harris	E P=148. A=1.0
3103	8/86	Harris	E
	8/86	Barucci	M
	1/87	Wisniewski	E A=0.5
3169	5/86	Wisniewski	E P=6.3 A=0.7
3199	8/82	Harris	M
	8/84	Harris	E P=3.0 A=0.1
3288	3/82	Harris	E P=75 A=1.0
3361	5/86	Wisniewski	M P=3.4 A=0.4
80AA	1/80	Harris	E
81QA	9/81	Poutanen	L
82XB	12/82	Harris	M P=9.0 A=0.2
83RD	9/83	Harris	E P=4.93 A=0.15
84KD	6/84	Harris	L
85PA	9/85	Di Martino	M
86EB	3/87	Wisniewski	E
86RA	9/86	Harris	L
86TK	1/87	Wisniewski	M P=long

A FOUR-HOUR CLOSE APPROACH EPHEMERIS OF 2212 HEPHAISTOS

G. Roger Harvey
169 Woodland Drive
Concord, NC 28025 USA

(Received: 24 April Revised: 27 July)

At its close approach in December 1987, and January 1988, planet 2212 Hephaistos will develop a speed of three degrees per day across the sky. The four-hour ephemeris generated here, for Western Hemisphere observers, is to assist the interpolation of positions.

1987/8	ET	RA (1950.0)	Dec	Δ	r	M vis
Dec 20	9^h	$12^h23.97^m$	+24°18'	0.572	1.155	14.99
	13^h	12 25.27	+24 13	0.569	1.153	14.99
Dec 21	9^h	12 31.91	+23 47	0.558	1.140	14.95
	13^h	12 33.26	+23 41	0.556	1.138	14.94
Dec 22	9^h	12 40.13	+23 13	0.544	1.125	14.91
	13^h	12 41.54	+23 07	0.542	1.122	14.90
Dec 23	9^h	12 48.66	+22 36	0.531	1.109	14.86
	13^h	12 50.11	+22 29	0.529	1.107	14.86
Dec 24	9^h	12 57.47	+21 55	0.519	1.094	14.83
	13^h	12 58.97	+21 48	0.517	1.091	14.82
Dec 25	9^h	13 06.57	+21 11	0.507	1.078	14.80
	13^h	13 08.12	+21 03	0.505	1.076	14.79
Dec 26	9^h	13 15.96	+20 23	0.496	1.063	14.77
	13^h	13 17.56	+20 15	0.494	1.060	14.76
Dec 27	9^h	13 25.63	+19 31	0.486	1.047	14.74
	13^h	13 27.27	+19 22	0.484	1.044	14.74
Dec 28	9^h	13 35.56	+18 35	0.476	1.031	14.72
	13^h	13 37.26	+18 26	0.475	1.028	14.72
Dec 29	9^h	13 45.76	+17 36	0.468	1.015	14.71
	13^h	13 47.49	+17 25	0.466	1.012	14.71
Dec 30	9^h	13 56.18	+16 32	0.460	0.999	14.71
	13^h	13 57.95	+16 21	0.459	0.996	14.71
Dec 31	9^h	14 06.82	+15 24	0.453	0.983	14.71
	13^h	14 08.61	+15 12	0.452	0.980	14.71
Jan 1	9^h	14 17.64	+14 12	0.447	0.966	14.71
	13^h	14 19.47	+14 00	0.446	0.963	14.72
Jan 2	9^h	14 28.61	+12 56	0.442	0.950	14.73
	13^h	14 30.46	+12 43	0.441	0.947	14.73
Jan 3	9^h	14 39.69	+11 37	0.438	0.933	14.75
	13^h	14 41.57	+11 24	0.438	0.930	14.76
Jan 4	9^h	14 50.88	+10 16	0.436	0.917	14.79
	13^h	14 52.75	+10 02	0.435	0.914	14.79
Jan 5	9^h	15 02.09	+ 8 51	0.434	0.900	14.83
	13^h	15 03.98	+ 8 37	0.434	0.897	14.83
Jan 6	9^h	15 13.32	+ 7 25	0.433	0.883	14.83
	13^h	15 15.20	+ 7 10	0.433	0.880	14.88
Jan 7	9^h	15 24.52	+ 5 57	0.434	0.866	14.93
	13^h	15 26.41	+ 5 42	0.434	0.863	14.94
Jan 8	9^h	15 35.66	+ 4 28	0.436	0.849	14.99
	13^h	15 37.51	+ 4 13	0.436	0.846	15.00

PHOTOELECTRIC PHOTOMETRY OF ASTEROIDS 5 ASTRAEA AND 22 KALLIOPE

Frank J. Melillo
North Valley Stream Observatory
870 Franklin Avenue
N. Valley Stream, NY 11580

(Received: 20 July Revised: 10 August)

Photoelectric photometry observations of the asteroids 5 Astraea and 22 Kalliope were made from North Valley Stream Observatory in February 1987 and December 1986. Astraea and Kalliope displayed lightcurve amplitudes of 0.20 and 0.16 magnitude, respectively.

Observations

During the winter of 1986-87, the asteroids Astraea and Kalliope reached favorable oppositions on January 31, 1987 and December 3, 1986, respectively. Their predicted B magnitudes were 10.4 and 9.7. The photometric observations described here were made from North Valley Stream Observatory located on Long Island approximately 20 miles east of New York City.

The observations were made using an Optec SSP-3 Solid State photometer coupled to an 8-inch Schmidt-Cassegrain telescope with digital read-outs. Both asteroids were observed photoelectrically only in near-infrared light since the peak spectral response of this photometer is near 800 nm.

Observational circumstances for the two asteroids are given in Table I. The sky conditions were exceptionally clear since it was cold and dry. For 22 Kalliope on December 5, 14 photometric measurements were made. For 5 Astraea, 23 photometric measurements were made on February 19 and 10 more were obtained on the following night. During all three nights, approximately four measurements were obtained each hour with integration times of 10 minutes.

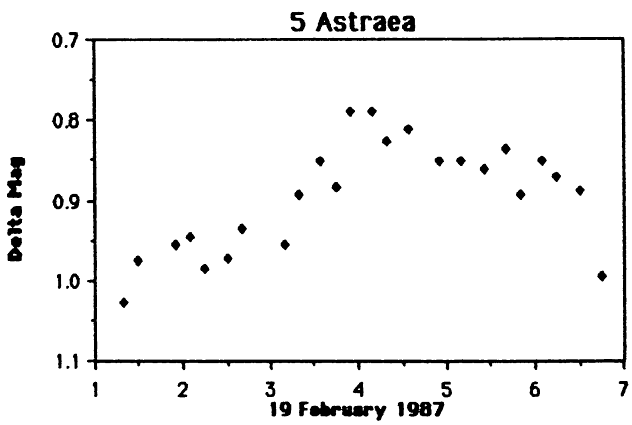
On December 5, Kalliope was 3/4 degree east of an 8.5 magnitude star which was used for comparison. On February 19 and 20, Astraea was 0.5 degree west-southwest of its 8.3 magnitude comparison star. The comparison stars were chosen to be in close proximity so as to minimize differential extinction effects.

Results

The photometric readings produced some partial lightcurves. Variations in these I lightcurves are nearly the same as the V lightcurves. However, these observations might be compared with previous V lightcurves to see whether any albedo variations between V and I occur.

5 Astraea. Astraea is listed by Bowell et al. (1979) as an S-type asteroid with a diameter of 113 km. This

past opposition was the closest in 40 years. Unfortunately, Astraea's opposition took place in the mid-winter which is the coldest time of the year. The observations were a little bit difficult but the readings were accurate enough to produce nice looking lightcurves. Astraea's rotation period is known to be 16.8 hours. On February 19, the maximum readings were at approximately 4:30 UT. Then on the following evening, a maximum occurred near 5:30 UT. This is consistent with the 16.8 hour rotation period assuming 1.5 cycles elapsed in this interval. Astraea displayed an amplitude of 0.20 ± 0.02 magnitude. This is one of the lowest amplitudes recorded for this asteroid.



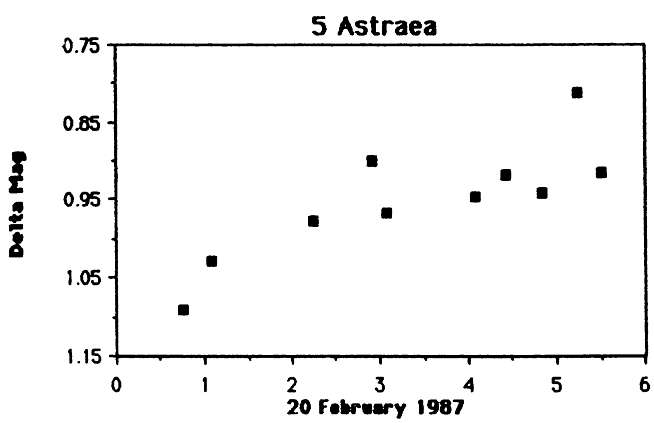


Figure 1. Near-infrared lightcurves of 5 Astraea in February 1987.

22 Kalliope. Kalliope is listed by Bowell et al. (1979) as an M-type asteroid with a diameter of 175 km. The rotation period is well known to be 4.14 hours. Kalliope was monitored only on one night for about 4 hours and shows a nearly complete lightcurve with two maxima and two minima which is consistent with its published period. Kalliope showed an amplitude of 0.16 ± 0.01 magnitude, which is also near its lowest reported value. Kalliope's polar axis was probably more directed towards the earth and this explains its low amplitude.

References

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. Ariz. Press, Tucson.

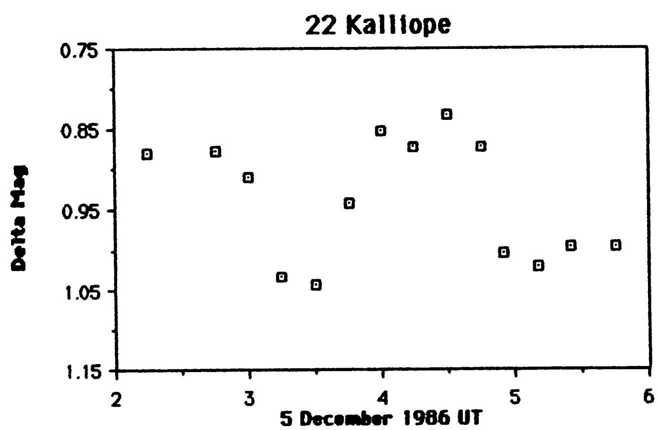


Figure 2. Near-infrared lightcurve of 22 Kalliope in December 1986.

Table I
Asteroid Aspect Data

Asteroid	Date (UT)	(1950) R.A.	(1950) Dec.	Ecliptic Long.	Ecliptic Lat.	r (AU)	Δ (AU)	Phase Angle
(5) Astraea	2/19/87	$8^h\ 38^m$	17°50'	127.3°	-0.6°	2.08	1.13	10.22
	2/20/87	$8^h\ 37^m$	17°56'	127.1°	-0.5°	2.08	1.14	10.74
(22) Kalliope	12/5/86	$4^h\ 36^m$	24°12'	71.0°	2.1°	2.62	1.64	0.88

PHOTOELECTRIC PHOTOMETRY OPPORTUNITIES NOVEMBER-JANUARY

Alan W. Harris
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91109

Vincenzo Zappalá
Observatorio Astronomico di Torino
10025 Pino Torinese
Italy

The table below lists asteroids which come to opposition during the months of November through January that 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 pole determinations (see the article by Di Martino and Zappalá in issue 12, No. 1), are targets for radar observations (see the article by Ostro in *MPB* 10, No. 4), or are subjects for shape modelling (see the article by Davis and Binzel in *MPB* 14, No. 3). The table gives (in order of opposition dates) the asteroid number and name, opposition date, opposition B magnitude (the V magnitude is about 0.8 brighter), 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, POL indicates the asteroid is a pole position candidate, RAD indicates the asteroid is a planned radar target, and MOD denotes an asteroid at a critical longitude for shape modelling. 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* (see the review by Tholen in *MPB* 11, No. 4). Ephemerides for all of the asteroids in the table are included in this issue. Some of these may appear on finding charts in *Tonight's Asteroids* prepared by Mr. Joseph F. Flowers, Route 4 Box 446, Wilson, NC 27893, USA. These charts are free for a self-addressed stamped envelope.

Asteroid	Opp'n Date	Opp'n B Mag	Per	Amp	
266 Aline	Nov 4	12.5	?	?	PER
106 Dione	Nov 23	12.0	?	?	PER
20 Massalia	Dec 2	9.8	8.098	0.2	RAD
88 Thisbe	Dec 18	12.4	6.042	0.2	MOD+PHA
654 Zelinda	Dec 25	11.1	31.9	0.3	RAD

Photoelectric Photometry Opportunities

DATE	R.A. (1950) HR	MIN	DEC. DEG	MIN	MAG V	PHASE ANGLE
Minor Planet 20 Massalia						
1987 Oct 27	4	55.82	+22	01.8	9.56	18.4
Nov 6	4	52.48	+21	50.8	9.29	14.2
16	4	45.76	+21	33.8	9.01	9.3
26	4	36.46	+21	11.2	8.70	3.7
Dec 6	4	26.01	+20	45.2	8.59	2.2
16	4	16.12	+20	19.4	8.87	8.0
26	4	08.38	+19	58.5	9.12	13.3
1988 Jan 5	4	03.88	+19	46.7	9.36	17.9
15	4	03.08	+19	45.7	9.59	21.6
Minor Planet 88 Thisbe						
1987 Nov 6	6	12.93	+25	34.9	11.99	14.9
16	6	08.75	+25	28.7	11.82	12.1
26	6	02.05	+25	20.4	11.63	8.8
Dec 6	5	53.36	+25	08.8	11.44	5.1
16	5	43.51	+24	53.1	11.19	1.2
26	5	33.56	+24	33.7	11.35	3.0
1988 Jan 5	5	24.55	+24	12.0	11.60	6.7
15	5	17.35	+23	50.4	11.83	10.1
25	5	12.49	+23	30.8	12.04	13.0
Minor Planet 106 Dione						
1987 Oct 17	4	17.24	+20	00.7	11.58	15.2
27	4	13.30	+20	05.9	11.38	11.8
Nov 6	4	06.88	+20	06.2	11.16	7.8
16	3	58.68	+20	02.0	10.92	3.4
26	3	49.71	+19	54.8	10.77	1.2
Dec 6	3	41.16	+19	47.0	11.10	5.6
16	3	34.10	+19	41.6	11.36	9.7
26	3	29.30	+19	41.4	11.60	13.2
1988 Jan 5	3	27.17	+19	48.3	11.82	16.1
Minor Planet 266 Aline						
1987 Sep 27	2	48.38	+25	38.9	12.24	17.6
Oct 7	2	45.50	+24	52.8	12.02	14.0
17	2	40.03	+23	43.2	11.78	9.7
27	2	32.75	+22	12.2	11.53	5.2
Nov 6	2	24.81	+20	26.2	11.37	2.5
16	2	17.48	+18	34.6	11.61	6.2
26	2	11.85	+16	48.5	11.89	10.6
Dec 6	2	08.67	+15	16.9	12.15	14.6
16	2	08.26	+14	05.2	12.39	17.9
Minor Planet 654 Zelinda						
1987 Nov 16	6	40.36	+34	58.3	11.29	22.1
26	6	37.77	+33	44.3	10.94	18.0
Dec 6	6	30.47	+32	05.9	10.55	12.9
16	6	19.30	+29	58.8	10.12	6.8
26	6	06.11	+27	24.6	9.74	2.3
1988 Jan 5	5	53.34	+24	33.3	10.06	7.9
15	5	43.28	+21	41.2	10.39	14.4
25	5	37.35	+19	03.9	10.70	20.2
Feb 4	5	36.08	+16	50.3	10.99	24.9

ASTEROID NEWS NOTES

David J. Tholen
Institute for Astronomy
University of Hawaii
Honolulu, HI 96822

Forty-seven New Asteroids

Through the August batch of Minor Planet Circulars, 47 asteroids were newly numbered, bringing the total to 3677. Non-main-belt objects include:

(3635) 1981 WO1	Mars crosser/Hungaria
(3655) 1978 SA3	Hilda
(3671) 1984 KD	Apollo
(3674) 1963 RH	Mars crosser
(3675) 1982 YP1	Cybele

Earth-approaching Asteroid Update

The dry spell noted in the last issue of the *MPB* was broken shortly after that issue went to press. 1987 KF was discovered by C. S. and E. M. Shoemaker at Palomar on 0.46-m Schmidt plates taken May 29. The object is of the Apollo variety.

A month later, C. S. Shoemaker found another fast-moving object on a Palomar 0.46-m Schmidt plate taken by E. M. Shoemaker and H. Holt on June 24. The object was designated 1987 MB. After additional observations became available, however, an orbit solution suggested that 1987 MB might be the same object as 1959 LM, a lost Apollo asteroid. A single orbit solution was able to satisfy all the observations of both objects, so 1987 MB and 1959 LM are one and the same.

New Asteroid Names

The July batch of Minor Planet Circulars included new names for a whopping 43 asteroids. The highest numbered object that is also named is now (3607) Naniwa. Celestial mechanics whiz E. Myles Standish (JPL) was honored with the naming of (3420) Standish. And as for (3403) Tammy, no, it was not named after Tammy Bakker; rather it was named after the wife of R. L. Irelan, the principal night assistant at Lincoln Laboratory's Observatory in New Mexico.

(944) Hidalgo and the Mass of Saturn - A Historical Note

In a 1970 paper for the Astronomical Journal, Brian Marsden investigated the relationship between comets and minor planets, a project that, in part, involved a study of the orbit of (944) Hidalgo, a Jupiter-crossing asteroid with a distinctly comet-like orbit. A purely gravitational orbit solution yielded a mean residual of 1.95 arcsec, but the individual residuals did seem to show some systematic trends. An orbit solution that included non-gravitational forces (of the variety that have been demonstrated to exist for a number of comets) showed a mean residual of only 1.36 arcsec, a number more consistent with what is possible given modern astrometric data. Thus the latter orbit solution, and the identification of (944) Hidalgo as a not-quite-extinct comet, seemed to be favored.

Enter P. Herget and W. Klepczynski, who suggested that the systematic residuals might be due to an error in the mass of Saturn. At the time of Marsden's work, the adopted mass for Saturn was 1/3501.6 solar masses. He slowly adjusted the mass of Saturn in his orbit solution for Hidalgo, and indeed the mean residual did decrease as the mass of Saturn was increased. The minimum mean residual of 1.24 arcsec was achieved when the mass for Saturn was increased to 1/3498.5 solar masses.

Of course, today we have the Voyager spacecraft flybys to accurately determine the mass of Saturn. So how does our new value compare with the 1970 value? The mass given in the book *Saturn* (p. 942, 1984, Arizona Space Sciences Series) works out to be 1/3497.0 solar masses (which gave Marsden a mean residual of 1.44 arcsec). The inclusion of Titan makes the total mass 1/3496.2 solar masses, which is slightly outside the range of masses for which Marsden tabulated mean residuals, but still closer to the mass that gave the smallest mean residual than the 1970 value for Saturn's mass.

Interestingly, the mass of Saturn adopted by the IAU for its 1976 System of Astronomical Constants is 1/3498.5 solar masses. The value adopted for the JPL solar system ephemeris designated DE200/LE200 is 1/3498.0 solar masses. The latter is very close to and the former is the value that yielded the smallest mean residual for Hidalgo's orbit solution.

And, of course, Hidalgo has made another perihelion passage since Marsden's 1970 work. The modern orbit solution for Hidalgo is due to W. Landgraf (1982, MPC 7448). It includes 210 observations made between 1920 and 1978, and the mean residual is now only 0.8 arcsec. (Marsden had less than half that amount of data to work with, covering only 1920 to 1964.) Hidalgo is due back at perihelion again in 1991.

[A line was omitted from "Asteroid News Notes" in *MPB* 14, 37. The last sentence of the first paragraph should read:

> Although it may not be obvious to some amateurs, professionals are painfully aware that the 1979 "Asteroids" book has now become obsolete!]