Occultation Newsletter

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FROM THE PUBLISHER

For subscription purposes, this is the third issue of 1981.

Please note the new subscription and membership rates spelled out in the paragraph at the top of the second column, on this page. Air mail shipment of *o.N.* subscriptions remains at $1.80/year extra, outside the U.S.A., Canada, and Mexico. Back issues still are priced at $1.00 per issue, but this probably will be changed in the near future.

European and U. K. observers should join IOTA/ES, sending DM 12.-- to Hans J. Bode, Bartold-Knaust Str. 8, 3000 Hannover 91, German Federal Republic.

IOTA NEWS

David W. Dunham

I am starting to write this only a few hours before departing for Somalia to observe the occultation of Nunki by Venus on November 17, so my written contributions for this issue necessarily are brief. We will need to produce the next issue in December; it will include details about the total eclipse of the moon on January 9, 1982, visible from the Eastern Hemisphere. Of the three total lunar eclipses of 1982, the richest star field is traversed on January 9. The 3.5-magnitude star δ Geminorum (Wasat = Z.C. 1110) will be occulted during totality in southeastern Asia and northwestern Australia; it is the brightest star to be occulted during a total lunar eclipse until 1985. The northern limit lies about 100 km northeast of Manila, Philippines, while the southern limit crosses Australian desert areas. It could be the first occultation wherein grazes are observed at both the north and south limbs, which would be valuable for accurately determining the moon's polar radius. I plan to distribute detailed predictions of occultations of Astrographic Catalog stars down to about 12th magnitude during the eclipse; especially if you have not received such predictions (J or M catalog) from me before and are in the Eastern Hemisphere, you should request these predictions and send me accurate geographical coordinates of your observing site. My address has changed, but only because our post office has moved to a new building. It is now: P. O. Box 7488, Silver Spring, MD 20907, U.S.A. This is the same as before, except that 7000 has been added to the box number. Reports of grazes and asteroidal occultations or close approaches should be sent to the new address.

John Phelps reports that inflation finally has caught up with us. Increased costs, especially those caused by the two postal rate increases this year and the fact that *o.N.* now is amounting to about 60 pages per year rather than 40, makes it necessary for us to raise our dues substantially, or we will be in trouble with our finances by the middle of next year. Effective after the publica- of *this* issue (Number 13), IOTA annual dues will be increased to $11.00 for North Americans, and $16.00 for others. Separate subscriptions to *o.N.* will cost $5.50, with an additional amount for overseas airmail. We are sorry that these increases are necessary, but we can not keep going at the original 1975 IOTA rates.

Those who have expressed an opinion have been favorably disposed to the idea of incorporation, so we are starting the procedure to incorporate in the State of Illinois. As soon as that is accomplished, we will apply for tax-exempt status as an educational organization.

Besides this article, my only other one for this issue will be the start of the article on predictions of planetary and asteroidal occultations during 1982. Observational details of asteroidal and lunar grazing occultations, and double stars, will be delayed to issue number 15, early in 1982. I will mention briefly that three asteroidal occultations have been observed since the last issue, though in each case, coverage was so poor that a reliable diameter determination will not be possible. Unfortunately, most of the paths shifted away from populous parts of North America, according to astrometry mainly by Klemola at Lick Observatory. The occultation by (18) Melpomene on August 7 was observed by David Herald at Mt. Stromlo Observatory in Australia, and at two telescopes on Mauna Kea, Hawaii. The depths of these photoelectric records were not as much as expected, indicating that perhaps only one component of a close double was occulted. A visual observer on Oahu, about 400 km from the path, timed an 18-second occultation using a 13-inch reflector. Although the magnitude drop was small, the altitude was high and the seeing very good. The observation indicates a separation of the stellar components of about 1''.2, for SAO 145972. On October 5, an occultation by (105) Artemis was recorded at Sutherland, South Africa, after being telephoned by Gordon Taylor, who just recently had obtained a plate of the approaching objects, only a few hours before.

There was about a 0''.75 southward shift for the occultation by (88) Thisbe on October 7, which was predicted to about one radius accuracy from measurements of a plate taken at the U. S. Naval Observatory at Flagstaff, AZ, the night before. About a dozen observations were made of the occultation, mainly by observers in the Denver and Minneapolis areas close to the center of the actual path; the longest durations were 11 seconds, about 10% greater than expected. Paul Maley and James Fox traveled well north of the others to obtain valuable northern chords, but no data were obtained on the southern half of Thisbe, which leaves its shape poorly determined, rather similar to the situation for the occultation by (78) Diana on 1980 September 4. An interesting trailed photograph obtained at the Barnard Observatory in Golden, Colorado, shows the occultation; it probably will be published in the January issue of *Sky and Telescope*.

Alan Fiala and Robert Bolster recorded ten events during the grazing occultation of 6.8-mag. ZC 796 at Stormont, VA, on September 20. They used the same video camera that Alan used during the graze of δ Cancri last May (p. 167 of the last issue) and the 14-inch Schmidt-Cassegrain owned by the National Capital Astronomers. The star was near the limits of detectibility with the video system; six other visual observers timed the graze. Mark Trueblood used a similar camera, which I recently purchased, with his video recorder and 8-inch Schmidt-Cass at a location about a kilometer farther north, where a miss occurred. The star was only faintly visible on the monitor, and almost impossible to record. Video suffers from the same contrast problems that plague visual observers during gibbous-phase grazes, and stars of similar brightness to ZC 796 probably could be recorded easily when the moon is a thin crescent. A week later, Mark Trueblood and I set up the same equipment on a moonless night. We got a reasonably good signal from 7th-magnitude stars, and could just barely detect 8th-magnitude stars. The R.C.A. TC 2055 Ultracon costs less than the price we mentioned in the last issue. Prices vary, with the lowest around $700 for the camera. Most video stores do not have it in stock, and have to wait 30 to 45 days to get one from the factory in Lancaster, PA. A good portable video recorder-player is in the same price range.

Studies of the orbital elements of some of the asteroids involved in 1982 occultations (see article starting next column) have shown that the Herget data for (386) Siegena are much better than those in the E.M.P.'s. Consequently, for the occultation on 1981 Nov. 22, the primary's path will miss the earth's surface, while the occultation of the 9.7-magnitude secondary probably will cross the U.K. and parts of western Europe. Unfortunately, both Gordon Taylor and I still will be in Africa for the occultation of Nunki by Venus, so that we will not be available to compute an astrometric improvement of the prediction.

A CORRECTION TO THE 1977 TOTAL OCCULTATION TALLY

Joseph E. Carroll

The 1977 occultation tally (*O.N. 2* (12), 156 ff.) contained an error which deprived N. P. Wieth-Knudsen of the number one position for individual observers. He is, as I have found out, a single observer and he has always been. Therefore, the "ET AL" which appears after his name should be deleted in the referenced tally.

Dr. Wieth-Knudsen is thus the leading lone observer for 1977, and, in fact, has also been among the top ten (tops of pp. 158-9) observers for the last several years (and continues to be thru 1980 according to the data on hand so far).

Also, I have spelled his name wrong. I thus very much apologize for these errors and hope that this correction will be noted by all interested parties.

PLANETARY OCCULTATION PREDICTIONS FOR 1982

David W. Dunham

Predictions of occultations of stars by major and minor planets during 1982 are given in two tables. They are like the tables for the 1981 events; see *O.N. 2* (10) 115-118.

Most of the events in the table were found by Gordon Taylor at the Royal Greenwich Observatory and published in his Bulletin 26 of the I.A.U. Commission 20's Working Group on Predictions of Occultations by Satellites and Minor Planets. Derek Wallentinsen, comparing the SAO catalog manually with astrometric ephemerides supplied by me, independently found many of these events and published predictions of them earlier in *Contribution* No. 2 of the James-Mims Observatory; the events on the following 1982 dates were not in Taylor's list: Mar. 9, Mar. 19, June 5, and Oct. 27. The events involving Pallas on Mar. 21, Juno on June 11, and (10) Hygiea on Dec. 6 were not in Taylor's Bulletin 26, but were listed in his article about occultations by the four largest minor planets during this decade in *Astron. J. 86*, p. 903. Drs. L. Wasserman, E. Bowell, and R. Millis at Lowell Observatory have made computer comparisons of ephemerides of 89 asteroids, mostly those larger than 150 km in diameter, with the AGK3 and SAO catalogs to find the following events not in Taylor's lists, or Wallentinsen's: Mar. 3, Mar. 20 (Bettina), April 29, June 4, June 29, and July 14 (both events). The Lowell astronomers have submitted their results for both 1982 and 1983 to the *Astronomical Journal*, which plans to publish them in the 1981 December issue. They asked Brian Marsden to check the orbital elements published in the *Ephemerides of Minor Planets for 1980* (E.M.P. 80) by comparison with recent observations, for the asteroids they were considering. About ten of the orbits were quite poor, so Marsden requested updated elements from Paul Herget in Cincinnati. Herget calculated them, Marsden found them to be much better than the elements in the E.M.P.'s, and the Lowell astronomers used them. Most of the Lowell events not found by Taylor involved the newly-improved orbits. Unfortunately, only a month after this work was done, Paul Herget passed away.

As was the case for the 1981 events, about half of the asteroidal ephemerides I use are computed from osculating orbital elements computed by Herget and published in the *Minor Planet Circulars* (M.P.C.'s). Most of the others were calculated at the Leningrad Institute of Theoretical Astronomy (I.T.A.) and published in the E.M.P.'s for 1980 or 1981. For many events, elements from both sources are available, so that I can make two separate predictions. For events on the following dates, the ephemerides differ by less than 0."4 and less than 2.5 minutes in time, smaller than the expected errors relative to the occulted stars: Jan. 21, Jan. 24, Mar. 24, Apr. 27, July 4, Aug. 29, Sept. 15, Sept. 21 (324), Oct. 7, Oct. 8, Nov. 18, and Dec. 13. Larger ephemeris differences are given in the final table, in the sense I.T.A. minus Herget, except for the noted cases. The value in the shift column gives the path differences in arc seconds measured perpendicular to the asteroid's geocentric motion; the letter following it tells which direction the occultation path will be displaced on the earth's surface from the

1982 DATE	UNIVERSAL TIME	PLANET NAME	PLANET m_v	PLANET Δ,AU	STAR SAO No	STAR m_v	STAR Sp	STAR R.A.(1950)	STAR Dec.	OCCULTATION Δm	OCCULTATION Dur	OCCULTATION df	OCCULTATION P	OCCULTATION Possible Area	El SUN	MOON El	MOON %Snl	MOON Up
Jan 2	19h47m	Adeona	13.5	2.94	165872	8.0	G5	23h43m.7	-13°39'	5.5	5s	12	31	n.w. Africa, Mediterranean	70°	17°	46+	all
Jan 5	16 22m-35m	Chiron	17.3	15.67		13.0		3 04.0	14 32	4.3	19	75	114	Asia, e. Africa; Europe?n	123	2	77+	all
Jan 11	20 09-21	Desiderata	13.1	2.45	42418	8.7	K0	8 29.3	43 48	4.4	9	18	24	Indonesia, s. Asia, Europe	155	29	94-	all
Jan 13	10 20-38	Panopaea	12.6	2.13	57881	8.7	K5	5 15.6	34 21	3.9	15	28	20	Pacific;Hawaii?n,Philippines?n	146	79	83-	e160°E
Jan 14	0 06	Patientia	12.5	3.12	120360	8.6	F2	14 12.1	2 44	4.0	14	18	16	Middle East, India	83	43	79-	all
Jan 21	15 54-60	Fides	12.2	2.56	158136	9.3	A5	13 42.1	-10 33	2.9	7	24	39	Japan; Hawaii?n	93	54	11-	e180°
Jan 24	8 32-47	Herculina	8.8	1.47		11.4	G0	8 52.6	26 56	0.1	18	19	10	nS.America,N.America,eSiberia	170	163	1-	none
Feb 8	0 19-28	Desiderata	13.2	2.49		10.7	F8	7 57.1	45 13	2.6	10	22	25	cen.Asia,n.Europe,neN.America	145	31	100+	all
Feb 14	20 20-30	Interamnia	11.3	2.42	137113	8.7	F8	9 43.7	-5 51	2.7	22	20	10	w. Australia?n; s. Africa	161	77	59-	e 35°E
Feb 18	18 06-18	Alauda	12.1	2.33		7.1	B9	9 19.2	-2 35	5.0	14	20	16	Australia?n; s. Africa?n	162	126	24-	e 85°E
Feb 22	10 27	Interamnia	11.3	2.43	137038	9.1	F2	9 37.4	-5 36	2.3	22	20	10	New Zealand?n; s.e.Australia?n	161	156	2-	none
Feb 25	19 11	Doris	12.7	3.17	159986	9.4	A2	16 31.7	-16 49	3.4	9	21	31	Indonesia	88	112	4+	none
Feb 28	16 16-52	Penelope	13.0	2.33		10.3	K5	7 17.8	18 01	2.8	31	66	23	Indonesia,seAsia,wUSSR,Lapland	129	68	26+	w 90°E
Mar 3	20 56-63	Bettina	12.1	2.37	58369	8.0	K5	5 40.1	38 20	4.1	18	26	16	Iberia?n; n.w.& central Africa	103	17	61+	all
Mar 9	14 33	Melpomene	10.4	2.42	110454	9.3	G0	2 14.8	5 17	1.4	3	7	24	central Asia	46	132	100+	all
Mar 15	20 08-19	Nemausa	10.7	1.47	140321	9.2	F2	15 03.6	-9 24	1.8	29	45	14	central Australia, New Guinea	128	18	68-	all
Mar 17	0 50-61	Vibilia	12.6	2.27		10.7	K0	12 03.3	7 03	2.0	9	19	25	S. Africa?n; n. S. America	173	80	56-	e 25°W
Mar 19	15 21	Eunomia	10.2	2.32	77304	9.0	K2	5 33.1	24 27	1.5	12	14	13	Mauritius?n	86	155	32-	none
Mar 20	7 32-47	Desiderata	13.6	2.85		10.2	F5	7 34.7	43 00	3.5	19	43	28	Canada, n.w. U.S.A.; Hawaii?w	108	158	26-	none
Mar 20	21 43-48	Bettina	12.3	2.59	58636	2.6	A0P	5 56.3	37 13	9.7	12	17	18	Caribbean?n,day; n. S. America	90	143	21-	none
Mar 21	15 05-15	Pallas	7.5	1.48		10.9	F0	13 22.8	10 49	.05	31	14	4	Midway, w.Aleutians, e.Siberia	157	118	16-	el75°W
Mar 23	05 35-40	Siegena	12.3	2.49		11.0	G5	6 56.4	6 46	1.6	14	21	18	Hawaii?n; Mexico, s.e. U.S.A.	102	127	6-	none
Mar 24	15 43	Bamberga	12.3	2.68	211211	10.2		19 18.7	-32 05	2.2	10	12	15	Hawaii?n	77	66	1-	none
Mar 30	17 17	Eunomia	10.3	2.48	77636	9.1	A0	5 48.2	23 55	1.5	11	13	14	southern Africa	78	8	33+	all
Apr 13	14 44	Eunomia	10.5	2.67	78094	7.4	K5	6 08.9	23 13	3.1	9	11	15	central and southeast Asia	69	169	76-	el12°E
Apr 18	20 14-34	Lucina	11.7	1.66		9.6	G5	12 37.1	17 14	2.2	17s	28	16	s. Asia, Middle East, n.Africa	147	140	28-	e 95°E
Apr 22	2 02-12	Uranus	5.5	18.02		10.3	M	16 05.7	-20 41	.29	47m	47	1	Africa, Europe, S. America	148	124	4-	e 40°E
Apr 27	17 34	Herculina	10.0	2.11	61101	9.2	G5	8 49.3	31 13	1.2	13s	17	14	central U.S.S.R., China	90	39	20+	w 85°E
Apr 29	6 37	Flora	10.9	2.35		11.5	F8	7 10.7	24 25	0.5	5s	10	21	Indonesia, New Guinea	68	6	36+	all
May 1	16 47-56	Uranus	5.5	17.94		9.9	G	16 04.2	-20 37	.13	42m	41	1	New Zealand, Australasia	158	97	63+	w125°E
May 17	16 34	Adelheid	13.2	2.26	141346	8.7	K2	16 42.8	-3 57	4.5	8s	20	27	Japan, Manchuria, Siberia	157	95	35-	el40°E
May 28	17 44	Fortuna	11.6	2.37	128460	9.2	G0	23 52.1	0 30	2.5	7	10	15	e. Australia; New Zealand?s	68	144	38+	none
May 28	18 16	Harmonia	11.5	2.20	99172	5.5	M2	10 29.5	14 24	6.0	6	16	27	w. & s. U.S.S.R., Himalayas	87	11	38+	w 85°E
Jun 4	15 36	Pandora	12.4	2.76	109635	9.3	F8	1 00.8	4 41	3.2	5	9	22	Samoa	57	145	96+	w165°W
Jun 5	3 52-76	Nysa	11.2	1.93	162993	8.3	F5	19 45.0	-18 32	3.0	11	45	41	s. Africa, Patagonia	139	58	98+	w 25°E
Jun 11	18 48	Juno	10.1	2.22	142233	9.1	G5	18 18.0	-4 53	1.4	20	22	12	Antarctica	157	46	78-	all
Jun 29	12 36	Loreley	13.1	3.21	92359	7.9	G5	1 15.7	18 19	5.2	9	14	20	Hawaii?n; California (sunrise)	73	165	63+	none
Jul 4	17 39	Pandora	12.2	2.43		11.3	K0	1 44.3	9 53	1.3	7	11	19	Philippines; Japan?n	74	123	98+	all
Jul 7	7 36	Melete	12.0	1.64	139812	8.3	K0	14 12.0	-5 06	3.7	17	31	17	Hawaii?s; w.U.S.A.?n; Mexico?n	108	83	99-	all
Jul 14	3 09-21	Palma	12.8	2.76	212479	9.5	K2	20 47.1	-33 10	3.4	12	21	20	central Africa, n. S. America	160	74	50-	e 50°W
Jul 14	17 45	Ino	12.1	2.31	110836	8.6	K2	2 52.6	6 02	3.5	5	10	20	Philippines?n; New Guinea?s	69	15	44-	all
Jul 18	10 09-26	Nysa	10.8	1.78	187802	9.3	K2	19 09.0	-20 20	1.7	5	21	38	s. Pacific, n. Australia	171	156	8-	none
Jul 27	21 23	Ino	12.0	2.18		11.1		3 15.4	6 19	1.3	6	11	19	w. Australia	76	166	51+	none
Jul 28	22 34-42	Myrrha	12.4	1.94	163787	8.2	G0	20 38.0	-18 58	4.2	12	22	19	w. Indonesia; s. Africa?n	178	78	62+	w 45°E
Jul 30	14 25-30	Cybele	12.4	2.98	139825	9.3	K2	14 13.5	-9 35	3.2	18	19	14	India?n;Indonesia?n;wAustrl?s	88	34	76+	all
Aug 1	2 02	Aspasia	12.9	3.22		11.4	K0	4 50.0	23 24	1.7	6	11	24	s. Africa?n	54	168	87+	w 40°E
Aug 11	3 00	Chicago	13.9	3.91	139729	8.4	G0	14 02.7	-7 45	5.5	8	17	29	n. Chile; Mexico?n	74	179	65-	none
Aug 29	7 57-72	Mnemosyne	11.4	2.05	127592	8.8	K0	22 30.3	6 20	2.7	9	22	26	s.Florida,s.Mexico,New Zealand	164	65	76+	w 95°W
Sep 5	13 30	Prokne	11.2	1.60		11.0	G0	3 16.9	-0 20	0.8	18	23	12	Pacific Ocean; Hawaii?n	114	41	95-	all
Sep 15	11 08	Europa	11.7	3.11	96932	8.5	G5	7 26.2	17 54	3.2	9	11	15	n.w. U.S.A., s. central Canada	61	35	6-	el22°W
Sep 17	3 00-20	Fortuna	9.6	1.15	92517	9.2	F8	1 31.7	10 40	1.0	60	56	7	Greenland,e.Canada,central USA	148	143	0-	none

nominal (usually Herget) prediction. The value in the Δt column tells whether the geocentric time of closest approach will be early (negative) or late (positive) in minutes relative to the nominal prediction. Some of the differences were so large that I compared the ephemerides with late 1970's (and some early 1980's) observations published in recent numbers of the M.P.C.'s, in particular, for minor planets 56, 62, 117, 145, 148, 334, 375, 386, 602, and 702. In addition, the I.T.A. orbits for (409) Aspasia and (476) Hedwig were found to be deficient a year ago for 1981 occultations, and Taylor predicts that these objects will occult stars again in 1982. For (409) Aspasia, the observations clearly favor Herget's orbit over the I.T.A. orbit, which was used by Taylor for his consequently incorrect

1982	MINOR	PLANET					MOTION		STAR			STELLAR	DIAMETER				COMPARISON	DATA			APPARENT	
DATE	No.	Name	km	-diam."	RSOI	Type	°/Day	PA	SAO No	DM No.	D	M"	M	Time	df	S	AGK3	No	Shift	Time	R.A.	Dec.
Jan 2	145	Adeona	137	0.06	569	C	0.305	54°	165872	-14°6540		0.32	687	25	2.0	P			-1".03	-3^m.1	23^h45^m.4	-13°28'
Jan 5	2060	Chiron	200	0.02	5911		0.022	256				0.13	1529	146	2.0	R					3 05.8	14 39
Jan 11	344	Desiderata	147	0.08	773	C	0.227	296	42418	+44 1754		0.70	1239	74	4.0	S	N43°	840	0.38	-0.6	8 31.5	43 41
Jan 13	70	Panopaea	153	0.10	731	C	0.158	264	57881	+34 993		0.64	982	97	3.4	S	N34	544	-0.32	3.3	5 17.7	34 23
Jan 14	451	Patientia	281	0.12	1919	C	0.209	94	120360	+03 2872		0.11	251	13	0.7	P	N 2	1738	-0.12	0.6	14 13.7	2 35
Jan 21	37	Fides	96	0.05	337	S	0.173	115	158136	-10 3745		0.06	120	9	0.4	X					13 43.8	-10 43
Jan 24	532	Herculina	217	0.20	1008	S	0.276	314		+27 1688		0.04	44	4	0.2	A	N26	972			8 54.5	26 49
Feb 8	344	Desiderata	147	0.08	768	C	0.192	270		+45 1520		0.05	96	7	0.3	A	N45	730			7 59.4	45 08
Feb 14	704	Interamnia	339	0.19	2709	C	0.212	277	137113	-05 2895		0.14	243	16	0.8	S					9 45.3	-6 00
Feb 18	702	Alauda	217	0.13	1352	CU	0.214	273		-02 2859		0.12	209	14	0.7	A	S 2	504	0.45	1.0	9 20.8	-2 43
Feb 22	704	Interamnia	339	0.19	2715	C	0.208	281	137038	-05 2861		0.09	153	10	0.5	S					9 39.0	-5 45
Feb 25	48	Doris	149	0.06	768	U	0.178	87	159986	-16 4308		0.05	112	7	0.3	X					16 33.6	-16 53
Feb 28	201	Penelope	144	0.09	679	CMEU	0.065	314		+18 1579		0.28	476	104	1.6	X	N18	724			7 19.7	17 57
Mar 3	250	Bettina	211	0.12	1091	CMEU	0.164	114	58369	+38 1266		1.88	3232	276	10.7	S	N38	617	-0.60	-1.6	5 42.3	38 21
Mar 9	18	Melpomene	148	0.08	433	S	0.598	69	110454	+04 379		0.12	218	5	0.7	S	N 5	244	-1.14	-0.3	2 16.4	5 26
Mar 15	51	Nemausa	153	0.14	543	U	0.119	24	140321	-09 4069		0.08	89	17	0.4	S					15 05.3	-9 31
Mar 17	144	Vibilia	132	0.08	636	C	0.225	293		+07 2512		0.13	207	13	0.7	A	N 7	1602			12 05.0	6 52
Mar 19	15	Eunomia	261	0.16	1331	S	0.301	99	77304	+24 875		1.58	2649	126	8.8	X	N24	515	-0.53	0.4	5 35.0	24 28
Mar 20	344	Desiderata	147	0.07	756	C	0.091	175		+43 1717		0.06	128	16	0.4	A	N42	834			7 37.0	42 55
Mar 20	250	Bettina	211	0.11	1093	CMEU	0.233	106	58636	+37 1380	A	0.80	1511	83	4.8	S	N37	668	-0.14	-0.5	5 58.5	37 13
Mar 21	2	Pallas	538	0.50	3897	U	0.392	338		+11 2562		0.03	37	2	0.2	A	N10	1623			13 24.4	10 39
Mar 23	386	Siegena	203	0.11	1071	C	0.197	48		+06 1468		0.08	146	10	0.5	A	N 6	848			6 58.2	6 43
Mar 24	324	Bamberga	256	0.13	1388	C	0.320	87	211211	-3215101						S					19 20.8	-32 01
Mar 30	15	Eunomia	261	0.15	1343	S	0.330	98	77636	+23 1083		0.06	101	4	0.3	X	N23	562	-0.26	0.4	5 50.2	23 55
Apr 13	15	Eunomia	261	0.13	1358	S	0.358	98	78094	+23 1243	V	1.58	3060	106	9.5	X	N23	626	-0.28	-0.4	6 10.8	23 13
Apr 18	146	Lucina	153	0.13	626	C	0.183	266		+17 2516		0.15	183	20	0.7	A	N17	1309			12 38.8	17 04
Apr 22		Uranus	50300	3.85	*****		0.033	281		-2051699		0.51	6622	370	7.9	H					16 07.6	-20 46
Apr 27	532	Herculina	217	0.14	960	S	0.269	107	61101	+31 1897		1.28	1964	114	6.9	S	N31	899	0.03	0.2	8 51.2	31 06
Apr 29	8	Flora	160	0.09	570	S	0.423	94		+24 1572		0.04	63	2	0.2	X	N24	802			7 12.6	24 21
May 1		Uranus	50300	3.87	*****		0.037	281		-2051615		0.46	6040	299	7.2	H					16 06.1	-20 42
May 17	276	Adelheid	122	0.07	559	CMEU	0.215	305	141346	-03 3988		0.38	624	43	2.1	S					16 44.5	-4 00
May 28	19	Fortuna	226	0.13	965	C	0.435	66	128460	-00 4584		0.14	232	7	0.8	X	N 0	2943	-1.41	0.1	23 53.7	0 40
May 28	40	Harmonia	118	0.07	392	S	0.276	117	99172	+14 2255		4.26	6793	370	23.2	P	N14	1127	-0.51	-0.1	10 31.2	14 14
Jun 4	55	Pandora	185	0.09	771	CMEU	0.424	64	109635	+04 164		0.11	214	6	0.7	X	N 4	133	0.18	-0.6	1 02.5	4 52
Jun 5	44	Nysa	68	0.05	200	E	0.105	258	162993	-18 5487		0.15	214	35	0.8	P			0.12	0.8	19 46.9	-18 27
Jun 11	3	Juno	267	0.17	1787	S	0.201	275	142233	-04 4444		0.20	319	24	1.1	S					18 19.7	-4 52
Jun 29	165	Loreley	228	0.10	1360	C	0.261	56	92359	+17 183		0.34	789	31	2.2	S	N18	102	-0.43	-1.7	1 17.4	18 29
Jul 4	55	Pandora	185	0.10	767	CMEU	0.367	64		+09 219		0.11	202	8	0.7	A	N 9	168			1 46.0	10 03
Jul 7	56	Melete	142	0.12	476	C	0.166	112	139812	-04 3645		0.46	547	66	2.2	P			-0.01	0.8	14 13.7	-5 15
Jul 14	372	Palma	196	0.10	1318	CEU	0.191	266	212479	-3315226		0.26	526	33	1.6	S					20 49.2	-33 03
Jul 14	173	Ino	169	0.10	614	C	0.445	85	110836	+05 414		0.39	652	21	2.2	S	N 6	301	0.04	-0.1	2 54.3	6 10
Jul 18	44	Nysa	68	0.05	201	E	0.234	258	187802	-20 5433		0.49	632	50	2.4	X					19 10.9	-20 17
Jul 27	173	Ino	169	0.11	615	C	0.417	89		+05 471						A	N 6	345			3 17.1	6 26
Jul 28	381	Myrrha	150	0.11	699	C	0.212	237	163787	-19 5889		0.16	222	18	0.8	X					20 39.8	-18 51
Jul 30	65	Cybele	311	0.14	2199	C	0.197	114	139825	-09 3896		0.29	618	35	1.8	X					14 15.2	-9 44
Aug 1	409	Aspasia	194	0.08	959	C	0.342	88		+23 755		0.09	203	6	0.6	X	N23	441			4 51.9	23 27
Aug 11	334	Chicago	199	0.07	1358	C	0.200	115	139729	-07 3762		0.20	554	23	1.4	X					14 04.4	-7 55
Aug 29	57	Mnemosyne	115	0.08	482	S	0.204	235	127592	+05 5029		0.36	540	43	1.9	S	N 6	3098	-1.90	5.4	22 32.0	6 30
Sep 5	194	Prokne	195	0.17	777	C	0.228	141		-00 526		0.05	59	5	0.2	A	S 0	349			3 18.6	-0 13
Sep 15	52	Europa	291	0.13	1771	C	0.337	97	96932	+18 1631		0.25	566	18	1.6	X	N17	772	0.30	0.4	7 28.0	17 50
Sep 17	19	Fortuna	226	0.27	908	C	0.109	243	[illegible]2517	+10 206		0.11	91	24	0.4	X	N10	[illegible]	0.30	-2.8	1 33.4	10 50

prediction of the occultation on 1982 August 1. Herget's path misses the earth by 0".4 to the south, but since even his orbit is probably accurate to only ±2", an occultation is possible in South Africa. All available orbits for (476) Hedwig are very poor, and have not been improved since last year, so it is quite probable that Taylor's predicted event for it on April 8 will not be visible from the earth's surface. Also, the observations clearly favor Herget's orbit over the I.T.A. orbits for (216) Kleopatra, (334) Chicago, (386) Siegena, (602) Marianna, and (702) Alauda, so that Taylor's I.T.A.-based predictions for these objects are wrong. In fact, Taylor's occultations predicted by Kleopatra on May 28, Alau-

1982	UNIVERSAL	PLANET			STAR					OCCULTATION						El	MOON		
DATE	TIME	NAME	m_v	Δ,AU	SAO No	m_v	Sp	R.A.(1950)	Dec.	Δm	Dur	df	P	Possible Area	SUN	El	%Snl	Up
Sep 21	13 44	Bamberga	10.5	1.37	188202	8.9	A3	$19^h27^m.1$	-24°48'	1.8	29^s	26	8	Burma, China	112°	62°	18+	e105°E
Sep 21	22 55-61	Io	11.6	1.79		10.5	K2	3 57.9	15 49	1.4	25	44	17	central Africa, Malagasy Rep.	117	172	21+	none
Sep 24	8 12	Parthenope	11.3	2.19	94833	9.3	A7	5 42.4	18 42	2.2	12	22	20	southern South America	95	175	42+	none
Sep 29	4 30	Gallia	12.1	2.39		10.6	A0	7 14.9	-0 01	1.7	4	13	38	U.K., western Europe	76	142	85+	none
Oct 4	12 00-08	Egeria	10.5	1.74	147137	9.0	K2	0 09.1	-18 15	1.8	19	21	10	New Zealand?n; Australia?n	156	36	97-	all
Oct 7	5 07-25	Emita	11.9	1.41	110631	9.2	G0	2 32.9	3 55	2.7	15	33	19	U.K.?s; s.e.Canada, n.w.U.S.A.	154	31	80-	all
Oct 8	13 14	Bamberga	10.7	1.49	188537	9.2	K2	19 43.0	-22 12	1.7	18	17	8	n.w. India, w. China, Siberia	99	152	66-	none
Oct 27	19 39-49	Undina	10.9	2.03	129289	9.4	K2	1 22.8	-6 44	1.7	17	26	16	w.Australia?n; S.Africa?far n	158	42	76+	w115 E
Oct 31	13 17	Lutetia	12.7	2.63	98369	9.4	F5	9 04.2	18 28	3.3	6	18	33	Hawaii?s; n.w. Mexico	84	109	99+	w120 W
Nov 2	16 03-15	Aquitania	11.5	1.92	148612	6.4	MB	2 45.5	-12 40	5.1	9	21	23	Indonesia, Tanzania	152	30	98-	e 40 E
Nov 14	9 38-55	Wratislavia	11.3	1.70		10.5	F8	3 35.3	24 55	1.2	15	22	14	U.S.A., Hawaii, Queensland	172	157	2-	none
Nov 15	4 18	Lutetia	12.5	2.44	98482	9.3	F5	9 15.7	17 56	3.3	10	27	31	southern Brazil	96	91	0-	none
Nov 15	11 11-27	Ursula	11.9	2.14	55791	8.7	K0	2 38.9	39 05	3.3	15	22	16	Mexico;USA?n;Philipp.Is?n;Java	157	154	0-	none
Nov 17	11 39-44	Ursula	11.9	2.15	55766	9.3	A0	2 36.9	38 57	2.7	15	22	16	New Zealand; Australia?n	157	145	3+	none
Nov 18	3 52	Themis	13.6	4.03	187719	9.1	A3	19 05.2	-23 15	4.5	7	11	23	northeast Pacific Ocean	50	22	6+	w145 W
Nov 22	3 35-45	Minerva	11.9	2.05	76017A	7.8	A0	3 33.1	29 49	4.1	12	20	17	Europe, North America	170	108	34+	w105 W
Nov 22	3 33-46	Minerva	11.9	2.05	76017B	11.5		3 33.1	29 49	1.0	12	20	17	wAfrica,Caribbean;nS.America?s	170	108	34+	w 80 W
Dec 1	3 37	Germania	13.5	3.48	138236	9.1	G0	11 27.3	-1 46	4.5	8	16	27	s.w. Europe, n. Africa	75	103	100-	all
Dec 6	2 40	Hygiea	11.0	3.33	139019	9.1	F5	12 50.5	-8 57	2.0	13	11	11	northern Africa	58	53	67-	all
Dec 13	2 56-64	Irene	10.4	1.80	93544	8.8	A0	3 37.5	14 02	1.8	14	23	17	northern South America	155	178	5-	none
Dec 21	5 49-55	Emita	12.5	1.67	110157	9.3	G0	1 47.5	6 43	3.2	16	38	22	western U.S.A.; eastern Canada	119	55	28+	w125 W
Dec 22	0 20-35	Adeona	11.2	1.35	60144	9.2	A0	7 27.7	30 41	2.1	14	24	14	India, central USSR, n. Alaska	159	128	35+	Alaska
Dec 27	15 31-43	Bellona	10.3	1.47	94638	9.2	G0	5 29.6	10 13	1.4	11	24	20	Japan?n; China, s.USSR, Turkey	162	28	89+	all

1982	MINOR PLANET						MOTION		STAR			STELLAR DIAMETER					COMPARISON DATA			APPARENT	
DATE	No.	Name	km-diam.	"	RSOI	Type	°/Day	PA	SAO No	DM No.	D	M"	M	Time	df	S	AGK3 No	Shift	Time	R.A.	Dec.
Sep 21	324	Bamberga	256	0.26	1041	C	0.213	45°	188202	-24 15372		0.08	78	9	0.3	X				$19^h29^m.0$	-24°44'
Sep 21	85	Io	149	0.11	568	C	0.110	143		+15° 564		0.17	216	36	0.8	X	N15 334			3 59.7	15 55
Sep 24	11	Parthenope	155	0.10	617	S	0.203	93	94833	+18 951		0.06	93	7	0.3	X	N18 494	0".19	$1^m.6$	5 44.4	18 43
Sep 29	148	Gallia	92	0.05	268	S	0.330	106				0.02	42	2	0.1	A	S 0 996			7 16.6	-0 04
Oct 4	13	Egeria	245	0.19	1327	C	0.240	272	147137	-18 11		0.33	416	33	1.6	P		-0.29	-0.1	0 10.7	-18 04
Oct 7	481	Emita	108	0.11	339	C	0.166	261	110631	+03 360		0.13	133	19	0.6	S	N 3 296	-0.95	-2.2	2 34.6	4 03
Oct 8	324	Bamberga	256	0.24	1015	C	0.315	60	188537	-22 14212		0.30	329	23	1.4	P		-0.82	-1.4	19 44.9	-22 07
Oct 27	92	Undina	184	0.13	955	U	0.178	261	129289	-07 227		0.27	401	37	1.4	P		-0.51	0.1	1 24.4	-6 34
Oct 31	21	Lutetia	114	0.06	426	M	0.222	102	98369	+18 2122		0.09	168	9	0.5	X	N18 939	-0.18	0.1	9 06.1	18 20
Nov 2	387	Aquitania	120	0.09	481	S	0.223	258	148612	-13 530		2.34	3261	251	11.9	P		-0.09	-0.5	2 47.1	-12 32
Nov 14	690	Wratislavia	175	0.14	800	CEU	0.226	239		+24 522		0.06	72	6	0.3	A	N24 312			3 37.2	25 01
Nov 15	21	Lutetia	114	0.06	428	M	0.156	100	98482	+18 2163		0.09	163	14	0.5	X	N17 1013	-0.10	1.4	9 17.5	17 48
Nov 15	375	Ursula	200	0.13	1123	C	0.202	253	55791	+38 542		0.38	591	45	2.0	S	N39 303	0.64	-3.2	2 40.9	39 13
Nov 17	375	Ursula	200	0.13	1123	C	0.200	251	55766	+38 532		0.04	68	5	0.2	S	N38 293	0.87	-1.9	2 39.0	39 06
Nov 18	24	Themis	249	0.09	1760	C	0.284	83	187719	-23 15076		0.06	175	5	0.4	X				19 07.1	-23 12
Nov 22	93	Minerva	170	0.11	864	C	0.227	261	76017	+29 579	A	0.10	152	11	0.5	S	N29 398	-0.89	-1.0	3 35.1	29 56
Nov 22	93	Minerva	170	0.11	864	C	0.227	261	76017	+29 579	B					S	N29 398	-0.89	-1.0	3 35.1	29 56
Dec 1	241	Germania	187	0.07	1108	C	0.213	120	138236	-01 2532		0.14	354	16	1.0	X	S 1 1596	-0.61	0.3	11 28.9	-1 57
Dec 6	10	Hygiea	443	0.18	3519	C	0.333	115	139019	-08 3443		0.10	243	7	0.7	X				12 52.2	-9 08
Dec 13	14	Irene	155	0.12	676	S	0.208	274	93544	+13 580		0.06	72	6	0.3	X	N14 322	-0.55	0.3	3 39.3	14 08
Dec 21	481	Emita	108	0.09	334	C	0.134	24	110157	+06 280		0.12	150	22	0.6	X	N 6 192	0.56	-2.6	1 49.2	6 53
Dec 22	145	Adeona	137	0.14	475	C	0.236	312	60144	+30 1519		0.05	53	5	0.2	S	N30 814	-0.38	-0.9	7 29.8	30 37
Dec 27	28	Bellona	109	0.10	356	S	0.224	283	94638	+10 806		0.13	139	14	0.6	S	N10 599	-0.46	-1.0	5 31.4	10 15

da on March 28, and Marianna on April 6 will not occur. Also, since Taylor issued his predictions, new orbits were published in E.M.P. 81 by I.T.A. for (62) Erato, (117) Lomia, and (148) Gallia; these new orbits clearly were favored by recent observations. Consequently, Taylor's events involving Lomia on March 16 and Erato on December 20 also will not occur from earth. On the other hand, the observations favored the I.T.A. orbits over Herget's for (56) Melete, (145) Adeona, (344) Desiderata, and (375) Ursula. Since I originally had selected Herget's elements for my predictions involving occultations by these asteroids, I had to change my nominal calculations to the I.T.A. bases, after which my paths were in good agreement with Taylor's. These events are indicated with asterisks in the table below.

Table of Large Ephemeris Differences for 1982

Date	MP#	Shift	Δt	Notes
Jan 2*	145	$0''.60$ S	$-1^{m}.8$	Herget MPC 4368-ITA 1977
Jan 11*	344	2.25 S	+5.8	Herget MPC 4371-EMP 81
Feb 8*	344	2.03 S	+4.6	Herget MPC 4371-EMP 81
Feb 18	702	6.83 N	-13.3	
Mar 20*	344	1.78 N	-11.7	See Jan 11
Mar 23	386	1.37 N	+6.8	
Apr 18	146	1.08 N	-4.2	
May 28	40	0.40 N	-2.7	
Jul 7*	56	0.47 N	-13.6	Herget 1977-EMP 80
Jul 28	381	1.49 S	+4.0	
Aug 11	334	1.83 N	-4.9	
Sep 21	85	1.21 N	-2.2	
Sep 24	11	1.67 N	-9.1	
Sep 29	148	1.17 N	-2.2	Early ITA-EMP 81
Nov 2	387	0.39 N	+7.2	
Nov 15	375*	0.54 N	+29.7	Herget MPC 4372-EMP 81
Nov 17	375*	0.11 N	+30.0	Herget MPC 4372-EMP 81
Nov 22	93	0.61 S	-0.3	
Dec 1	241	0.33 S	+5.9	
Dec 21	481	0.50 S	+2.0	
Dec 22	145*	2.77 N	+6.3	See Jan 2

For the cases in the table not mentioned in the text above, the orbit differences are too small to decide by published recent observations. However, preliminary astrometry a few months beforehand could improve the predictions substantially for most of these events.

The occultations by Uranus were found by Arnold Klemola, Doug Mink, and Jim Elliot by scanning Lick Observatory plates. Their results for events for 1981 through 1984 were published in the *Astronomical Journal* early in 1981. General information about these events was published in *O.N. 2* (10), 118. Elliot and other M.I.T. astronomers have found that occultations of even fainter stars than they've considered, often only 15th magnitude in V, can be recorded at major infrared observatories. Mink presented a long list of additional events in a talk at the American Astronomical Society's Division of Planetary Sciences in Pittsburgh, PA, in October.

A map showing my predicted paths of asteroidal occultations during 1982 in the U.S.A., southern Canada, and northern Mexico will be published in the 1982 January issue of *Sky and Telescope*. Mitsuru Sôma's world maps for early January occultations are included in this issue. Additional maps and some finder charts for the early 1982 events will be published in the next two issues of *O.N.*

Observing techniques and strategy have been discussed in considerable detail in articles in previous issues. Improved path predictions based on astrometry obtained a few to several days before possible North American events are usually available on recorded telephone messages at 312,259-2376 in Chicago, IL, and 501,771-0978 in Little Rock, AR. In the case when "last-minute" astrometry indicates an unusually favorable event, we will try to have a message broadcast on WWV. Since *Sky and Telescope* is published more frequently than *O.N.*, asteroidal occultation news and finder charts often will appear there first.

The generally poor coverage of the 1981 asteroidal occultations (so far) points out the need for more observers and better coordination; mobile observers are needed especially to fill in the gaps between fixed-site observers in widely separated cities. When you learn that last-minute astrometry shows that an asteroidal occultation is likely to occur in your area, pass the word on to other observers, especially those living in other cities and those with portable telescopes. The value of observations by two observers about a mile apart, to obtain independent confirmation of any observed events, and the need to practice locating the target star well before the occultation, can not be overemphasized!

Notes about Individual Events

Jan. 2: Sôma's world map was produced using an ephemeris based on Herget's orbit, but later texts mentioned above favored the more northern I.T.A. path plotted as a single solid line crossing the night part of the map.

Jan. 5: A special finder chart based mainly on Astrographic Catalog data is given to facilitate locating this faint uncatalogued star. The 8½-mag. SAO star nearby will help. But the gibbous moon only 2° away will make observation extremely difficult, perhaps possible only with large telescopes at major observatories. But so little is known about Chiron, the most distant asteroid, that some observational effort is encouraged.

Jan 11: Same note as for Jan. 2; the E.M.P. 81 path is the more likely.

Jan. 24: (532) Herculina probably has at least one large satellite, according to observations of the 1978 June occultation of a 6th-mag. star. Unfortunately, the small magnitude drop precludes visual observation.

Notes about events later in 1982 will be included in future issues of *O.N.*

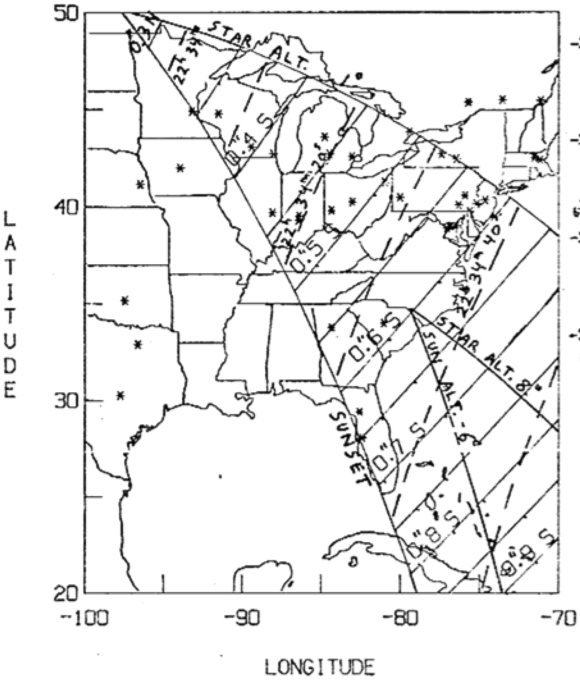
ERRATA

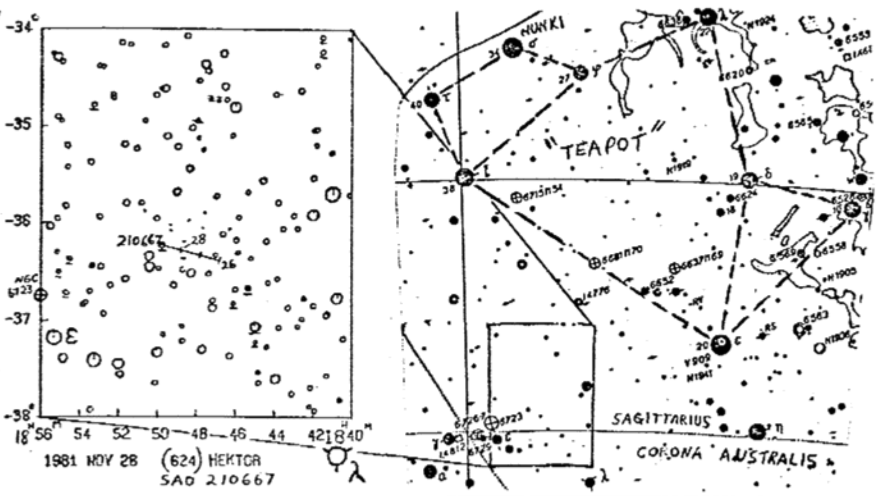
Ken Kelly reports the following errors and corrections in and to the Table of Ecliptic Variables, *O.N. 2* (12), 162:

For SAO 97596, read 97496,
For SAO 164829, read 164830.

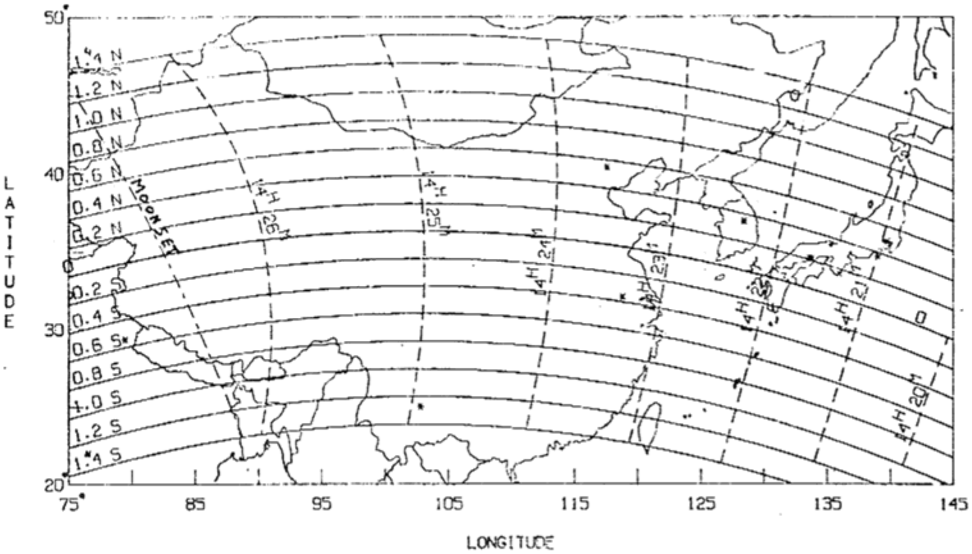
Dietmar Büttner has provided the value +28, to be substituted for the question mark in the entry for SAO 162511 (ZC 2825), in the article Erroneous Star Positions from Occultations, *O.N. 2* (11), 137.

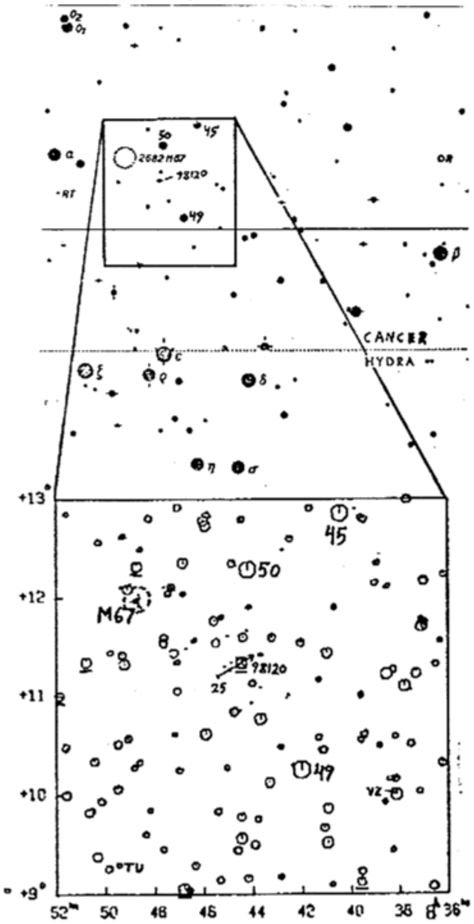
1981 11 28 (624) HEKTOR SAO 210667
DIAMETER 234 KM = 0".05



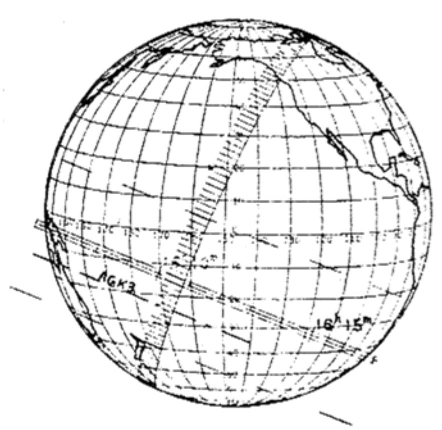


1981 11 30 (471) PAPAGENA B.D. +20° 1035
DIAMETER 145 KM = 0".15

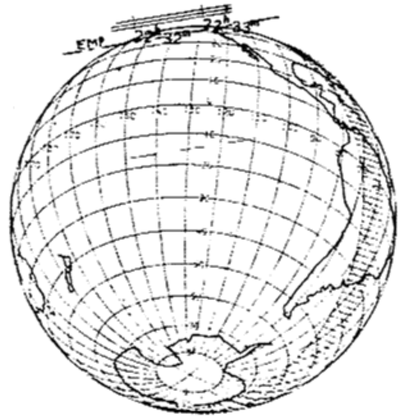




1981 DEC 27 (357) NININA SAO 98120



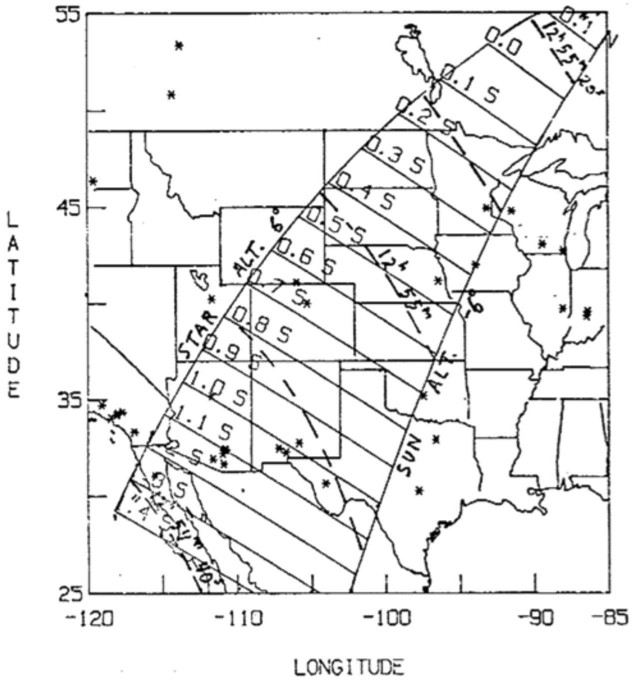
SAO 118607 by Psyche 1981 Nov 28



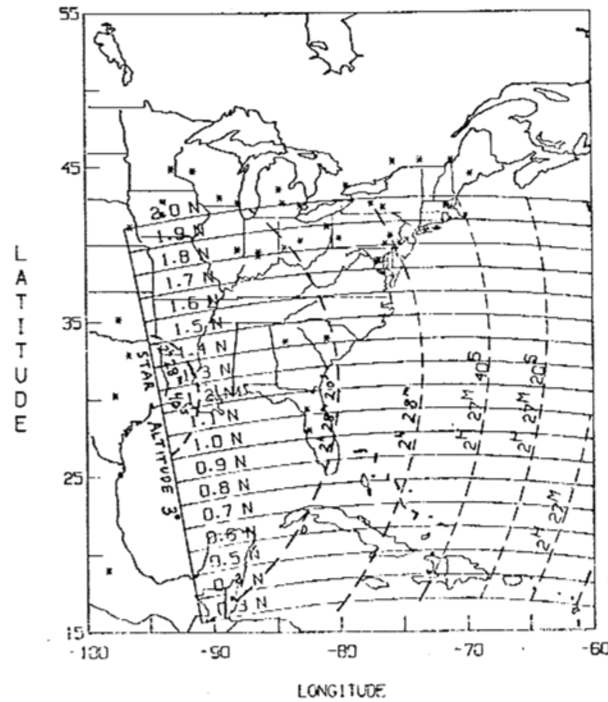
SAO 210667 by Hektor 1981 Nov 28

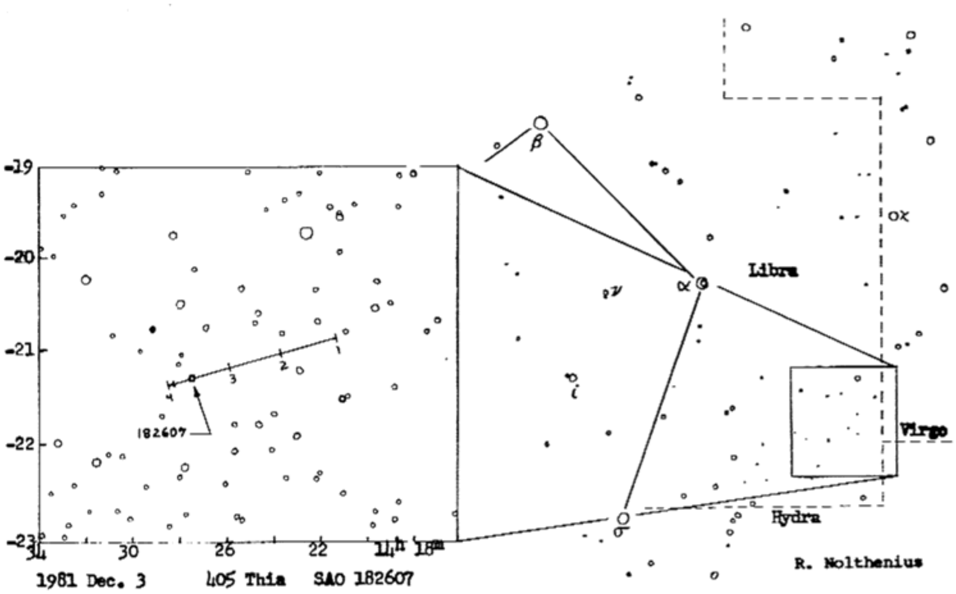
DM +20 1035 by Papagena '81 Nov 30

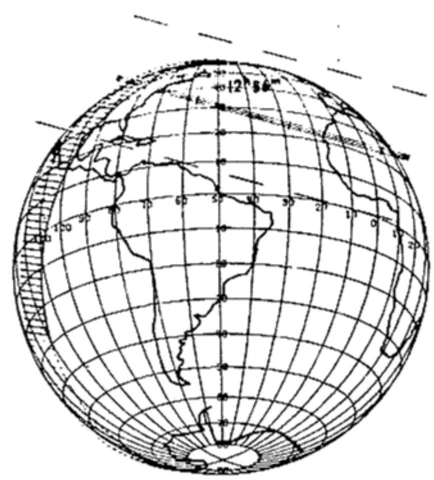
1981 12 3 (405) THIA SAO 182607
DIAMETER 126 KM = 0".06



1981 12 27 (357) NININA SAO 98120
DIAMETER 110 KM = 0".07





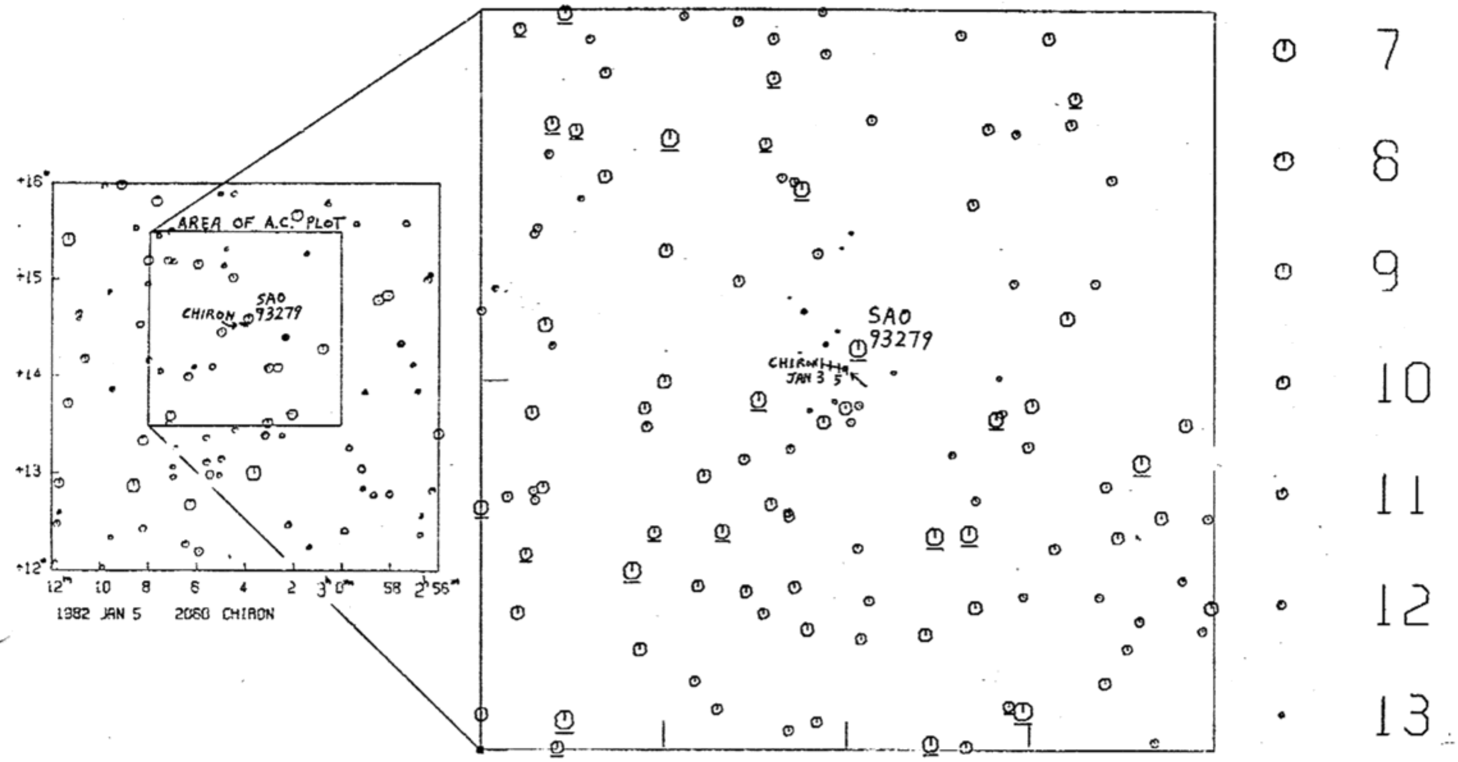


SAO 182607 by Thia 1981 Dec 3

SAO 99271 by Harmonia 1981 Dec 5

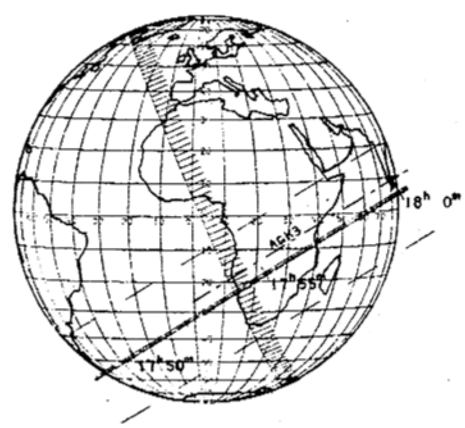
SAO 165680 by Adeona 1981 Dec 8

SAO 189428 by Undina 1981 Dec 14

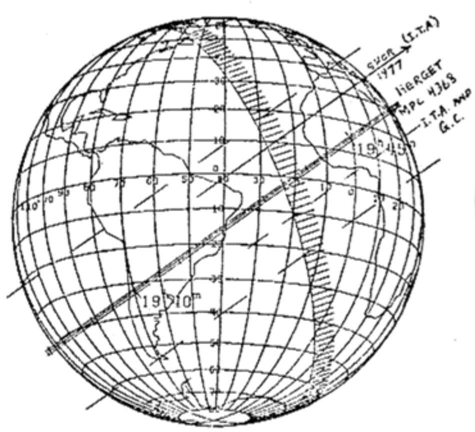


SAO 188659 by Aquitania '81 Dec 15

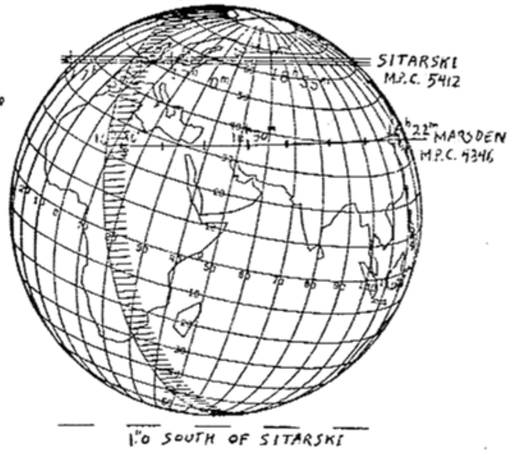
SAO 98120 by Ninina 1981 Dec 27



SAO 109467 by Dione 1981 Dec 30



SAO 165872 by Adeona 1982 Jan 2



Anonymous by Chiron 1982 Jan 5

SAO 42418 by Desiderata '82 Jan 11

OUT OF FOCUS

Roger Giller

After a recent graze expedition, I had reason to criticise the way in which some supposedly mature and experienced observers had filled out a relatively simple Station Report Form. This took the form of an article in our local society journal, *The Southern Observer*. In response, one of the team, Glen Dawes, of the Astronomical Society of New South Wales, decided that we needed a new Station Report Form. This was published in their journal, *Universe*. The form is reproduced below.

OOF GRAZING OCCULTATION OBSERVATION FORM

N.B., form also used for observations of blue moons and aurora borealis (observed from Southern Hemisphere).

State how many head of cattle were present. ______

Date / / / / / /(if known) Star No. / / / / / / /(RS Catalogue No. preferred) Observer's Full Name / / / /

Observing Conditions (A) / / / Telescope Type / / / / / / /(Reflector, Refractor, Transit Instrument, etc.)

***TIMINGS

U.T. (or Dec. Year)			(B) EVENT	(E) PERSONAL	(F) P.E.	(C)	(D) TIMING	(G) OBSERVATION
HR	MIN	SEC	CODE	EQUATION	APPLIED?	CERTAINTY	METHOD	DISCONTINUED

If further events are observed, additional forms can be obtained

E X H A U S T I V E O . O . F . C O D E S

(A) OBSERVING CONDITIONS
Yes/No If Yes, which of the following?

1) Clear moonless day/night
2) Heavy fog
3) Raining
4) Snow / sleet
5) Hail
6) Tornado
7) Hurricane
8) All of the above

(B) EVENT CODE

1) Disappearance
2) Reappearance
3) Blink
4) Flash (Star rapid variable?)
5) Star failed to reappear
6) Star passed in front of moon (or seen through moon)
7) A miss was seen / star veered off at last minute
8) Moon disappeared / it set
9) Total lunar eclipse
10) Total solar eclipse
11) Star went supernova
12) Moon went supernova

(C) CERTAINTY

1) Sure of event
2) Sure of event but possibly wrong star
3) Sure of event but observer is a compulsive liar
4) Observer thought at one stage the star was sighted
5) Unsure whether or not the moon was sighted
6) Probably due to astronomer's active imagination

(D) TIMING METHOD

1) Photoelectric
2) Eye and Ear
3) Ear, nose, and throat
4) Tape recorder, voice, and -
   a) Time signal
   b) Water clock
   c) Hour glass
   d) Egg timer
   e) Atomic clock
5) Mickey Mouse wrist watch assisted by time signal

(G) IF OBSERVATION DISCONTINUED AT ANY STAGE: STATE REASON

1) Position of telescope was adjusted
2) Radio adjusted due to loss of signal
3) Observer tripped over tripod
4) Batteries failed in radio
5) Batteries failed in recorder
6) Battery failed in car which was running telescope
7) 4,5, and 6 above
8) Police harassment (was bail fund required?)
9) Milkman harassment
10) Neighbor complained / he couldn't stand the beeping any more / you were blocking his driveway
11) Neighbor's dog complained
12) Hand brake failed in car, car rolled forward, running down observer and his instrument
13) Observer run down by passing car / did car swerve to avoid missing you?
14) Astronomer struck by lightning during freak storm
15) Swept away during flood caused by same freak storm
16) Earthquake (was it caused by conjunction of planets?)
17) Observer kidnapped by passing UFO
18) Sun went supernova!!!

N.B., *only* reasons 17 and 18 will be accepted as an excuse for late lodging of results.

(E) PERSONAL EQUATION

$$Z = \Sigma \int \sqrt{z^2} + \log\left(\frac{\rho}{\delta}\right) \cdot \int \sin\left(\varepsilon \cos(\alpha)^{\sigma}\right)$$

Would all observers please supply own values for z, β, ρ, δ, κ, π, ε, α, ϕ (This request has been ignored in the past). For an explanation of the variables in this equation, refer to the *Short Guide to OOF Graze Codes, VI*, 482 (At present permanently out of ~~focus~~ print).

(O.O.F. G.O.O.F. Oct '81)