

THE MINOR PLANET BULLETIN

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

VOLUME 13, NUMBER 4, A.D. 1986 OCTOBER-DECEMBER

37.

MINOR PLANET AND DEEP SKY OBJECT APPULSES JANUARY-MARCH 1987

Basil H. Rowe
5320 Miami Road
Cincinnati, Ohio 45243

(Received: 21 July Revised: 14 August)

A list of minor planet appulses with deep sky objects is presented for astrophotographers and deep sky observers seeking a truly unique photograph or observation. To allow easier identification and to keep the list short, only minor planets brighter than 11.5 visual magnitude are considered. The chosen minimum separation was one degree.

This list has been compiled by a manual search of ephemerides of minor planets coming into opposition in late 1986 and early 1987. After a possible event was found, orbital elements in the 1986 *Ephemerides of Minor Planets* (henceforth referred to as *EMP*) were used with a computer program I wrote for a Radio Shack TRS-80 Model I to produce geocentric ephemerides generally accurate to ± 1 arc minute. The time of closest approach was then refined to the nearest quarter day.

All positions should be close to those generated using the unpublished (as of this writing in mid-July) 1987 orbital elements. The list may not be complete, but should provide enough opportunities to all observers. A more complete list for the rest of 1987 will be published after a search of the 1987 *EMP*.

Observers may want to sketch the field around the deep sky object a week or two before the event and then identify the minor planet, as the object not on your chart, passing through the field. Astrophotographers may want to use my computer program in the February 1986 *Sky and Telescope* (p. 190) to calculate the exposure time necessary to produce a photo showing one "star" that obviously moved during the exposure. (I would love a copy of such a photo!)

—Summary of appulse criteria for inclusion in the Table:

- 1) The minor planet must be brighter than 11.5 visual magnitude.
- 2) Deep sky objects must be plotted on A. Becvar's *Atlas Coeli 1950* or W. Tiron's *Sky Atlas 2000*.
- 3) The minimum angular separation must at some time be less than one degree.
- 4) The event should take place more than 90 degrees from the Sun, preferably near opposition.
- 5) Any event involving a previously listed minor planet and nearby naked eye stars should also be listed.

—The columns in the Table represent the following information:

- 1) The U.T. date of closest approach, accurate to ± 3 hours (except events on Jan. 10, Jan. 11 (354 Eleonora), Feb. 28 (both), Mar. 19, and Mar. 23 which should be accurate to ± 90 minutes). All subsequent data pertain to this time.
- 2) The minor planet name.
- 3) The deep sky object (or star). NGC number if no letter prefix.
- 4) The type of deep sky object. OC=open cluster, GX=galaxy, GC=globular cluster, BN=bright nebula, PN=planetary nebula, S=star, MS=multiple star.
- 5) The angular separation in degrees, accurate to ± 1 arc minute.
- 6) The minor planets' apparent daily motion in degrees per day.
- 7) The position angle of the minor planets' motion, measured eastward from north. A + sign means add 90 degrees to obtain the position angle (measured from the deep sky object to the minor planet) of closest approach. A - sign means subtract 90 degrees from the position angle.
- 8) The illuminated percentage of the Moon. A + sign means waxing; - means waning.
- 9) The elongation of the Moon in degrees. An asterisk means Moonlight should interfere.
- 10) The minor planets' approximate visual magnitude (V). Based on B(1,0) and methods in the 1986 *EMP* and accounting for the phase effect, but not for the opposition effect. 0.8 magnitude was then subtracted from all B magnitudes to product the V magnitudes.
- 11) The deep sky objects' visual magnitude from *Burnhams Celestial Handbook*. Bright nebula magnitudes are for the brightest associated star. Multiple star magnitudes are for the brightest component only.
- 12) The elongation of the Sun in degrees.

-Notes to events, listed by date:

Jan 8.00 16 Psyche is moving very slowly, near the end of direct motion.
 Jan 10.13 11 Parthenope will pass between Nu and 16 Geminorum.
 Feb 3.25 Consists of open cluster NGC 2175 and the faint emission nebula NGC 2174.
 Feb 3.75 This is the first of several favorable appulses of 354 Eleonora as it passes near the center of the Virgo galaxy cluster. Only very close appulses are listed (<0.3 degrees). Moonlight will interfere from approximately Jan. 10-24, Feb. 7-21, and from Mar. 9-20.
 Feb 18.75 22 Kalliope will pass almost exactly in between the two objects.
 Feb 24.25 (and May 23.75) 532 Herculina first passes west of NGC 5172 heading almost due north,

then almost exactly three months later it passes east of NGC 4635 heading almost due south; both at the same rate of 0.18 degrees per day. Also, the Moon is at nearly the same phase on both nights!

Feb 28.75 354 Eleonora should appear superimposed on NGC 4298, however the minimum separation is less than the accuracy of my computer program.

Mar 20.50 A small reflection nebula around the star 12 Geminorum.

Mar 29.75 5 Astraea will pass through the southern part of the Praesepe cluster and should prove challenging to follow from night to night.

I would like to thank Frederick Pilcher for preparing ephemerides of selected minor planets coming to opposition in early 1987.

TABLE I

1987	DATE	PLANET	OBJECT	TYPE	SEP	MOTION °/DY PA	MOON % EL	PMAG	OMAG	SUN
JAN	5.25	4 Vesta	245	GX	0.97	0.28 56+	32- 17	7.9	12.9	86
JAN	8.00	16 Psyche	3611	GX	0.69	0.01 19-	60+ 139	11.0	12.6	120
JAN	10.13	11 Parthenope	Nu Gem	MS	0.05	0.24 280+	79+ 43	10.3	4.2	167
JAN	11.25	11 Parthenope	16 Gem	S	0.19	0.24 280-	87+ 29	10.3	6.1	166
JAN	11.25	354 Eleonora	4215	GX	0.05	0.20 65-	87+ 112*	10.6	12.8	109
JAN	19.00	79 Eurynome	3169	GX	0.27	0.15 284+	86- 12*	11.4	11.4	144
JAN	19.50	79 Eurynome	3166	GX	0.32	0.15 285+	83- 16*	11.4	11.5	144
FEB	3.25	11 Parthenope	2174-5	OC	0.78	0.11 289+	26+ 77	10.7	6.8	138
FEB	3.75	354 Eleonora	4424	GX	0.29	0.18 12-	31+ 157	10.2	12.5	131
FEB	4.50	354 Eleonora	4417	GX	0.16	0.18 10-	38+ 148	10.2	12.2	132
FEB	14.00	19 Fortuna	PK171-25.1	PN	0.75	0.30 78+	99- 86*	11.2	13.9	95
FEB	18.75	22 Kalliope	52 Tau	MS	0.42	0.19 74-	75- 142	10.9	5.0	98
FEB	18.75	22 Kalliope	IC 359	BN	0.48	0.19 74+	75- 142	10.9	12.0	98
FEB	19.75	354 Eleonora	4388	GX	0.21	0.23 342-	67- 42*	9.9	12.0	147
FEB	20.50	354 Eleonora	M 84	GX	0.13	0.23 341-	60- 52	9.9	10.5	148
FEB	24.25	532 Herculina	5172	GX	0.40	0.18 4-	19- 92	9.2	12.5	136
FEB	28.63	354 Eleonora	4302	GX	0.04	0.25 332-	1+ 162	9.8	12.9	155
FEB	28.75	354 Eleonora	4298	GX	0.01	0.25 332	1+ 163	9.8	11.9	156
MAR	12.25	11 Parthenope	Eta Gem	MS	0.15	0.14 81+	89+ 40	11.4	3.3	102
MAR	13.75	511 Davida	5230	GX	0.15	0.18 313+	97+ 48*	11.1	12.9	148
MAR	15.50	11 Parthenope	IC 443	BN	0.36	0.16 83+	99+ 80*	11.4	8.8	99
MAR	19.25	354 Eleonora	4147	GC	0.06	0.25 316-	85- 52*	9.8	11.0	162
MAR	20.50	11 Parthenope	IC 444	BN	0.75	0.18 85+	74- 146	11.5	7.5	95
MAR	23.13	11 Parthenope	Mu Gem	MS	0.05	0.20 86-	45- 174	11.5	2.9	93
MAR	29.75	5 Astraea	M 44	OC	0.18	0.14 89+	0+ 116	10.2	3.1	119
MAY	23.75	532 Herculina	4635	GX	0.87	0.18 171-	15- 153	9.6	13.0	117

A BIBLIOGRAPHY OF MINOR PLANET BOOKS

Clifford J. Cunningham
Dance Hill Observatory
250 Frederick Street
Kitchener, Ontario
Canada N2H2N1

(Received: 21 July Revised: 22 August)

A comprehensive list of books devoted primarily or exclusively to asteroids is given, along with a further selection of books that devote a chapter or section to the subject. Both English and foreign sources are included.

Introduction

Despite having been observed and written about in scientific papers since 1801, asteroids have generally been given short shrift in books. A selection of references of minor planet names and history was given by LoGuirato (1981), but apparently no comprehensive bibliography of minor planet books has ever been published. What follows is such a comprehensive listing: 22 books from 1888 to 1986 that are devoted largely or exclusively to asteroids are noted, along with a sampling of 27 other books containing some asteroid material. Sources in English, Russian, German and Italian are considered. Wherever possible, data includes author, publisher, date and number of pages. A capsule description following this usually includes a grading system ranging from young reader through amateur, advanced, and professional level.

Books devoted largely or exclusively to asteroids:

Kirkwood, Daniel (1888). *The Asteroids*. J. B. Lippincott Co.; 60 pages. First book ever written on asteroids, by the man whose name is associated with the gaps in the asteroid belt. Amateur level.

Leuschner, Armin O. (1910). *Tables of Minor Planets Discovered by James C. Watson*. National Academy of Sciences Vol. 10, 7th Memoir.

Williams, Kenneth P. (1934). *The Calculation of the Orbits of Asteroids and Comets*. Principia Press Inc., Indiana; 214 pages. Classic work on celestial mechanics. Professional level.

Komendatov, N. V. (1935). *On the Determination of the General Perturbations of the Minor Planets*. United Scientific & Technical Publishing House, Moscow; 75 pages. Mathematical treatise on celestial mechanics. Professional level.

McDonald, Sophia L. and Leuschner, Armin O. (1952). *Tables of General Perturbations for a Group of Minor Planets*. Berkeley; 210 pages. Professional level.

Putilin, I. I. (1953). *Minor Planets*. Technical-Theoretical Institute, Moscow; 412 pages. An excellent book in Russian, largely devoted to orbital work but containing a wealth of historical data. Professional level.

Krinnov, E. L. (1956). *Dwarf Planets*. State Publication of Technical-Theoretical Literature, Moscow; 31 pages. A brief popular review, in Russian.

Roth, Gunter (1962). *The System of Minor Planets*. Faber & Faber Ltd., London; 128 pages. Written largely from a European perspective for the advanced amateur; well done, with a particularly good historical section.

Knight, David C. (1973). *The Tiny Planets*. William Morrow & Co., N.Y.; 95 pages. An excellent book for the young reader; includes a glossary.

Gehrels, Tom (editor) (1971). *Physical Studies of Minor Planets*. U.S. Govt. Printing Office; 687 pages. Proceedings of the first Tucson asteroid conference. Professional level.

Pilcher, Frederick & Meeus, Jean (1973). *Tables of Minor Planets*. Privately published; 104 pages. An important compilation of facts and figures about asteroids.

Cristescu, Cornelia, Klepczynski, W. J., & Millet, B. (eds.) (1974). *Asteroids, Comets, Meteoric Matter*. Colloquium of the International Astronomical Union; 350 pages. A professional review concentrating on celestial mechanics. Partially in French.

Nourse, Alan E. (1975). *The Asteroids*. Franklin Watts Pub., N.Y.; 59 pages. Excellent introduction for the young reader.

Morrison, David & Wells, William (eds.) (1978). *Asteroids: An Exploration Assessment*. NASA Conf. Pub 2053; 300 pages. Deals mainly with meteorites, mineralogy, and space missions to the asteroids. Professional level.

Gehrels, Tom (ed.) (1979). *Asteroids*. Univ. of Arizona Press; 1181 pages. The largest and most comprehensive work ever published on minor planets, it includes the complete TRIAD file. Professional level.

MIT Students System Project (1979). *Project Icarus*. MIT Press; 162 pages. Not about asteroids *per se*, it describes a hypothetical space mission to prevent the asteroid Icarus from colliding with Earth. Professional level.

Silver, Leon T. & Schultz, Peter H. (eds.) (1982). *Geological Implications of Impacts of Large Asteroids and Comets on the Earth*. Special Paper 190, The Geological Society of America; 528 pages. A professional review, based on papers presented at a meeting in Snowbird, Utah in 1981.

Farinella, P., Paolicchi, P. & Zappala, V. (1983). *Gli Asteroidi (The Asteroids)*. Il Castello Collane Tecnica, Milan, Italy; 127 pages. Volume 1 in a series of astronomy books in Italian for the amateur.

Lagerkvist, C.-I. & Rickman, H. (eds.) (1983). *Asteroids Comets Meteors*. Uppsala University, Sweden; 455 pages. Recent European asteroid research is presented in 200 pages of this excellent book. Professional level.

Lagerkvist, C.-I. & Rickman, H. (eds.) (1985). *Asteroids Comets Meteors II*. Uppsala University, Sweden; 620 pages. Another 197 pages of the latest professional research on asteroids in both Europe and North America.

Kessler, J., Grun, E., and Sehnal, L. (eds.) (1985). *Space Debris, Asteroids and Satellite Orbits*. Pergamon Press; 229 pages. Proceedings of two workshops and the COSPAR Commission P meeting, held in June-July, 1984. Professional level.