Occultation Newsletter

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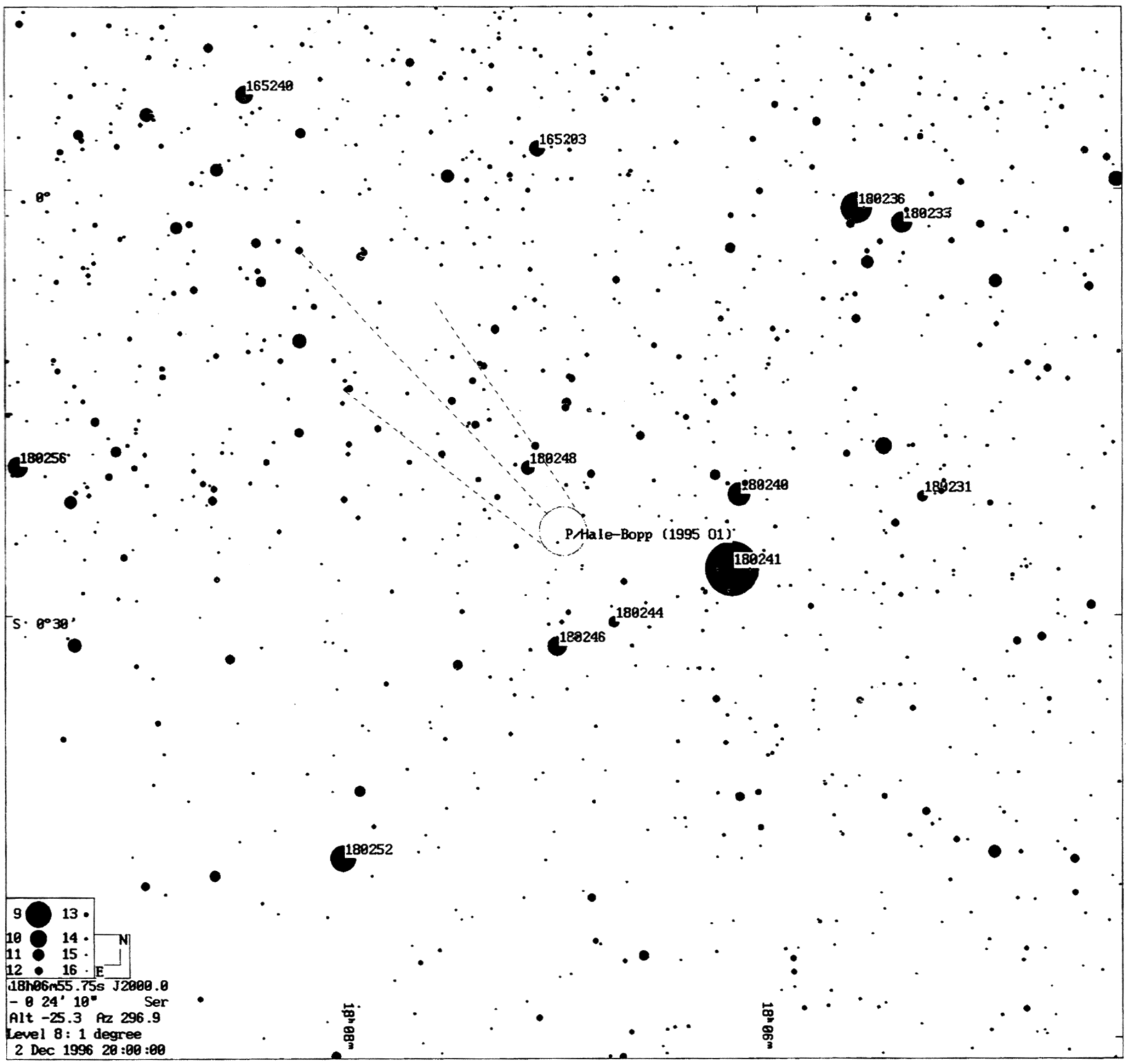

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A close approach of PPM 180241 by Comet C/1995 O1 (Hale-Bopp) on 1996 December 2.
(This star field was printed from Guide v5.0 from Project Pluto.)

In This Issue

The deadline for submissions for the next issue is Saturday, 1996 December 7. The next issue will be sent to the printer on or before Saturday, 1996 December 14. It will be mailed on or before Saturday, 1996 December 28.

Memberships and Subscriptions

IOTA annual membership dues, including **ON** and supplements are $30.00 US for U.S.A., Canada, and Mexico; $35.00 US for all others. Annual IOTA membership dues may be paid by check or money order drawn on a United States bank, or by charge to VISA or MasterCard. If you use VISA or MasterCard, include your account number, expiration date, and signature.

ON subscriptions (1 year = 4 issues) are $20.00 US for U.S.A., Canada, and Mexico; $25.00 US for all others. Single issues are 1/4 of the subscription price.

Although the following are included in membership, nonmembers will be charged for: Local circumstance (asteroidal appulses) predictions $1.00 US; Graze limit and profile predictions (per graze) $1.50 US; Papers explaining the use of the above predictions $2.50 US. Asteroidal Occultation supplements will be available for $2.50 US: for South America via Orlando A. Naranjo (Universidad de los Andes; Dept. de Fisica; Mérida, Venezuela); for Europe via Roland Boninsegna (Rue de Mariembourg, 33; B-6381 DOURBES; Belgium) or IOTA/ES (see back cover); for southern Africa via M. D. Overbeek (Box 212; Edenvale 1610; Republic of South Africa); for Australia and New Zealand via Graham Blow (P.O. Box 2241; Wellington, New Zealand); and for Japan via Toshiro Hirose (1-13 Shimomaruko 1-chome; Ota-ku, Tokyo 146, Japan). Supplements for all other areas will be available from Jim Stamm (11781 N. Joi Drive; Tucson, AZ 85737, U.S.A.).

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What to Send to Whom

Send **ON** articles and editorial matters (in print or **preferably in electronic form**) to:

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Send new and renewal memberships and subscriptions, back issue requests, address changes, graze prediction requests, reimbursement requests, special requests, and other IOTA business, **but not observation reports**, to:

Craig A. and Terri A. McManus
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Send IOTA Web Page information to:

Rob Robinson
E-Mail: Robinson@solar.sky.net

From the Editor

I have received a number of positive comments in e-mail and paper mail about the changes in the ON. I haven't received any negative ones. (No, that's not an invitation to send me any. <grin>) I got one that was very pleased to read that I would continue and encourage the inclusion of human interest articles. I even got one message that thanked me for killing the "Man in the Moon." Thank you all for your support. I'm glad you like the changes and that I could be of help.

Corrections

I miss printed the IOTA membership dues in the previous issue on the inside front cover. They have been corrected in this issue. The Secretary & Treasurer have honored those renewals that they have already received. They will not honor those erroneous prices after you reach the end of this sentence.

In the **ON** V.6, N.10, the article "Analysis of Large O-C's, 1986-1994 by Robert H. Hayes, Jr. there was an error in Table 2. The entry for 1991 marked 07/31/91 X22134 should be 07/21/91 X21419.

IOTA News

Richard Nugent
RNugent@ghgcorp.com

The IOTA meeting for Saturday Dec 7, 1996 is confirmed at LPI by Becky Schultz, the President of the Johnson Space Center Astronomical Society (JSCAS). Becky and I share the same e-mail address.

The lecture room is available from 9 AM - 5 PM with 2 slide projectors and a overhead projector with possibly a large screen TV for videos. The address is:

Center for Advanced Space Studies
Lunar and Planetary Institute
3600 Bay Area Blvd
Houston, Texas 77059

This building is located at the corner of Bay Area Blvd and Middlebrook just 4 miles east from Interstate 45 south at Bay Area Blvd. This is the same building IOTA met at a few years ago. Looking forward to seeing you.

Appulses by PPM Stars of the Comet C/1995 O1 (Hale-Bopp) November 6, 1996 - February 9, 1997

Ovidiu Vaduvescu
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Bucharest, Romania
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This study computes appulses of the comet Hale-Bopp inferior to 5' by PPM stars. It provides opportunities of small-field CCD observations. The study was conducted using "Celestial Maps v.4.5" PC software (Vaduvescu and Birlan, 1996) which plotted the path of the comet (by ephemeris of Yeomans, 1996) through PPM stars (NASA, 1991).

The results are printed in the table. The significance of the columns are: PPM - the PPM number of the catalogs' numerical version of the star; Date, UT - the date and approximate UT of the appulse (precision of 2h); alpha2000, delta2000 - the J2000 coordinates of the star; Ph - the photographical magnitude of the star; Sep - the minimum separation star-comet in '; Pos - the position of the comet at minimum approach. If Occ, then occultation.

PPM	Date	UT	alpha2000	delta2000	Ph	Sep	Pos
509822	Nov 6	10	17 43 22.829	- 2 58 52.83	8.9	2	NW
509842	Nov 9	0	17 45 13.600	- 2 45 44.08	7.3	1	NW
180171	Nov 15	2	17 49 33.312	- 2 13 45.40	9.8	3	NW
180197	Nov 21	12	17 55 9.304	- 1 43 47.50	8.6	3	NW
180202	Nov 22	20	17 56 17.132	- 1 28 22.53	9.9	3	SE
180204	Nov 23	6	17 56 37.221	- 1 23 33.75	9.7	5	SE
180214	Nov 26	16	17 59 53.949	- 1 9 55.63	8.7	1	NW
180221	Nov 28	20	18 2 12.880	- 0 55 23.77	10.2	3	NW
180222	Nov 29	2	18 2 30.943	- 0 55 2.87	9.6	5	NW
180229	Dec 1	4	18 4 15.623	- 0 32 27.59	9.7	3	SE
180241	Dec 2	20	18 6 7.429	- 0 26 45.95	6.8	3	NW
180240	Dec 2	22	18 6 5.471	- 0 21 31.41	9.3	1	SE
180248	Dec 3	16	18 7 5.981	- 0 19 41.60	10.6	3	NW
165350	Dec 7	22	18 11 33.248	+ 0 19 43.81	10.6	2	SE
165414	Dec 9	14	18 13 21.172	+ 0 33 19.32	10.3	2	SE
165423	Dec 10	0	18 13 43.389	+ 0 41 7.01	9.0	5	SE
165535	Dec 12	20	18 17 4.860	+ 1 0 20.76	6.7	0	Occ
165871	Dec 21	4	18 27 36.970	+ 2 22 59.59	8.9	5	NW
166089	Dec 25	20	18 33 43.220	+ 3 17 35.24	9.9	5	NW
166181	Dec 27	22	18 36 54.059	+ 3 47 23.66	7.3	5	NW
166247	Dec 29	0	18 38 11.713	+ 4 9 45.15	10.5	5	SE
166378	Dec 31	6	18 41 20.353	+ 4 33 29.40	7.6	0	NW
166413	Dec 31	22	18 42 15.930	+ 4 41 40.79	9.5	1	NW
166411	Jan 1	0	18 42 14.372	+ 4 47 9.32	10.3	2	SE
166423	Jan 1	6	18 42 38.450	+ 4 48 1.72	8.9	0	SE
166469	Jan 2	2	18 43 59.114	+ 4 57 17.50	9.3	1	NW
166477	Jan 2	4	18 44 11.269	+ 4 55 34.06	8.8	3	NW
166475	Jan 2	6	18 44 8.468	+ 5 0 13.07	9.1	0	NW
166487	Jan 2	12	18 44 31.208	+ 5 1 32.39	9.6	2	NW
166540	Jan 3	18	18 46 9.049	+ 5 27 59.10	10.6	3	SE
166615	Jan 5	0	18 48 51.139	+ 5 41 37.95	10.2	3	NW
166658	Jan 6	8	18 50 30.669	+ 6 13 36.28	9.0	5	SE
166730	Jan 7	20	18 52 57.542	+ 6 39 12.92	9.1	5	SE
166741	Jan 7	22	18 53 8.993	+ 6 40 25.43	10.5	5	SE
166828	Jan 9	16	18 56 0.509	+ 7 7 34.45	7.3	3	SE
166869	Jan 10	12	18 57 19.083	+ 7 21 59.97	10.2	5	SE
166902	Jan 10	22	18 58 17.285	+ 7 24 2.04	9.0	1	NW
166919	Jan 11	4	18 58 40.946	+ 7 30 0.10	10.3	0	Occ
166971	Jan 12	2	19 0 22.132	+ 7 47 14.50	10.6	0	Occ
166997	Jan 12	12	19 1 12.032	+ 7 52 8.89	10.7	4	NW
167036	Jan 13	6	19 2 17.630	+ 8 11 7.24	9.8	1	SE
167070	Jan 13	22	19 3 31.847	+ 8 17 37.36	8.1	4	NW
167138	Jan 15	2	19 5 19.627	+ 8 46 28.51	9.1	3	SE
167219	Jan 16	0	19 7 24.020	+ 8 59 22.22	10.1	4	NW
167210	Jan 16	4	19 7 12.007	+ 9 9 3.57	9.8	5	SE
167209	Jan 16	4	19 7 11.542	+ 9 9 32.62	10.6	5	SE
167234	Jan 16	10	19 8 4.468	+ 9 8 52.87	11.1	3	NW
167253	Jan 16	22	19 8 45.643	+ 9 22 4.26	9.3	2	SE
167311	Jan 17	20	19 10 46.042	+ 9 35 52.36	10.5	5	NW
167303	Jan 17	20	19 10 25.861	+ 9 42 14.24	9.6	3	SE
167330	Jan 18	4	19 11 3.198	+ 9 49 15.11	10.0	3	SE
167350	Jan 18	12	19 11 41.920	+ 9 57 6.91	8.9	3	SE
135961	Jan 19	4	19 12 51.950	+10 9 13.89	10.8	3	SE
135981	Jan 19	12	19 13 27.470	+10 16 27.25	10.4	3	SE
136014	Jan 20	2	19 14 58.099	+10 24 33.71	7.4	4	NW
136016	Jan 20	8	19 15 8.157	+10 34 31.43	9.5	3	SE
136035	Jan 20	14	19 15 45.429	+10 34 22.22	10.8	3	NW
136040	Jan 20	16	19 16 0.896	+10 37 12.15	9.5	4	NW
136074	Jan 21	12	19 17 43.438	+11 1 51.41	9.7	0	SE
136116	Jan 22	12	19 19 24.464	+11 26 31.48	11.5	4	SE
136128	Jan 22	16	19 19 53.067	+11 32 6.32	6.1	4	SE
136201	Jan 24	2	19 22 58.788	+12 1 43.39	9.8	0	Occ
136225	Jan 24	12	19 23 57.637	+12 7 19.48	9.9	4	NW
136239	Jan 24	20	19 24 27.525	+12 16 58.08	8.4	1	NW
136252	Jan 24	22	19 24 49.380	+12 15 19.57	9.8	5	NW
136282	Jan 25	16	19 26 6.895	+12 35 54.26	8.5	2	NW
136298	Jan 26	0	19 26 43.059	+12 51 30.00	9.9	5	SE
136300	Jan 26	2	19 26 48.637	+12 52 4.57	9.3	4	SE
136338	Jan 26	12	19 28 8.270	+12 55 34.61	10.6	5	NW
136370	Jan 27	0	19 29 12.507	+13 11 7.54	8.6	2	NW
136409	Jan 27	16	19 30 38.867	+13 27 16.56	9.2	3	NW
136445	Jan 28	2	19 31 43.135	+13 37 9.42	9.1	5	NW
136551	Jan 29	20	19 35 13.453	+14 29 15.42	8.6	3	SE
136582	Jan 30	0	19 36 3.167	+14 30 28.77	8.5	3	NW
136725	Jan 31	12	19 39 43.403	+15 12 15.47	9.6	5	NW
136781	Feb 1	6	19 41 18.944	+15 34 12.47	9.4	3	NW
136851	Feb 2	0	19 43 6.862	+15 59 32.48	9.9	0	Occ
136907	Feb 2	16	19 45 5.999	+16 17 8.71	8.0	4	NW
136969	Feb 3	14	19 47 15.647	+16 42 43.82	10.0	4	NW
136991	Feb 3	22	19 47 48.194	+16 59 12.30	10.4	3	SE
137028	Feb 4	6	19 48 51.795	+17 0 41.13	9.0	4	NW
137062	Feb 4	12	19 49 40.424	+17 9 34.65	8.6	5	NW
137077	Feb 4	20	19 50 12.617	+17 26 11.55	10.0	3	SE
137110	Feb 5	10	19 51 53.153	+17 48 35.58	8.4	5	SE
137112	Feb 5	12	19 51 58.049	+17 48 50.23	10.0	4	SE
137114	Feb 5	12	19 51 59.437	+17 50 18.62	8.4	5	SE
137148	Feb 5	18	19 52 57.007	+17 48 53.84	8.1	5	NW
137157	Feb 5	22	19 53 13.021	+18 1 34.76	9.8	3	SE
137160	Feb 6	0	19 53 18.271	+18 4 11.51	10.6	3	SE
137180	Feb 6	6	19 53 58.717	+18 12 59.82	9.0	3	SE
137245	Feb 6	20	19 56 7.635	+18 27 13.34	9.2	3	NW
137289	Feb 7	8	19 57 27.697	+18 45 33.37	9.6	2	NW
137393	Feb 8	10	20 0 12.102	+19 19 34.96	9.6	0	Occ
137406	Feb 8	12	20 0 32.671	+19 20 1.46	9.8	3	NW
137421	Feb 8	18	20 0 55.162	+19 32 28.45	9.5	3	SE

References:

NASA, 1991, Selected Astronomical Catalogs, Vol.1, No.1, Astronomical Data Center, NSSDCC;

Vaduvescu O. and Birlan M., 1996, Software Package for Preparing and Reducing of an Astronomical Observations, in press in Romanian Astronomical Journal, Vol.5, No.1, Romanian Academy Printing House, Bucharest;

Yeomans D., 1996, Orbit and Ephemeris Information for Comet 1995 O1 Hale-Bopp (through Internet); ι

Some Basic Information about Timing Occultations

David W. Dunham

This article was first written to send to new observers who contacted me by e-mail, and was later updated and placed on IOTA's lunar occultation Web site (see end of this issue for site URL's). The article is published here for the benefit of **ON** readers who don't have Web or e-mail access, and to "officially" publish it. The next article on grazing occultations has a similar history and purpose.

This is written to help those who are just starting to time occultations. First, especially North Americans should read my "Lunar Occultation Highlights" article in the January issue of **Sky and Telescope** magazine. This outlines the most important occultation events that are predicted to occur during the year, and gives sources where more detailed information can be found. The article for 1996 starts on page 76 of the January, 1996, issue. Other valuable **Sky and Telescope** articles discuss timing occultations (September, 1990 issue, p. 288) and the value of occultation observations (November, 1988, p. 480). Also in the January (or sometimes February) issue of **Sky and Telescope**, I discuss planetary (mainly asteroidal) occultations that will occur during the year, starting on p. 68 of the February issue for 1996.

Accurate time signals are needed for timing occultations. The time provided by the telephone company in most North American cities is not accurate enough; you should not use it. In the U.S.A., accurate time signals, from the U. S. Naval Observatory master clock, can be obtained by calling 900-410-8463; the call should be placed via AT&T to ensure use of land lines, which will give an accuracy of a few hundredths of a second, more than sufficient for visual timings. If the call is not made via AT&T, or if the National Bureau of Standards' WWV 303-area-code number are used, the call might (or might not, you would not know) be routed through a geosynchronous satellite, causing a quarter-second delay, which is unacceptable, even for visual timings. In the Washington, DC area, the USNO master clock can be reached with a local call to 202-762-1401, but those outside of the DC toll-free area should not use that number, because it might go through a satellite. Some other nations, such as the U.K., also have accurate time signals available by telephone.

Often more convenient than telephone time, especially for field use such as grazing occultations, are short-wave radio time signals, such as WWV and WWVH at 2.5, 5, 10, and 15 megahertz. Radio Shack used to sell a convenient receiver, the "Weatheradio-Timekube", for these frequencies for about $40, but they are no longer available. Some grazing occultation expedition leaders have extra Timekubes that they may be able to loan. A more expensive alternative (kit, $59; wired board, $99) that requires some assembly is the Hamtronics' WWV Receiver, described on pages 48-49 of the January 1996 issue of **Sky and Telescope**. It gives a much more reliable signal than similarly-priced general-purpose short-wave receivers. If you buy a general-purpose short-wave radio, try to get one that at least covers 5 and 10 megahertz, the best nighttime frequencies. [Ed Note: see the article "Excellent Shortwave Radio," page 263] Also, one with digital tuning is highly recommended; many observations have been lost while observers tried and failed to find a weak time signal with a dial (analog) tuner. Reception with Timekubes and general-purpose receivers can be improved by connecting a copper wire, at least 50 feet long, to the receiver's antenna, and stringing it out approximately perpendicular to the direction of the transmitter (WWV is in Ft. Collins, Colorado, and WWVH is on Kaui, Hawaii). The wire should be suspended above the ground and attached to a tree or a wooden (or other non-electrically-conducting) post. Time signals are also broadcast at 5, 10, and 15 megahertz from Japan, China, and Russia, so WWV receivers are also useful in much of the rest of the world.

Unfortunately, short-wave time signals are no longer available in much of Europe, but accurate time can be obtained there from the German long-wave DCF time signal transmitted at 77 kilohertz. Conrad Electronic made a DCF 77 receiver, Best.-Nr. 19 89 35; it gives a digital LCD display of the time, and the DCF signal can also be fed into a speaker or tape recorder for an audible signal. The unit is no longer sold, but about 200 European observers bought it via group purchases while it was available.

Most observers find stopwatches most convenient for making timings. Unfortunately, most stopwatches now are digital. Stopwatches with dial displays (such as those on most mechanical stopwatches) are needed for some of the timing methods discussed in Van Flandern's Precision Timing of Occultations (P.T.O.). Methods that don't use a stopwatch include the Eye-and-Ear method and tape recording method, discussed in P.T.O. If a tape recorder is used, total occultation times should be marked with a mechanical clicker (such as a toy cricket) or buzzer (such as for a door bell) rather than with voiced calls. Voiced calls are sufficient for grazing occultations, where half-second timings are acceptable.

For reporting occultations, you need to determine your accurate geographical longitude, latitude, and height above sea level. These can be measured from a large-scale topographic map of your area, preferably with a scale in the range of 1:50,000 to 1:24,000. Check your telephone book for map, engineering supply, or sporting goods stores in your area that sell these maps. College, University, and sometimes municipal libraries have map collections that you might be able to use to measure positions. The maps can also be ordered by mail, usually for less than the price charged by local dealers; index maps and order forms can be obtained from your national mapping agency. In the U.S.A., the address is: Map Distribution Office, U. S. Geological Survey (USGS); Box 25286, Building 810; Denver Federal Center; Denver, CO 80225; telephone 1-800-USA-MAPS. USGS service can be slow; in general, you are better off trying to find a local map dealer. But if there is no nearby map store, or an expedition is planned outside the area of their coverage, Richard P. Wilds suggests using Powers Elevation Co. in the Denver area for a quick response (they can get any USA map over the counter). Their address is P.O. Box 440889; Aurora, CO 80044; phone 1-800-824-2550. They accept credit card orders. Richard recommends ordering several maps at once to offset their $5.00 service fee per order. Richard finds they are very friendly and will send maps by overnight delivery. In Canada, contact the Canada Map Office; 615 Booth St.; Ottawa, ON, K1A 0E9.

For planning grazing occultations, smaller-scale large-area topographic maps are most useful; I prefer the 1:250,000-scale maps that show all rural roads and cover an area of 1° of latitude by 2° of longitude. These are also sold by dealers and the national mapping agencies. Some good maps are also available commercially, although they are not detailed enough for determining longitude and latitude to the necessary 1″ (100 feet or 30 meters on the Earth's surface) for reporting lunar occultation timings. One of these is a series of atlases covering several of the states of the U.S.A. at 1:150,000-scale sold by the Delorme Publishing Co., Freeport, Maine, telephone 207-865-4171. After using these maps to select locations from which the graze might be observed, if time permits, it is helpful to also get the detailed large-scale maps of those areas. Then, you can find sites whose positions can be accurately determined and avoid newly-constructed buildings and roads that are not shown. In any case, you will need the detailed maps for determining accurate coordinates of those stations from which the graze is successfully observed. But take the large-area maps with you for selecting possible alternate sites, since bad weather or other last-minute problems can chase you away from your prime sites. Another source of large-area maps are aeronautical charts available at many airports; these are less detailed than the 1:250,000-scale topographic maps and not as useful for grazes, but they are useful for those who want to travel out of their immediate area with portable equipment for asteroidal occultations. Note that most civilian GPS receivers are NOT accurate enough for determining geographical positions for lunar (especially grazing) occultation timings. Simultaneous differential GPS measurements, from a known base station to a field station using two differential-capable receivers, are needed to obtain the 30-meter accuracy required for lunar occultation work. The situation will change if and when the degradation caused by Selective Availability (S/A) is turned off. Although a decision was recently made to phase out S/A, it will be a few years under the current plan before that will be accomplished, and in the meantime, some who want to keep S/A on could prevail. Two detailed articles about GPS use for occultations were published in **ON** V.6, N.6, pp. 126-135.

Even if you don't join the International Occultation Timing Association, you might want to write to them at 2760 SW Jewell Ave.; Topeka, KS 66611-1614, enclosing $1.00 and asking for a copy of their most recent list of members. Perhaps one lives near you who could help you get started, or you could find others for organizing grazing occultation expeditions or attempts to observe asteroidal occultations that might occur in your region. Information about upcoming events can be found by telephoning the IOTA occultation line at 301-474-4945 in Greenbelt, MD. Or read IOTA's pages on the World Wide Web, URL http://www.sky.net/~robinson/iotandx.htm. For e-mail notification of updated asteroidal occultations, send a message with your location and brief telescope description to the e-mail address: Dunham@erols.com ι

An Introduction to Grazing Occultations

David W. Dunham

See the previous article for general information on timing occultations, as well as additional hints for grazing occultations. This article has a history and purpose similar to that of the previous article.

As the Moon moves through the sky, it passes in front of, or occults, stars in its path. It can be thought of as casting a shadow of each star, where the star is hidden behind the Moon. If the shadow of a particular star falls on the Earth, this star is occulted. As the shadow moves (due to the Moon's motion) across the Earth's surface, a region is defined from which the occultation of the star is visible. At the advancing edge of the shadow, the star is just disappearing at the Moon's edge. For most observers within the region of visibility of the occultation, the event (time from star's disappearance until its reappearance at the opposite edge of the Moon) will last a little more than an hour. North or south of the region of visibility of the occultation, the Moon will be seen to miss the star, passing close to it. Within a mile or two of the northern or southern boundary, or limit, of the region, a grazing occultation can be seen. Here the star will appear to pass along a line just touching (or tangent to) the edge of the Moon, and the star will disappear and reappear among the mountains and valleys along the Moon's edge for a period of a few minutes. Such a grazing occultation is a spectacular sight; at no other time, except perhaps during a solar eclipse, is the Moon's motion more apparent.

A grazing occultation is visible from a zone about usually about two miles wide, depending on the lunar topography, which can be predicted approximately from lunar charts. If several observers with telescopes and timing equipment are positioned at intervals across the zone, they can each time the sequence of disappearances and reappearances as seen from their location. If the positions of the` observing locations are measured, the timings can be reduced afterwards to determine details of the lunar profile, and gives a very accurate fix of the position of the Moon relative to the star. Such observations are useful for refining knowledge of the positions and motions of stars, and can be used to improve parameters such as the tilt of the Earth's equator relative to the ecliptic (the plane of Earth's orbit around the Sun) and even the rotation of the Milky Way galaxy. Improvement of knowledge of the lunar profile for these observations aids the analysis of total solar eclipse timings, which can be used to study climactically important small changes in the diameter of the Sun over periods of many years. Also, the star's disappearances or reappearances may occur in steps, indicating a previously undiscovered close double star that can not be resolved by direct observations.

The location of the telescope should be described to an accuracy of about ten feet relative to landmarks (road intersections or large buildings) that are shown on the detailed topographic map of the area; the latitudes and longitudes of the observation sites can then be measured from the map by the expedition leader. Timings can be made by calling out the successive events (can use "D" for disappearance or "R" for reappearance; some are more comfortable thinking the star as a light that goes "off" and "on") and also tape recording a radio station. The best is to record the shortwave time signals from station WWV at 2.5, 5, 10, or 15 megahertz, but many observers do not have shortwave receivers. If the expedition leader makes arrangements for someone (not necessarily in the graze path) to create a master tape by recording WWV and a local AM or FM radio station, observers in the graze zone can record the agreed-upon local station with car or other radios. A strong AM station is generally preferred since they can be received over long distances, but if reception of a particular FM station is known to be reliable throughout the area of observation, an FM station could be used. Camcorders are now almost as common as tape recorders and can be used in this case as tape recorders; the video is not needed. There are ways to hook sensitive video cameras to telescopes and some grazes, generally of relatively bright stars, have been recorded this way, but this is more advanced work. For bright stars, a camcorder can simply be held up to the eyepiece and, with a little adjustment, the graze can be recorded; this has been done successfully with a few previous grazes. Visual timings made to an accuracy of half a second are quite adequate for defining the lunar profile; for a graze, the observer's location is more sensitive than the timings, since observers even 50 feet apart will notice differences in their event timings.

Try to stress to new observers that making the observations is not that difficult. Besides observing the event, all they need is a tape recorder or camcorder to record their call-outs of the events, plus a background time reference, which could be an agreed-upon local AM or FM radio station, if a time-tagged master tape is prepared, as described above. It's more satisfying to even new observers to both observe a graze, and record it for comparison with records at adjacent sites to build up the profile, whose detail and accuracy is proportional to the number of stations recording data. ι

Grazing Occultation Observations

Richard P. Wilds

This issue has no occultation report because no one sent in a report that was complete and usable. Several reports were sent in, but they were missing critical information--mostly the shift. If you want your observations to be useful to other observers, you **must** provide the shift information. If you need help in determining the shift, **please** contact me (see What to Send to Whom) and I will show you how easy it is to do. The importance of the shift can be clearly seen in the article "Using Past Graze Observations," page 263. ι

Online Astronomy

Rex L. Easton

For this issue, I would like to tell you about some weather pages on the WWW. They are very helpful in planning your activities. REAL-TIME WEATHER: SATELLITE DATA at http://rap.ucar.edu/staff/gthompsn/cur_wx/satellite.html has very good images of the North American continent. The resolution is such that you get a very distinct three-dimensional effect on the visual images. THE WEATHER CHANNEL is at http://www.weather.com/site_guide/ and has current conditions, updated hourly forecasts, and satellite images for the entire world. ι

Request for Articles

Rex L. Easton

I have a few ideas for articles that I think our readers would find interesting. From the members outside the U.S.A., I would like to see articles on what it is like to do occultation work across country borders. Do you need to have passports for each country that you enter? How much work is involved in preparing to cross borders? How many different languages do you need to know to do multi-country expeditions? Tell us of some of your more eventful (out of the ordinary) expeditions. From all of the members I would like to get your input on what makes a vehicle good for astronomy in general, and occultation work in particular. Tell me what vehicle you like to use and why. After I have received enough responses I will put together an article that can be used for reference when you have to add or replace a vehicle. As the mission statement (on the back cover) indicates, I always want your articles on observing techniques and equipment reviews. Half of the **ON** is member articles. What you get is what you give. The other half, of course, is the reports of your observations and notification of changes to the observing program. ι

Young Moon Record

Jim Stamm

When I returned to my hobby of amateur astronomy in 1980, I read Guy Ottewell's account of the Young Moon Record, and thought that, "This is a record that can be broken - if one knows exactly when and where to look." I had always marveled at the thin crescents I had seen on camping trips.

The calculations were cumbersome, and I knew that I needed to buy a computer and learn programming. This I did, with an outgrowth of teaching BASIC programming at the college level for several years. It also permitted me to work on the record with some early sightings in the "teens" (see Lunar Crescent Visibility by Doggett and Schaefer; **Icarus** 107, 388-403).

In 1989 Robert Victor broke the record with a binocular sighting. This had to be extremely difficult, because of the scanning that was necessary. The only way to better that superb observation would be to catch all the right circumstances and have a fixed scope on the right coordinates.

Near perfect circumstances did occur for us (Tucson) in December of 1995. Both Victor and I posted announcements that a large part of the country would have a chance at the record. As far as I know, only Tom Polakis, and Pierre Schwaar, and myself each tried for the Young Moon the morning of December 21. We were each thwarted by clouds. Too bad, because, "This was a once in a lifetime opportunity."

However, the next month (January) offered even better circumstances for Tucson in some respects. I posted another announcement on the news group sci.astro.amateur, and went to work. The program that I wrote in the early eighties had a subtle error in it that I corrected with the help of Polakis and Jim Van Nuland. The visibility aspect had been improved with the help of Bradley Schaefer's work - some of which was published in **S&T**.

Knowing that conditions would have to be exceptional to have any chance at sighting the Young Moon, I approached the project as a fun planning effort. I would plan my observations as thoroughly as possible. Sighting the Old Moon the day before would be relatively simple, but it would be the test run for the Young Moon attempt.

After determining when and where the Moon would be as it rose over the Santa Catalina Mountains, I found that Beta Scorpii had a declination only 40 minutes south of the Moon. Another star (named or near ν Sgr?) had a declination of 17 minutes less than the Moon's, and it preceded the Moon by 37 minutes. I could set up on Beta Scorpii, hop to ν Sgr, turn the declination knob 0.9 turn counterclockwise, slew to the horizon, and wait the remainder of the 37 minutes.

On Friday morning, January 19, 1996, at exactly 14:04 UT the thin crescent came into view over Pusch Ridge at precisely the calculated time and location. I followed it naked eye until 14:11 (age - 22:39 from new), when I picked it up with 9 x 63 binoculars. At

14:22 I focused the image away and could not retrieve it. It was still easy in my 6 x 30 C-8 finder until 14:32. After that I watched it climb through the C-90 and C-8 with powers of 55 and 50 respectively (original eyepieces), not being able to decide which scope would hold the image longer, as the sky got brighter and brighter. My last view of the Moon through the C-90 was at 15:00, but the image was still distinct through the C-8 at 15:08 (3 minutes before sunrise over the ridge), when I bumped the scope while putting the lens cap on the C-90. I couldn't find it again.

I left the C-8 on my permanent mount, pointed to the location of the Young Moon for Saturday, January 20-21. I watched w^2 Aqr, 46 Cet, 53-I Eri, 14 Lep, 11 Cma, and M-47 drift through the field Friday night - making slight declination adjustments, and "discovering" the effects of refraction.

We all (3 adults and 4 children) assembled as the Sun set, and the time approached for the 5 degree high Moon to slip into the fields of view of the C-8 and C-90. It stayed too bright to even attempt viewing through the binoculars or finders, right up to the time (00:52:12) to engage the clock drive of the C-8. I did not see Beta Cap drift through the field of the 41' 50x C-8 eyepiece at 00:42:54. This worried me a little.

For five minutes I uttered disclaimers to my wife and neighbor, assuring them that there actually had been a real possibility of seeing something, and that they would indeed share in a world record if we were successful. Then it just appeared, as if to have come from behind something, as I slowly rotated the declination knob of the C-8. The crescent was close to the center of the field! At 00:57:06 I was able to confidently announce "I've got it!"

In a minute I was certain that none of us could see the thin sliver in binoculars. So we spent the next 16 minutes taking turns looking through the C-8, and watched the Moon set at 0.9 degrees (not factoring in the 34 arcminutes of refraction). Two of the children never did see the image in the telescope. One of my strategies had been to use children's eyes to maximize our potential. I'm now sure that experience is a far more important factor in making tough observations.

At the time of first visibility, the Moon's elongation from the Sun was 7.7 degrees. Percent sun lit was 0.6. Altitude was 4.3 degrees (without effects of refraction considered). AGE WAS 12 hours 07 minutes!

21-January-1996

First Sighting:	00:57:06 UT (WWV).
Age:	12 hours, 07 minutes.
Altitude:	4.3 degrees.
Lunar elongation from Sun:	7.7 degrees.
Percent lit:	0.6.
Moon's semi-diameter:	16.6 arc minutes.
Position Angle of Bright Limb:	222 degrees.
Position of Center of Bright Limb	(apparent w/o refraction): 20h 30.2m -14d 32m.
Last sighting:	01:15:00 UT (WWV).

Sunset:	00:46; azimuth = 246.6 degrees
Moon set:	01:15 at 0.9 degrees; azimuth = 252.4 degrees.

Location: Tucson, AZ; W110.9645; N32.4202; Elev.= 842m

Description: The image seemed to "pop" into view. It was an unbroken crescent about 45 degrees in arc. It was white on a bright background. After about 5 minutes the image seemed to be about 60 degrees in arc length, and a little easier to see. The image reddened as it got closer to the horizon, and was distinctly reddish as it set (0.9 degrees).

Equipment: Celestron C-8 with original 55x eyepiece.

Confirming observers: Jim Stamm, Tom Murdock, Matt Stamm, Chris Stamm.

Other observers: Josh Stamm, Ian French, Matt Murdock. ι

Adventures in Occultations

On the evening of 1996 September 22, a lunar occultation of a 9.0 magnitude star was observed successfully at an elevation only 5 deg above the horizon with the IOC (IOTA Occultation Camera). The telescope used was a 200mm f/6 Newtonian reflector. Integration time was 0.3 seconds. Wavelength range 400 to 1000nm (without filter). This is just to let you know, what can be done even at low elevations.

Wolfgang Beisker
IOTA/ES--Research and Development

Here in New York City, New York, USA the skies converted through the afternoon to a high level system--mayonnaise smeared on glass. So, I thought, "I'll go ride my bike around downtown Manhattan". I did. I watched a beautiful sunset through all that sky sculpture as a backdrop to the Statue of Liberty before heading back home at about 7:30 PM. For laughs, I thought to look at what little I could see of the Moon through my Fujinon 14x70's. Hey! Even through the haze, I could see the star! And it was getting close. In an instant, I thought "Go for it!" Running back downstairs, I grabbed my tripod and C-102, and climbed back up the stairs. The superintendent wasn't in the building so I couldn't get through to the roof via the main fire escape door (without setting off the alarm), but there is a double hung window next to it.

There I was, in my black bike shorts, black t-shirt and white tennis shoes, climbing out of a window in the top of a New York City residential building with all sorts of equipment in tow . . . and in a hurry. It suddenly struck me, this may be my last occultation timing.

Set up without motor drive, no alignment (oh, okay, I was within 30 degrees of the NCP), tape recorder going--gee, I hope I left a tape in there (better look, yup, Tosca)--and, gloriously, CHU coming through loud and clear. Finding the Moon the way a hunter aims a shotgun when surprised by panicked pheasant, I grabbed my little duck clicker and was joyous beyond words that a). I found the Moon. b). I found the star, and c). I saw the star disappear, getting a solid timing. No duplicity noticed. But it crossed my mind that the position angle could well be a factor--especially without the benefit of a graze and gentle lunar slopes to help split a double.

Whew. Now the paperwork, which I expect will be less eventful. Cladio (Guy Nason) ι

IOTA Graze Patch
Richard P. Wilds

We would like to let the readers know that we still have about 150 IOTA Graze Patches. These are beautiful patches centered on the Pleiades Star Cluster (M 45) as the crescent moon is passing by and the entire view on a stunning black background. The moon is about to occult the southern chain of eighth and ninth magnitude stars found south of the brighter stars of the cluster. It is also going through a graze of Merope. The border of the patch is red, blue and yellow with the words "Lunar Graze IOTA" around the edges. The IOTA Graze Patches sell for US$5.00 payable to Richard P. Wilds. Please send a check or money order drawn on a US bank. Send your request with payment to my address shown in "What to Send to Whom."

[Ed. Note: It is a beautiful patch and you can see a full color rendition of it on the IOTA Web Page listed in "IOTA Online."] ι

Excellent Shortwave Radio
Richard P. Wilds

This is a notice of a very good shortwave radio buy. The Sangean SG-789A is a very small and portable shortwave radio which does a good job of picking up 5 and 10 MHZ for WWV and 7.335 MHZ for CHU time signals. This will even be easier soon since a recent issue of Science News indicates that WWV is due for a fourfold increase in power output. The SG-789A runs on three AA cells. The radio is also lots of fun for listening to international worldband radio broadcasts. There are a number of general science and astronomy shows from various countries (ie. Seeing Stars on the BBC from Great Britain and Research Files on Radio Nederlands from the Netherlands). The radio costs $44.95 plus $4.00 Shipping and the catalog number is #2153. To place an order contact:

Universal Radio
6830 Americana Pkwy.
Reynoldsburg, OH 43068-4113 USA
Phone 1-800-431-3939
Fax 614 866-2339
E-mail dx@universal-radio.com ι

Using Past Graze Observations
David W. Dunham, Mitsuru Sôma, Don Oliver, Don Stockbauer

On p. 204 of **ON** V.6, N.10, Tom Campbell described how he video recorded 14 events during a spectacular grazing occultation of δ^1 Tauri when he observed from a location recommended by Dunham, who computed the position with the help of Sôma's reduction profile of a graze of the same star that was well observed at similar librations and Watts angle range in Europe 3 months earlier (of the countries listed there, the last was wrong - Dunham's mistake; it should have been Slovakia, not Czech Republic).

Last year, for a series of grazes of ρ^1 Sagittarii (ZC 2826), we made effective use of past observations, first those of four grazes of the star observed during the previous series 18 years before, to successively improve the predictions for grazes that occurred in September, October, and November. Bob Sandy has nearly completed reduction profiles for those events, which will be the subject of a future **ON** article.

Another example of this activity is illustrated by the reduction profiles of two grazes of 6 Leonis observed earlier this year, shown here. They also provide some guidance of what not to do. First, the graze on April 26th (local; April 27th UT) was well observed from only the southernmost three stations of the seven station expedition near Eugene, Oregon, organized by Larry Dunn, member of IOTA and the Eugene Astronomical Society. In February, they had observed a graze of another star in the same part of the lunar profile (same Watts angle range and very similar librations), in which the path shifted south relative to the GRAZEREG profile that they used (so in that case, also only a few of the southernmost observers had the graze). When I sent Larry the results of Sôma's reductions of the February graze and how they would affect the 6 Leonis graze, based on the profile shift, I warned him that there could be a difference in the error in the PPM declination for the February star relative to 6 Leonis, so that he should extend the range of observers at least 0."3 south of the "best" range. Because the expected multiple events range was rather narrow, he did not want to risk having some of his observers seeing only one long occultation, so he ignored my advice, much to his regret after the fact. The observations he did obtain were reduced by Sôma to improve the prediction for a graze in northern Japan at the end of May. This paid off for a few observers in northern Honshu, who timed several events at each of their stations, but a larger expedition on Hokkaido was clouded out. The April graze was also observed by an expedition near Houston organized by Wayne Hutchinson.

Recently, Dunham received **Occultus** number 45 (July 1996), on p. 15 of which appears the reduction profile of a graze of 6 Leonis observed on March 30th in the Netherlands, reproduced here. If we had known about these observations before April 26th, we could have reduced the observations and given warning to Larry Dunn of the additional southward shift that occurred. We need more communication about successful observations (a brief summary without a detailed report sent by e-mail shortly after the event would help) and about plans for relatively large expeditions that might benefit from analysis of past events.

To more systematically organize past grazing occultation observations to aid efforts like the ones described above, Stockbauer and Oliver in the Houston, TX, USA, area prepared a master summary of all successful graze expeditions undertaken from 1974 (with a few back to 1972) to early 1986, as published in **ON**. The files, which are nearly in the same format as they are published in the summary lists in **ON**, were sorted both chronologically and by star number. Only a small part of this file is shown in the table, which shows the first few entries, then all of the entries for ZC 0692 (Aldebaran), and then a few other expeditions near the transition from ZC to SAO numbers, and from SAO to other numbers, etc.

Star numbers are given mostly as 4-digit Zodiacal Catalog (Robertson) numbers. For most non-Z.C. stars, 6-digit SAO numbers are given. But for many of the early grazes, SZ catalog (USNO Z) numbers are given, a "Z" followed by 5 digits. These need to be

IOTA Graze Report Database
(Sorted by Star & YrMoDy)

YrMoDy	V	Star	Mag	%Snl	CA	c	Location	#St	#Tm	SS	Acm	c	Organizer	C	St	WA	b	v	pag
790104		0004	63	39+	N		Tonda, Japan	4	4	8	6		Jiichi Nakamura			3	15	2	088
790714		0004	63	68-			Horsley, Austrl.	3	13	8	15		Roger Giller					2	069
830119		0018	60	26+	S		Burguillos,Spain	3	20	1	20		L. Quijano					3	226
840109		0018	60	35+	S		Mezieres, France	1	8		20		Ginat					3	227
750701		0029	72	53-	6N		Elkhorn, WI	4	7	8	15		Homer DaBoll		1S	355	-48	1	043
750701		0029	72	53-	6N		New Berlin, WI	10	12	7	9		Raymond Zit		1S	355	-48	1	055
800122		0036	72	27+	2S		Kurashiki, Japan	1	4	8	20		MinoruSasaki-ILOC			180	40	2	126
800122		0036	72	27+	1S		Akashi, Japan	3	7	3	6		Masaki Ikada			181	40	3	324
800122		0036	72	26+	S		Kyoto, Japan	4	12	6	15		Fumio Matsui			162	40	2	088
800122		0036	72	27+	S		Yokohama, Japan	5	10	7	6		Toshio Hirose			158	40	2	088
780211		0047	77	14+	4N		Estero, FL	1	4		20		Harold Povenmire					1	148
780411		0692	11	17+			FerteSt.Aubin,Fr	8	56		26		Jean Schwaenen					2	028
780411		0692	11	17+	S		Vill.LaFaye, Fr.	1	19		21		Jacques Fulgence					1	155
780411		0692	11	17+	S		Vallorbe, Switz.	1	6	9	20		Hans-Joachim Bode					1	155
780411		0692	11	17+	S		Possens, Switz.	1	2		20		Maurice Roud					1	155
780702		0692	11	7-	3S		Orinda, CA	5	49	5	15		James Ferreira			175		2	028
780702		0692	11	7-	3S		Concordia, CA	7	25	8	8		Raymond Bryant					2	028
780826		0692	11	45-	N		Inverness,Sctlnd	1	4		5		Graeme Nash					2	028
780922		0692	11	67-	-5S		Riviera, TX	1	4	7	15		Don Stockbauer			178	67	2	028
780922		0692	11	67-	-5S		Citrus, FL	18	89	9	25		Tom Campbell		2N	184	67	2	028
780922		0692	11	67-	-5S		Valkadia, FL	2	3	7	8		Wyck Hoffcer			184	67	2	068
781019		0692	11	86-	N		Beregovo,Ukraine	1	1	2	7		MikhailetsBarnaya					3	225
781116		0692	11	98-	-25S		Lake City, FL	4	10	8	20		Tom Campbell		6N	173	68	2	029
781116		0692	11	98-	-25S		Callahan, FL	3	14	8	11		Karl Simmons					2	029
790109		0692	11	88+			Edefors, Sweden	1	5		15		N.P.Wieth-Knudsen					2	029
790205		0692	11	69+	-4N		Paicines, CA	1	4	8	15		RichardNolthenius		N			2	029
790305		0692	11	47+	-6N		Obihiro, Japan	8	34	7	6		Hidetoshi Yoshida			354	72	2	126
790912		0692	11	58-	10N		China Lake, CA	17	76	9			James McMahon		1S	351	73	2	069
791230		0692	11	93+	N		Bridgeport, MI	1	1		15		David Harrington		S			2	088
791230		0692	11	93+	3N		Wiarton, Ontario	6	34	8	15		DouglasCunningham		S	353	73	2	088
791230		0692	11	93+	3N		Lockport, IL	11	71	8	13		John Pelps		5S	353	73	2	095
791230		0692	11	93+	3N		Algonquin Pk,Ont	2	2	9	9		Brian Burke		S	353	73	2	095
800321		0692	11	32+	N		Tol., Belorussia	2	5		6		V. A. Golubev					3	225
800321		0692	11	32+	N		Sosnovka, Russia	5	18		8		Alexander, Osipov					3	225
800321		0692	11	33+	N		Sloinge, Sweden	1	4		6		N.P.Wieth-Knudsen		N			2	088
800805		0692	11	28-	-7S		San Antonio, FL	3	14	8	20		Harold Povenmire			170	66	2	126
810212		0692	11	64+	-S		Gorredijk,Hollnd	10	50	1	8		D. Schmidt					3	225
810212		0692	11	63+	9S		Delaware, OH	5	27	7	15		Charles Hafey		2S	170	65	2	127
810212		0692	11	63+	9S		Streetsboro, OH	4	25	9	15		Robert Clyde		2S	170	65	2	127
810212		0692	11	63+	-3S		Lembruch, G.F.R.	1	10		6		N. Wieth-Knudsen			180		2	127
810312		0692	11	41+	10S		Honjyo, Japan	1	2	3	13		Isao Sato			170	64	3	324
821029		3536	47	89+			Sakata, Japan	1	7	1	13		Isao Sato			170	70	3	324
830702	V	3536	47	60-	10N		Cor.de Tucson,AZ	11	99	1	20		Derald Nye		6S			3	227
800510		3537	68	19-	1S		Te Hana,N.Zealnd	6	8		20		G. Allcott			181		2	126
790701		+32522	92	36+	1S		Lick Obs., CA	1	3	8	15		RichardNolthenius					2	069
790906		-66132	98	0E	31U		Lyndoch,Austrl	2	1	3	15		David Steicke		2N	4	4	2	069
840406		076593	80	19+	3N		Fellsmere, FL	2	5	1	15		Harold Povenmire					3	207
840724		076609	75	20-	11N		Hagerstown,MD	1	1	3	20		David Dunham			347	4	3	207
851215		189406	72	12+	18S		Tucson, AZ	1	4	1	15		R. Nolthenius		2N	169	71	3	324
821026		190146	79	60+	8S		Kenney, TX	1	7	1	20		Don Stockbauer		3N	173	46	3	226
750525	-	204406	95	0E	80U		Celina, TX	1	6		20		Danny Morrison					1	043
740331	+	211354	94	50+	N		Satellite Bch,FL	1	1		41		Harold Povenmire					1	007
791026		??????	111	27+	6S		Black Birch,N.Z.	1	3	9	40		Graham Blow					2	069
830902		C02597	101	28-	15N		Los Angeles, CA	1	2	1	42		RichardNolthenius			345	-12	3	227
821230		C03747	102	0E	U		Kailua, HI	1	10	1	20		Paul Maley				-5	3	226
821230		C03747	102	0E	U		Pahala, HI	1	6	1	25		William Albrecht				-5	3	226
801005		Venus	-37	13-	S		Zuidwolde,Hollnd	1	2	9	15		Jean Meeus					2	126
801005		Venus	-37	13-	S		Lingen,German FR	1	0		6		N. Wieth-Knudsen					2	126
801005		Venus	-37	13-	3S		Zossen,German DR	1	8	7	6		Wolfgang Rothe					2	126
780211		Z00267	90	14+	0S		Peotone, IL	1	3	6	20		John Phelps, Jr.		6S	183	3	1	148
760620		Z00391	92	41-	2N		LakeArrowhead,CA	1	3	5	15		RichardNolthenius		4S	359	-29	1	094
780113		Z24817	85	24+	N		Canberra, Austrl	2	4	6	20		David Herald		13N	5	-28	1	148
760108		Z25246	82	35+	6S		Samsula, FL	1	4		25		Harold Povenmire					1	069

converted to SAO numbers. For some stars neither in Z.C. nor in SAO, other catalogs are used, such as B.D., USNO E, and USNO K catalogs. Grazes of planets (partial occultations) and some of the Sun (solar eclipse observed at the northern or southern limit of annularity or totality) are also included.

Richard P. Wilds has all of the **ON** graze summary lists that he prepared, but not in one place. They need to be consolidated like the list here, and Z.C. numbers given where appropriate. Then the list can be brought virtually up-to-date. For earlier grazes, Don Oliver was working on a project to use a database of observations of grazes observed up to 1976, as collected by HMNAO (Royal Greenwich Observatory) and processed by Tom Van Flandern at USNO (this includes all timings, but unfortunately not the accurate positions of the observers, or their names) to generate expedition information. Oliver ran into technical problems and gave up the project. During a recent business trip to Japan, I gave these data to Sôma and Toshio Hirose, and explained that we wanted to create a comprehensive list of graze expeditions from this information. So with the help of these others, the project started by Stockbauer and Oliver can be finished to give a list of graze expeditions that is as complete as possible. This will be valuable for searching by star number and latitude libration/Watts angle range to locate previous graze observations, and perform new analyses of them to improve the predictions for important future grazes. At least the current file of 1972-1986 grazes sorted by star number will be put on IOTA's lunar occultation Web site for viewing, printing, or downloading before this issue is distributed. If you don't have Web access, the file can also be sent by e-mail; specify whether you can receive and retrieve mime-encoded or uuencoded attached files.

Dietmar Büttner described his and Reinhold Büchner's project to derive lunar profiles from occultation observers in **ON** V.6, N.9, p. 199. Past grazing occultation observations largely define the lunar profiles in the polar regions, and eventually these will be used for predicted profiles for at least Cassini-region grazes generated with the GRAZEREG program by Eberhard Riedel. But so far, this has been limited to the data collected by ILOC since 1980, while most well-observed grazes were seen before then. At ESOP XV in Berlin, Büchner reported that he had recently received the earlier total occultation observations from the Royal Greenwich Observatory (collected by HMNAO), but he had not yet received the grazing occultation data that they collected. He hopes to receive them sometime during the next month, after which it will be possible to create a much better dataset of observed profiles on a consistent system than the current "Cassini" dataset of observed grazes used by ACLPPP and OCCULT. The GRAZEREG input datasets for 1997 have already been generated by E. Riedel, in the same way that they were produced for 1996, and their distribution to the graze computors has begun. However, as soon as Büttner and Büchner complete the improved profile data for the polar regions (their top priority), they and Eberhard Riedel will develop software that the graze computors can use to generate new predicted graze profiles for distribution to observers.

During the years when we depended on the mainframe computer at USNO, I had a computer program there that read the observer scan data from the prediction runs (I collected those files on magnetic tape from the graze computors) to generate a copy of them sorted by star number. Then, when graze observations indicated a shift froma the predictions, we could warn observers of future grazes of that star. We hope that this can be revived. The ASCII observer scan files can still be generated from the GRAZEREG output files with the ACLPPPIN program, and later maybe they could be generated from the binary XREF files also generated by GRAZEREG. With e-mail, the exchange of the necessary files should be easier now.

The star positions and proper motions that will soon become available from the Hipparcos satellite observations (the Hipparcos and Tycho output catalogs) will be much more accurate than any catalog data previously available from groundbased data, and will largely eliminate the star position error problem for events observed during the last half of the 1900's and during the first several years of the next century. Then, we will not need to be concerned with following the data from different stars, since the data from a graze of any star can be used just as well for all others. NASA has given Dunham a grant to incorporate the Hipparcos satellite data into the star catalogs used for occultations, and Wayne Warren will help with this effort, as soon as the Hipparcos data are released. ι

International Occultation Timing Association, Inc.

Grazing Occultation Results Column Identification

Richard P. Wilds

Some readers have asked to have the columns of the Graze List explained in its current updated format. Therefore, I am providing the following list which also includes the importance of the most significant columns.

Grazing Occultation Results Table

UT Date Universal Time of the graze event. The UT Date includes the year, month and day.

VP This column indicates whether the graze team included either a video camera (V) or a photometer (P) as part of the graze effort.

PP This is the newest column in the listing. It was found to be needed as IOTA began dealing with a number of different Prediction Programs (ie. ACLPPP, Riedel GRAZEREG, OCCULT and EVANS as well as others). Readers need to be aware of which program is being used, because this can be important in how the graze leader must shift the observers to insure they are in the right place for the graze. Please send me a copy of your predictions in order to determine the prediction program.

Star # This is generally the SAO # of the star observed. This is changed only when the star is too faint, so that it does not have an SAO #. Then we will use its USNO #, PPM # or GSC #.

Mag This is the formal brightness rating of the star.

% Sun This is the brightness of the moon. It is followed by a minus sign if the moon is in its waning phase.

CA This is the Cusp Angle of central graze followed by whether it was a north or south graze. A minus sign means the graze was on the bright side. Generally, a number less than 3 means that some part of the graze involved the bright side. This is a fun section because the reader can sometimes see some very interesting grazes from these numbers. It normally takes a very bright star to be seen against a bright limb. This can vary, however, with the color of the star (any color other than the sun) and with the brightness of the moon (a crescent phase allows observations of faint stars).

Location The site from which the graze was observed. This usually includes the nearest City as well as the State, Province and Nation.

 # Sta The number of stations in the expedition which produced timings.

 # Tm The number of timings produced by all the stations on the expedition.

SS This is the rating of the Sky Stability during the graze (1 is excellent, 2 is workable, but with some difficulty and 3 is where there were observations made with great difficulty).

Ap Cm The Aperture in Centimeters of the smallest telescope that produced timings on the expedition.

Organizer The graze leader who was in charge of the expedition and the person responsible for the data.

Sh This is the heart of the graze list. The shift is the reason for the list. When a graze leader takes a group hundreds of miles to a graze site, then it is usually good to be in the right place to observe the graze. The only way to be in the right place is to learn from the mistakes of others. When you look at the current list, or past lists, then you need to note the Watts Angle of your graze and its B (Latitude Libration) and find a past graze that is similar. Then note the shift and this figure should be used on your current expedition. After your graze you MUST detirmine a shift for your graze. This is done, simply, by comparing the difference in seconds of arc (found on the left side of the profile) between the predicted location of your observers and where they actually ended up on the profile according to their timings.

NS The shift discussed above, of course, could be a shift either to the north or the south.

WA This is the Watts Angle of the central graze of the event.

B This is the latitude libration at the time of the observation. A large negative libration on a south graze or a large positive libration on a north graze is an indication of a graze in the Cassini Third Law Region. The Cassini Region is the one area that Dr. Chester B. Watts had difficulty with imaging in his construction of the Watts Charts of the Marginal Zone of the Moon. Therefore, grazes in this area are more difficult, but they are also the most needed.

<u>Stellar Cross Reference Table</u>

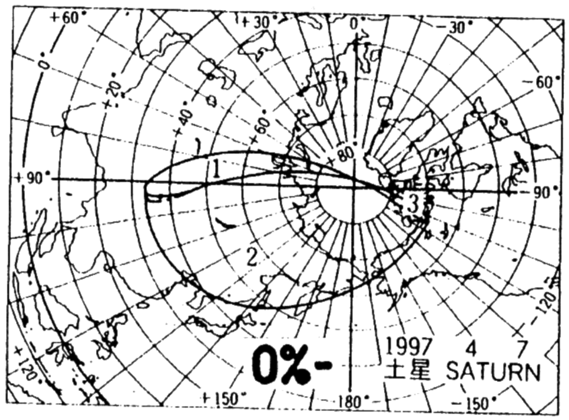
SAO # The Smithsonian Astrophysical Observatory number of the graze star.

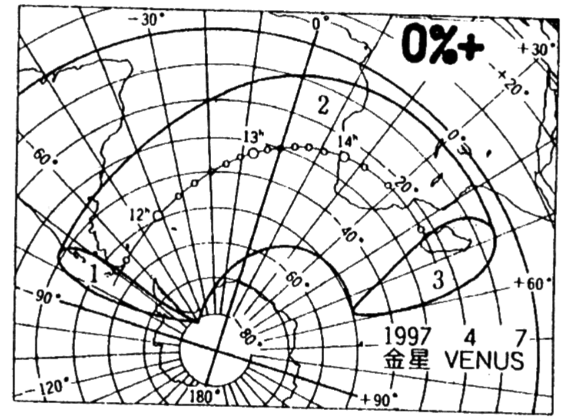
ZC # The Zodiacal Catalog number. This is from a catalog first produced by James Robertson and most recently by Isao Sato.

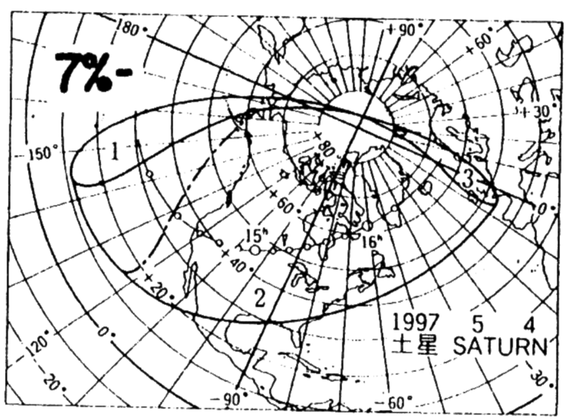
Other Ref This is a column for star names and other reference numbers from catalogs such as the PPM or the GSC.

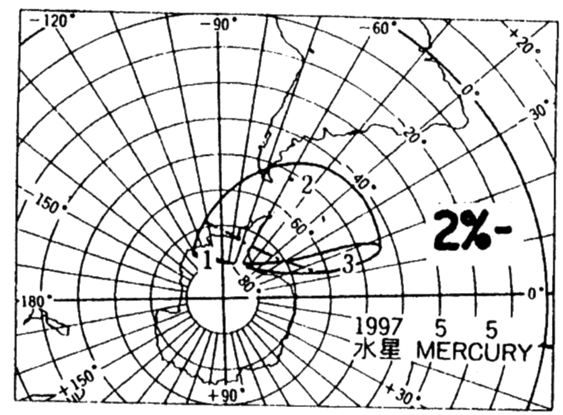
Lunar Topography This is where we list the lunar features found in the graze area from the Watts Charts of the Marginal Zone of the Moon.

1997 年 の 惑 星 食 図　　世界時
LUNAR OCCULTATIONS OF PLANETS IN 1997　　UT

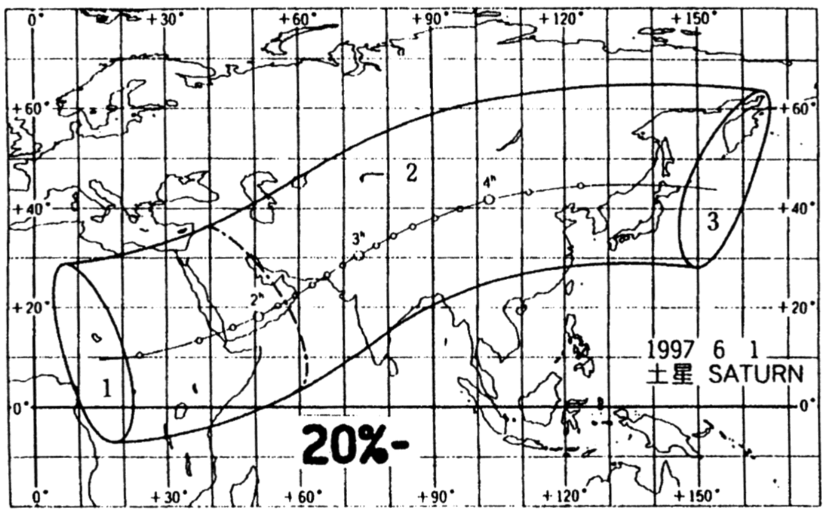


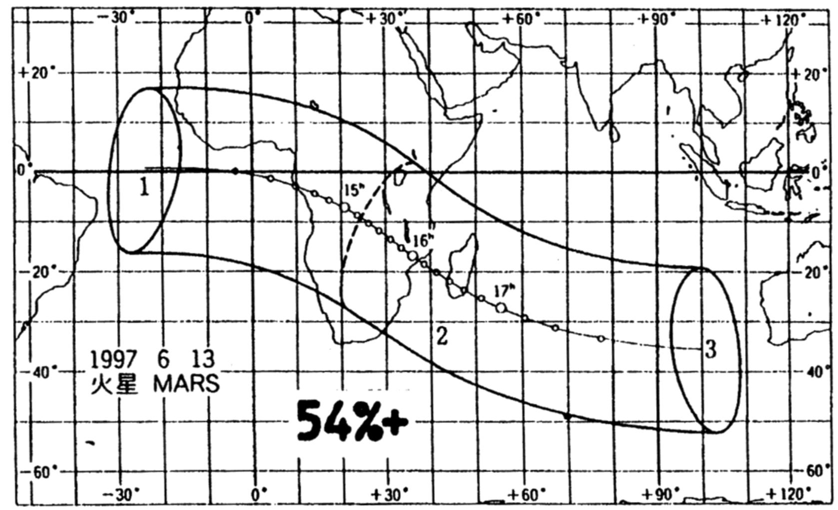






1997 年 の 惑 星 食 図　世界時
LUNAR OCCULTATIONS OF PLANETS IN 1997　UT





1の地域では出現だけ見られる.

In region 1 only reappearance visible.

2の地域では潜入・出現ともに見られる.

In region 2 both dis-and reappearance visible.

3の地域では潜入だけ見られる.

In region 3 only disappearance visible.

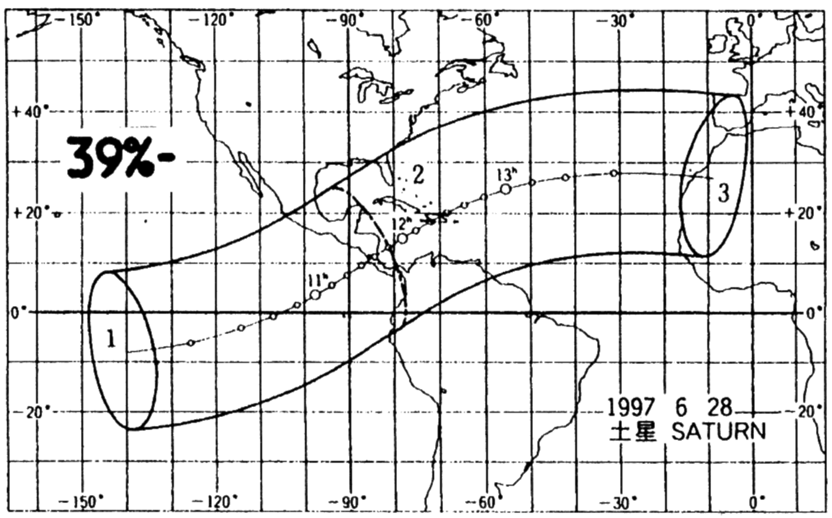
日出潜入線：この線上では日出に潜入となり，この線から東側では日出後に食が始まる.

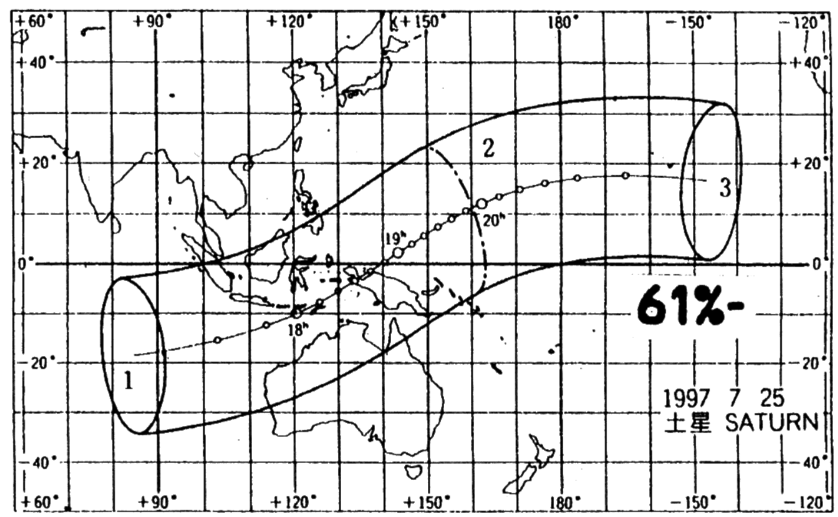
———Disappearance at Sunrise. In region east of the line, occultation begins after Sunrise.

日没出現線：この線上では日没に出現となり，この線から西側では日没前に食が終わる.

--------Reappearance at Sunset. In region west of the line, occultation ends before Sunset.

1997 年 の 惑 星 食 図 世界時
LUNAR OCCULTATIONS OF PLANETS IN 1997 UT





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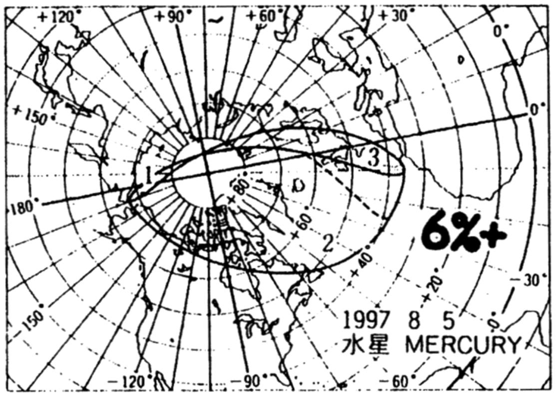

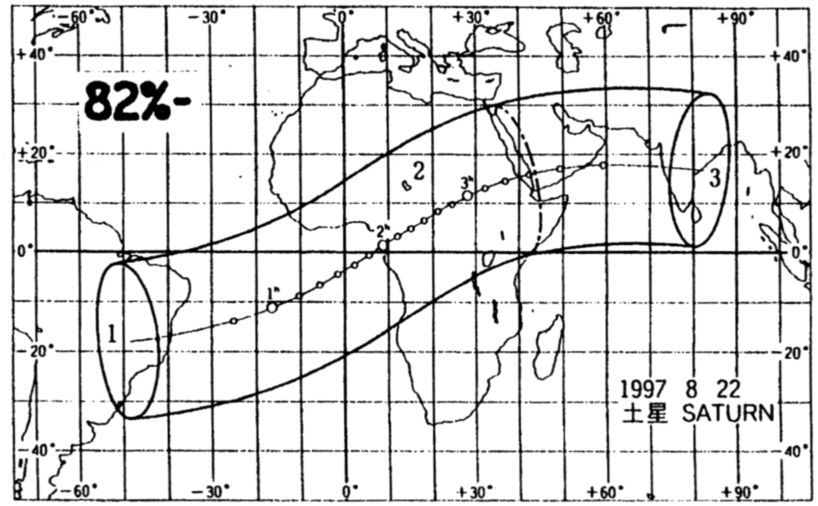

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2の地域では潜入・出現ともに見られる.

In region 2 both dis-and reappearance visible.

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In region 3 only disappearance visible.

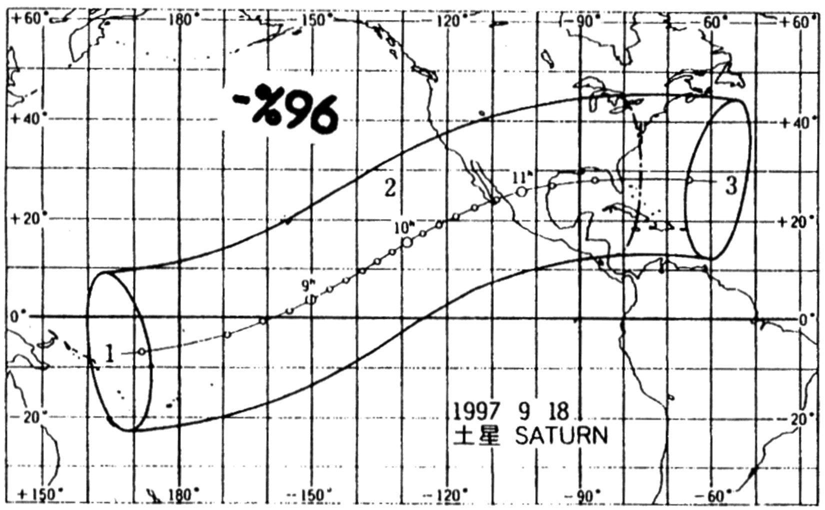
日出潜入線：この線上では日出に潜入となり，この線から東側では日出後に食が始まる.

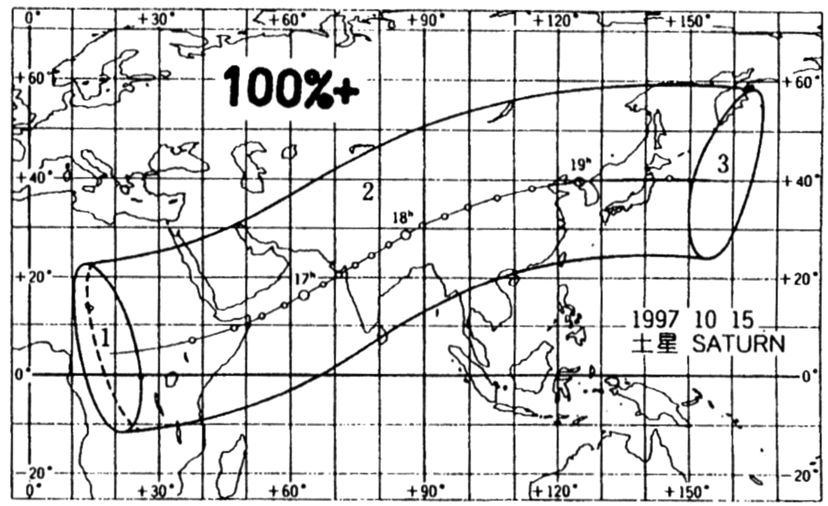
———Disappearance at Sunrise. In region east of the line, occultation begins after Sunrise.

日没出現線：この線上では日没に出現となり，この線から西側では日没前に食が終わる.

--------Reappearance at Sunset. In region west of the line, occultation ends before Sunset.

1997 年の惑星食図　世界時
LUNAR OCCULTATIONS OF PLANETS IN 1997　UT





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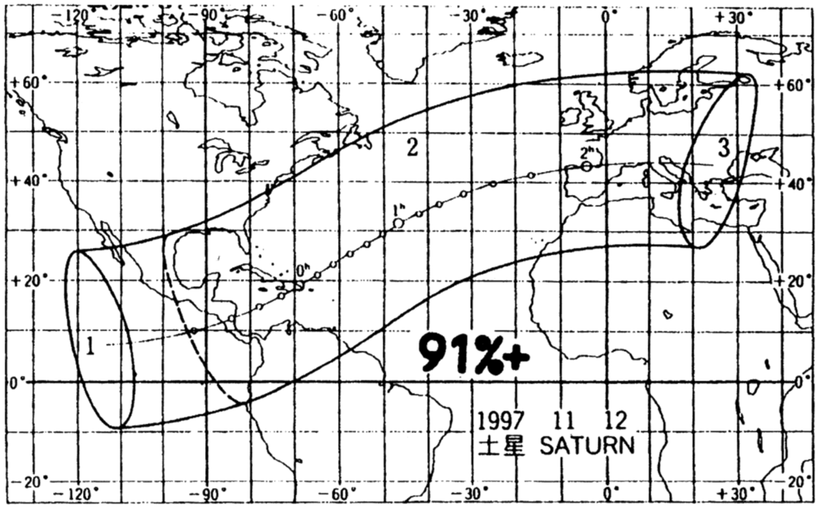
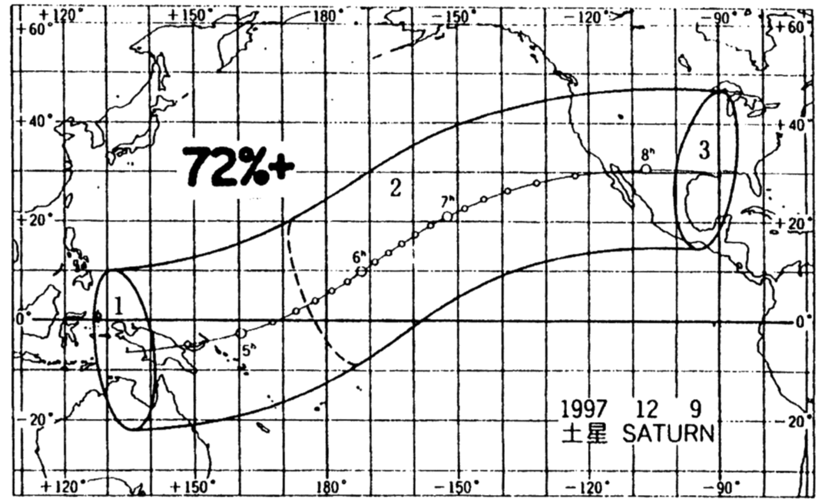
LUNAR OCCULTATIONS OF PLANETS IN 1997　UT





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————Disappearance at Sunrise. In region east of the line, occultation begins after Sunrise.

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--------Reappearance at Sunset. In region west of the line, occultation ends before Sunset.

IOTA's Mission

The International Occultation Timing Association was established to encourage and facilitate the observation of occultations and eclipses. It provides predictions for grazing occultations of stars by the Moon and predictions for occultations of stars by asteroids and planets, information on observing equipment and techniques, and reports to the members of observations made.

The Offices and Officers of IOTA

IOTA Online

The Occultation Information Line at 301-474-4945 is maintained by David and Joan Dunham. Messages may also be left at that number. When updates become available for asteroidal occultations in the central U.S.A., the information can also be obtained from either 708-259-2376 (Chicago, IL) or 713-480-9878 (Houston, TX). The IOTA WWW Home Pages are at **http://www.sky.net/~robinson/iotandx.htm** for lunar occultations and eclipses (maintained by Walt Robinson) and **http://www.anomalies.com/iota/splash.htm** for asteroidal occultations (maintained by Jim Hart).

Observers from Europe and the British Isles should join the European Service (IOTA/ES), sending a Eurocheck for DM 40,00 to the account IOTA/ES; Bartold-Knaust Strasse 8; D-30459 Hannover, Germany; Postgiro Hannover 555 829-303; bank-code-number (Bankleitzahl) 250 100 30. German members should give IOTA/ES an "authorization for collection" or "Einzugs-Ermaechtigung" to their bank account. Please contact the secretary for a blank form. Full membership in IOTA/ES includes the supplement for European observers (total and grazing occultations) and minor planet occultation data, including last-minute predictions, when available. The addresses for IOTA/ES are:

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Local Circumstances for Appulses of Solar System Objects with Stars	1	2	3	4	5
Planetary Occultation Supplement	1	2	3	4	5
Preliminary Occultation Manual (POM)	1	2	3	4	5
Western Hemisphere Grazing Occultation Supplement	1	2	3	4	5

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