Occultation Newsletter

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FROM THE PUBLISHER

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[1] Single issue at ¼ of price shown
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[5] Area "B" includes the rest of South America, Mediterranean Africa, and Europe (except Estonia, Latvia, Lithuania, and U.S.S.R.).

IOTA NEWS

David W. Dunham

Unless otherwise stated in the next issue, the next meeting of IOTA will be held on Saturday, November 12th, at the Lunar and Planetary Institute; 3303 NASA Road 1; Houston, Texas (just east of the Johnson Spaceflight Center and about 35 miles southeast of downtown Houston). The meeting will start at 9 a.m. and is expected to last all day, as previous meetings have. More information can be obtained from Paul Maley; 15807 Brookvilla; Houston, TX 77059; phone 713,488-6871. The agenda will include business (tax-deductibility of trips promises to be a hot item; see p. 201), status reports of IOTA's many observational, analysis, and software projects, and predictions and plans for future occultations and eclipses. On Sunday evening, November 13th, those staying in the area are invited to join an expedition for a spectacular graze of 3rd-magnitude Tau Sagittarii near Houston. The profile for this graze is more interesting than that for the November 30th Regulus graze, which in Texas is dominated by one very high mountain at central graze, making it hard to guarantee more than one D-R pair for any observer. I hope that the profile will be better farther west; a large expedition is planned in the San Francisco area, where a graze of 3.7-magnitude Kappa Geminorum will also occur a few nights earlier. More information about these grazes will be given in the next issue.

I will be attending much of the International Astronomical Union's General Assembly in Baltimore, Maryland, August 1-10, and hope to see some of our overseas members and subscribers there. Unfortunately, the meeting conflicts with the very favorable European Pleiades passage on August 5-6 and with the start of this year's IOTA/ES (ESOP VII) meeting in Czechoslovakia. The main interest in the IAU meeting will be Commission 20, where asteroidal occultations will be discussed. Robert Millis has expressed his desire to step down as chairman of Commission 20's working group on occultations.

My new office address was given in the January issue. My wife and I have a contract on a new home in a housing development about four kilometers from where we work. The house is more than half complete, and we expect to settle and move in August. I won't give the new address until we actually move, which should be before the next issue. We will keep the P.O. Box 7488; Siver Spring, MD 20907 through the end of the year, although we will visit that post office only about once a week after we move. During 1989, the P.O. box will be closed, with mail forwarded to our new address. Also this summer, Jim Stamm is planning to move to Tucson, Arizona, as will be announced in the next issue. After moving, his mail will be forwarded from Kentucky.

In early March, I attended the interesting Asteroids II Convention in Tucson, Arizona. Besides occultations, there were many interesting new results from radar, speckle, IRAS, and Viking observations. I was delighted to meet Jim Stamm and Dr. Wang Sichao, who coordinates occultation work in China. During much of March and April, I worked with Robert Millis at Lowell Observatory, to write a chapter on occultations for the Asteroids II book that is planned for publication by the University of Arizona Press late this year. The current version of our chapter was kept in a disk file on the Lowell VAX computer. I was able to download this file to our PC at home, make corrections and additions, and then send a modified version back to the Lowell VAX. My main job was to produce a list of all confirmed asteroidal occultation observations. I started from a running list of all occultations maintained by Paul Maley. New analyses of several events were needed. In a companion effort, I am spending much of May and June preparing an article on asteroidal occultation results for *Sky and Telescope*, now scheduled for their September issue. The analyses and checking of the observations of the 1983 May 29th Pallas occultation are now virtually complete (see p. 202), although they took much longer than expected, and we hope to distribute a manuscript of the paper about that event to co-authors before the end of June.

During June and early July, I plan to merge the XZ and ZZ catalogs, and use the updated XZ catalog to generate the data for 1989 IOTA graze predictions. I have already produced a preliminary file of 1989 graze data with the current XZ, for use only for making regional and hemispheric graze maps. I hope to merge the Canadian provincial boundaries with the world boundary database that I use for these maps. I have also been given a lead to data on Australian state boundaries.

During the last third of July, Prof. Wan Lai and another astronomer from Shanghai Observatory plan to work with me and Alan Fiala at the U. S. Naval Observatory to analyze both their and IOTA's videotapes of last September 23rd's annular solar eclipse.

This issue is being distributed in early June, for the June 12th Pleiades passage. The Moon will be only 4% sunlit then, so the passage will be visible only from the westernmost parts of North America. Since well less than half of *O.N.* readers live in the area of visibility, the chart and other information about it are being included only as a supplement to those living in the affected region. The passage will occur for most of North America, but in broad daylight for all but the far west. The Moon is too close to the Sun for daytime observation of occultations. On August 5-6, a very good Pleiades passage will occur in Europe and the Middle East, and again, a special supplement about it is being sent only to IOTA and IOTA/ES members and subscribers in those areas. The favorable September 1-2 Pleiades passage will be visible throughout North America, so an article about it is included in this issue. More information about that event will appear in my article in the August issue of *Sky and Telescope*. We hope to distribute the next issue of *Occultation Newsletter* near the end of September.

GRAZING OCCULTATIONS

Don Stockbauer

My goals as lunar grazing occultation report recipient for IOTA are as follows:

1. To provide a forum for the exchange of information through these articles;
2. To quality check the reports received and to request any needed clarifications;
3. To publish tabular summaries of each expedition's results; and
4. To maintain an independent repository of the reports.

In order to help IOTA accomplish these goals, please send a copy of your graze report to me at 2846 Mayflower Landing; Webster, TX 77598; U.S.A. (make a copy for yourself, of course). Sending a copy to ILOC in addition is very helpful; their address is: International Lunar Occultation Centre; Geodesy and Geophysics Division; Hydrographic Department; Tsukiji-5, Chuo-ku; Tokyo, 104 Japan. Data on diskette should be sent to ILOC ; if you prefer this medium, please send me a printout of your data file only. Total occultation data in any format should only be sent to ILOC, as I do not need it to produce this article.

This graze list is larger than normal due to the inclusion of reports sent by David Dunham from some of his old files. The ILOC entries are from their publication "Grazing Occultation Observations in 1978-1986"; expedition leaders were not specified.

Multiple expedition leaders may be given on the report. The graze table can accommodate a maximum of 17 characters (blanks included), so one cannot exceed this. Names should be separated by slashes; the first one listed will be considered the "primary" leader for the purpose of forming statistics. Who should be listed as a leader can become quite complex for certain grazes, and only a consensus among the participants can resolve such situations. I will include exactly what the person sending the report specifies for the 17 characters. An explanation of the roles of those listed can be included in my text.

The shifts of SAO 186964 on 9/30/87 and ZC 1836 on 1/11/88 were determined from predictions generated by Brian Loader of the Royal Astronomical Society of New Zealand (RASNZ). The plots are of very high quality, complete with explanatory notes directly on the profile. I am curious as to whether the prediction basis is the same as that of the U.S. Naval Observatory, so that the shifts might be directly compared. I thank Graham L. Blow, the director of the RASNZ, for sharing their Circulars with us; the mutual feedback benefits both organizations.

Col. J. E. S. Singh saw a miss of ZC 731 on 3/23/88 at Lucknow, India; thus the zero for the number of timings in the table. The zero for Richard Wilds' graze of ZC 555 at Moonlight, KS, represents a different situation. He occasionally saw the star through breaks in the clouds near central graze, but he did not see any actual contacts. This is useful information (the times of clouding and clearing were carefully noted), and a report should be made in such a situation. If a contact can be determined to a 5-second accuracy, then it may be counted as a timing.

My paper "How to Calculate a Lunar Grazing Occultation Shadow Shift" has a section concerning the correction of a profile to a location other than the point of closest approach. I have rewritten it to describe a method which is exact, rather than approximate, and can also be used to combine separate expedition results on a single ACLPPP profile. The original paper and/or the rewritten section are available from me upon request.

A few details concerning the filling out of graze reports are rather obscure, due mainly to inadequate explanation on the form. When the form is next modified, I have a few ideas on how to improve this. In the meantime, it would help me to produce a more complete table if the following conventions were to be used:

1. "PLACE NAME" is misleading; many observers repeat the city given in the address (the next line). It actually means the city closest to the place of observation. In rural areas, landmarks may be used. If the place name repeats the city which is listed in the address, I generally use the map name instead, unless it seems quite obvious to me that the person observed within his own town.

Date	V P	Star #	Mag	% Snl	CA	Location	# Sta	# Tm	S S	Ap Cm	Organizer	C	St	WA	b
1978															
0922		0729	7.2			Sadowara, Japan	2	2		20	I. L. O. C.				
1980															
0715		1487	1.3			Kurasiki, Japan	1	4		20	I. L. O. C.				
1981															
0130		2390	6.6			Kanonzi, Japan	3	6		20	I. L. O. C.				
1983															
0119		3480	7.3	20+	10S	Kingston, OH	1	2	2	25	Mark Allman			176	70
0819		2672	2.9	83+	-10S	Terry, MS	2	4	1	25	Benny Roberts			191	23
1001		079917	7.9	32-	13N	Jackson, MS	1	9	1	33	Benny Roberts			347	-39
1984															
0930		185716	7.4	40+	-0S	Henryburg, Quebec	1	3	1	20	Marc A. Gelinas				40
1986															
0120		0525	6.4			Iki, Japan	3	5		20	I. L. O. C.				
0228		2021	6.6			Kanbara, Japan	2	4		20	I. L. O. C.				
0417		080171	8.4	54+	9N	Nalinnes, Belgium	1	2	2	20	Jean Schwaenen			10	-62
0811		139432	8.1	31+	13N	Marshall Mt, NSW	1	4	1	25	Nick Kiceluk			14	1
0909		183232	7.7	28+	-1S	Windang, NSW	2	7	2	25	Nick Kiceluk			184	31
1112		3526	5.2	82+	12S	Watsonville, CA	1	6		15	Richard Nolthenius		1N	165	32
1207		146509	7.3	48+	15S	Pigeon Point, CA	2	4	2	15	Richard Nolthenius		3S	164	41
1210		0184	6.2	76+		Coventry, CT	1	2	3	11	Philip Dombrowski				
1987															
0406		079295	7.6	51+	14N	Brisbane, Q'land	1	4	1	40	Peter Anderson			15	-73
0505		080165	7.3	40+	14N	Innisville, Ont.	7	15	2	9	Brian Burke		0	14	-58
0507		098897	7.8	59+	15N	North Gower, Ont.	4	12	2	10	Brian Burke		5N	17	-42
0507		099251	7.6	68+	10N	Grembergen,Belg'm	4	15	1	11	Henk Bulder		0	13	-29
0508		1644	4.1	76+	13N	Dortmund, GFR	8	53	1		Guenther Neue		4N		-21
0514		2366	1.2	98-		Dubbo, N.S.Wales	3	22	1	20	David Herald				
0605		1712	3.8	61+	18	Socuellamos,Spain	2	4	1	8	Manuel Iglesias			20	-8
0803		2129	7.5	56+	18N	Bargara,Australia	2	9	1	20	Dennis Lowe		5S	18	44
0816		076041	8.3	46-	16N	Nilma, Australia	2	17	2	20	Nelson/Kruijshoop			344	-60
0929		185394	7.6	38+	12S	Bundaberg, Q'land	2	2	2	20	Dennis Lowe		6N	170	66
0930		186964	8.4	50+	9S	Christchurch,N.Z.	2	0	1	20	Brian Loader		25N	171	62
1029		188817	7.4	43+		Bethel Church, OK	2	5	2	20	Edward Vinson				
1103		1361	6.3	95+	12	Dinant, Belgium	2	4	2	15	Jean Schwaenen			169	-8
1106		0537	3.8	98-	0	Palafolls, Spain	2	4	2	10	Carles Schnabel			345	-53
1223		189971	8.3	12+	17	Le Roux, Belgium	1	4	1	25	Jean Schwaenen		10S	166	54
1988															
0111		1836	6.3	56-	15S	Waimakariri, N.Z.	1	4	1	20	Glenn Evans		5S	197	13
0111		1836	6.3	56-	15S	Buouham, Nw Zlnd	1	2	2	20	Lionel E. Hussey			197	13
0210		2109	6.1	55-	17S	Halloran Spr., CA	1	8	1	20	David Werner		5N	198	59
0221		109634	8.4	15+	4S	Otto, IL	1	8	1	25	Berton Stevens		0	173	-26
0222		0289	8.1	25+	2N	Hardin, TX	1	2	3	20	Don Stockbauer		1N	2	-43
0224		0536	5.4	45+		Denver, CO	1	2	2	20	Peter Young				
0224		0541	4.0	45+	0S	Moonlight, KS	3	24	1	6	Richard P. Wilds		0	180	-61
0224		0541	4.0	45+	-1S	Stilwell, KS	3	12	1	15	Robert Sandy		0	180	-61
0224		0541	4.0	45+	-4S	Corbin, KY	1	2	1	20	Jim Stamm		2S	183	-61
0224		0548	6.7	46+	5S	San Gabriel, CA	1	2	2	20	Gregory Lyzenga				-62
0224		0548	6.7	46+	4S	Lk. Arrowhead, CA	1	4	1	20	David Paul Werner		0	175	-62
0224		0555	6.8	46+	5N	Moonlight, KS	1	0	3	33	Richard P. Wilds			4	-61
0224		0555	6.8	46+	5N	Boicourt, KS	1	12	1	15	Robert Sandy		0	5	-61
0323		0731	5.9	34+	13N	Lucknow, India	1	0	1	6	J. E. S. Singh		>2S	11	-66
0325		078233	7.2	50+	12N	Mulvane, KS	1	5	2	15	Richard P. Wilds		0	13	-64
0326		1169	5.4	64+	15N	Lucknow, India	1	2	1	6	J. E. S. Singh		8N	17	-56
0419		076345	7.8	8+	14N	Blue Ridge, MO	1	2	1	20	Homer DaBoll		1N	6	-60
0423		1169	5.4	41+	14N	Silver Lake, KS	1	2	1	15	Richard P. Wilds		4N	15	-55
0425		1392	7.1	61+	16N	Lake Geneva, WI	1	9	1	20	Homer DaBoll		3N	19	-34

2. % Snl — This is the percent sunlit, plus a code of "+" for a waxing Moon, "-" for a waning Moon, or "E" for lunar eclipse.

3. C.A. — The cusp angle consists of both the angle and the code — "N" for north, "S" for south. Do not use the "position angle of cusp" given in the limit prediction's header; use the cusp angle listed in the body of the prediction for your expedition's specific longitude. The umbral distance is given instead during lunar eclipses.

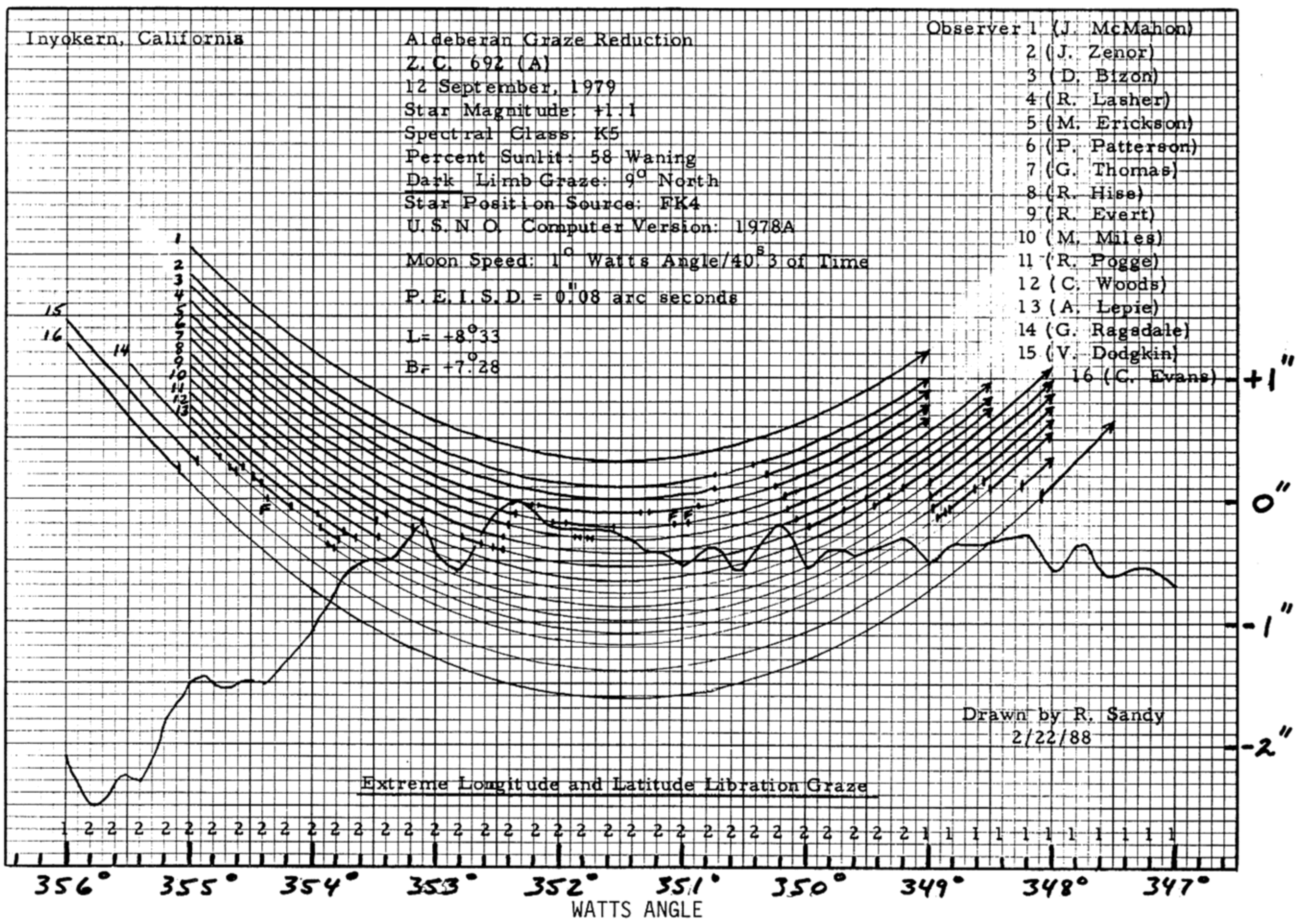
4. The shift is given to 0".1 (the scale at the left hand side of the profile is in arc seconds). Please indicate an "N" if the profile must be shifted north to explain the observations, or an "S" for south.

It is extremely important that the map used for final coordinate determination be accurate enough for the job. As far as I know, the only maps accurate enough for our purposes (± 100 feet or ± 30 meters for totals, ± 50 feet or ± 15 meters for grazes) are those produced by the USGS, for the U.S.A. Presumably, maps of adequate accuracy are also available for other countries. As an example, the Texas Highway Dept. maps cannot be used to scale coordinates, since they print a disclaimer that they are for internal departmental use only, that they have no official status, and are of limited accuracy. I have encountered errors on these maps of 0.1 mile or more, so what they say is true. They are excellent, however, for showing highway development more recent than many USGS maps.

The graze at Hardin, TX, on 2/22/88 had perhaps the worst seeing I've ever encountered in my life. In spite of the large oscillations of the star's intensity, I was able to tell when it finally disappeared. While driving home from the site, I noticed that an operating wood-burning chimney had been directly under my line of sight, hidden behind an intervening clump of trees!

Corrections: In *O.N. 4* (6), p.142, the graze of ZC 2366 observed 7/8/87 at Lyndhurst and Geelong had a cusp angle of -3°S. For the expedition at Lyndhurst, the number of stations and observers should be reversed. The expedition for the graze of SAO 76401 at Nilma, Australia, should have been listed in the last table; Alfred Kruijshoop noticed it was missing, and I tracked it down in my files. My thanks to him for all these corrections; please always check the list carefully to ensure that your own results are listed, and listed accurately.

Good luck; I hope to hear from you soon.



A 55-OBSERVER CLOUD-OUT

Henk Bulder

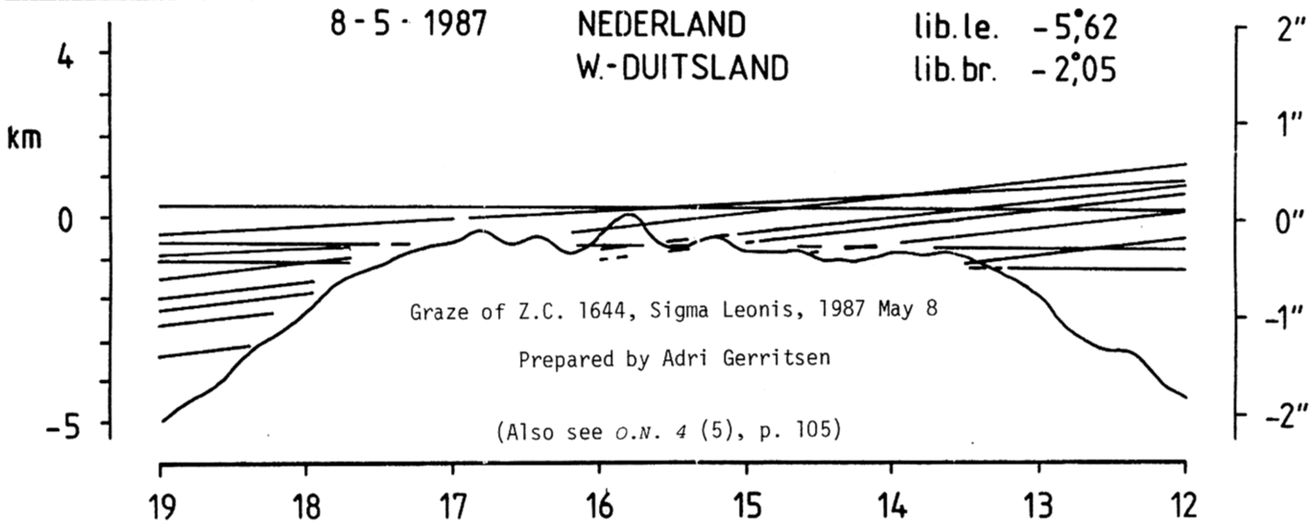
What seems to be a new 'clouded-out' record came about in Belgium, near Deinze, where 55 Belgian, French, Dutch, and Polish observers gathered on January 27th, between 15:00 and 16:00 U.T., to observe no less than three grazing occultations of Pleiades stars, including a dark-limb graze of Alcyone. Telescopes ranged from 6 to 28 cm diameter, in a wide variety of types.

Headquarters were set up at a typical Belgian tavern "De Zandvlooi" (in English, "The Sandflea"). Arrangements were made for time signals to be transmitted by a local radio amateur. All stations were marked by poles with aluminum numbered plates. Local authorities were informed, and they distributed a special bulletin to all the residents in the neighborhood stating that street lights would not be lit on the 27th of January, in connection with an important astronomical project. They all were asked to stay out of the area with lights, and not to use car main headlights.

Although the weather had been fine during all of the morning and part of the afternoon, it became clear (oh what a paradox) that there would be no chance at all to observe any of the Pleiades occultations, due to clouds coming from a Spanish rain front that speeded up towards the north.

At this time, the lack of a back-up expedition was painfully felt. We had tried to coordinate work with colleagues in Germany, but we did not receive any specific information about expeditions planned there. Although the weather prospects for areas east of Belgium were not good, they were better than ours, and a few of us would have been willing to take a gamble by travelling east, if we could join local observers. This might have worked, judging from the success reported on p. 169 of the last issue. We hope that there will be better international coordination for future favorable European grazes.

I should like to address my compliments to Pierre Vingerhoets and his family for the outstanding organization of this European expedition. Although we were clouded out, and drenched by rain showers, we had a great opportunity to meet fellow observers from several parts of Europe, while enjoying the taste of the famous Belgian beers.



Graze of Z.C. 1644, Sigma Leonis, 1987 May 8

Prepared by Adri Gerritsen

(Also see *O.N. 4* (5), p. 105)

VIDEO DATA REDUCTION

Peter L. Manly

There are now several observers making video observations of occultations. Generally, the observer reduces the data from his own tape, but recently David Dunham has supplied several tapes for further data reduction. Several techniques have been developed to refine the data on the tapes, but these techniques require that the data be taken in a certain way in order to be useful. Two devices have been developed for secondary data reduction.

The first is a bar/time inserter. The original tape can be duplicated and during duplication, digital time is superimposed on the original video data. The displayed time is synchronized to the audio WWV beep on the original tape. If there is no WWV beep or the audio is of poor quality then a white horizontal bar whose length is proportional to the audio intensity can be superimposed at the top of the picture. Individual audio ticks can thus be seen when the duplicate tape is played back one frame at a time. The audio on the tape, however, must be clear to synchronize to WWV. In most of the cases we have seen, the observer talks over the minute mark. Ideally, if the video recorder is capable of stereo operation, the WWV signal should be recorded on one channel with a direct electrical connection to the WWV receiver. That way, extraneous noises such as other observers, dogs barking, and cars whizzing by will not wind up on the tape. Record your voice comments on the other channel.

The second device is called a box digitizer. In this circuit, a small square box is superimposed over the star of interest. The box is positioned with a joystick from a video game. The circuit measures the peak video amplitude (star brightness) within the box for each video frame (actually it makes two measurements per frame). This video amplitude is converted to an eight-bit digital number and sent to a computer. The computer takes these values and then records them. Slow star fades and multiple flashes can easily be documented this way. See Fig. 1.

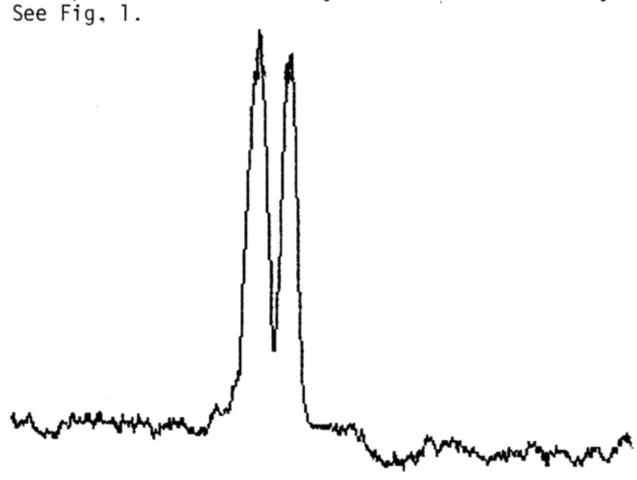


Fig. 1. A double flash from David Dunham's recording of the β Tauri graze at Genoa, Texas, on 1987 October 12. The total time shown is 13.9 seconds.

During the digitizing process, the operator occasionally slews the box off the star to record the background sky brightness. This is useful in determining the signal-to-noise ratio which enables us to determine whether the event is a seeing effect or a real occultation. Now for the problems: In many of the tapes, there is no sidereal telescope tracking. Thus the star maves across the screen until the observer resets the telescope position. Other than the fact that an occultation during the telescope-pointing adjustment may be missed, this causes the data reducer to chase the star all over the screen with the box position joystick. Some of you may like playing video games like this, but it gets a bit tedious, requiring multiple data-reduction runs to make sure all the video gets sampled. In addition, most TV cameras have much different sensitivity at the center than at the edge. I've seen tapes where the star fades slowly because its image is moving to the less-sensitive edge, not because of a slow occultation. Similarly, in one tape a slow fade was suspected but could not be verified because the star wandered all over the camera field of view and we have no idea what the relative sensitivity is from point to point for that camera.

A second problem is bumping the telescope and vibrations due to wind. While the star may remain visible under slight motion, the digitizing box has to follow the star. For rapid motions like a bumped telescope, the only solution is to make the box larger. Unfortunately, this decreases the sensitivity of the digitizer. Ideally, the smallest possible box gives the best results. For some tapes, where the operator is constantly fiddling with the position of the star, moving it a little up, then a little to the left, then down a bit, the data reduction people can't track all the motions. If you must move the star, announce it on the tape before you do it. Then do it slowly and smoothly. When you get it near where you want it, stop. Leave it alone, and don't try to make a few fine adjustments.

In summary, keep the star tracking near the center of the field of view. You may let it drift a little (up to about $^1/_3$ of the distance to the edge), then bring it back to near the center in one smooth, previously announced motion. Then don't touch it. Be quiet around the microphone, and try to get good quality audio of WWV. Lastly, remember to announce who you are, what the date is, and what the event is. I have a couple of real interesting tapes of occultations where I have no idea who the observer was, or when the event occurred.

REPORTS OF ASTEROIDAL APPULSES AND OCCULTATIONS

Jim Stamm

If you do not have a regional coordinator who forwards your reports, they should be sent to me at: Rt 13 Box 109; London, KY 40741; U.S.A. Names and addresses of regional coordinators are shown in "From the Publisher," on p. 189.

Peter Manly has designed and built a reaction-time tester which simulates a star going off, then on. The observer speaks "out" or "in," and a clock records the delay between the event and the observer's voice. Manly has used the device on several grazes, and it works well in the field. Results have confirmed his suspicions that PEs for disappearance and reappearance are not the same. If anyone is interested, write to Pete at 1533 W. 7th St.; Tempe, AZ 85281; U.S.A. [Ed: A similar device, but with the clock stopped by pressing a button, has been built by the Milwaukee Astronomical Society. You could obtain further information through Frank Roldan; 5585 Balsam Ct.; Greendale, WI 53129; U.S.A.]

While I was 'on the road', the University of Arizona and the Amphitheater School District of Tucson made their resources available to me so that I could get my last report out on time. I wish to thank them for being so gracious.

I have received a number of reports since the 1987 — First Half Summary was published in the last issue of *O.N.* The new information is reflected in Tables 1 and 2 below. Table 1 lists the 1987 date, minor planet, occulted star, IDs of successful observers, and a reference to any notes. Table 2 lists the observer's name, nearest town to location of observation, state or country, organization through which the report came, and the total number of observations made in the period. References are to those notes that were published in *O.N. 4* (7), 161-164.

Table 1. Additional and revised entries; observed asteroidal occultations and appulses; Jan-Jun 1987.

Date	Minor Planet	Cat.	Star	Obsrvrs & Ref.
Jan 25	30 Urania	AGK3	+17°0955	SwMpMfSsSv 3
Apr 11	944 Hidalgo	SAO	254746	Lo
Apr 28	2060 Chiron	A	1839319	Ht
Apr 29	1264 Letaba	AGK3	+04°2799	LdSi
May 22	175 Andromache	SAO	146511	HsAz
May 23	24 Themis	SAO	159402	HtAn
May 27	197 Arete	AGK3	+16°1175	HtNlSc
Jun 13	1214 Richilde	SAO	182379	Gv
Jun 14	615 Roswitha	AGK3	+05°0115	AnSc
Jun 24	1902 Shaposhnikov	AGK3	+06°1540	AnSc
Jun 28	519 Sylvania	AGK3	+07°0248	Sc
Jun 29	508 Princetonia	AGK3	+04°1594	HtAnScRb
Jun 29	570 Kythera	SAO	187567	HtAnSc

Table 2. Additional and revised entries; observers and locations of events; Jan-Jun 1987.

ID	Name	City and State or Country	Group	No.
Al	Allen, Bill	Christchurch, New Zealand	RASNZ	1
An	Anderson, Peter	Melbourne, Queensland	RASNZ	12
Gv	Grant, Ian	Kingston, Tasmania	RASNZ	1
Hs	Hutcheon, Steve	Redcliffe, Queensland	RASNZ	1
Ht	Hutcheon, Steve	Sheldon, Queensland	RASNZ	12
Ld	Loader, Brian	Blenheim, New Zealand	RASNZ	1
Lo	Loader, Brian	Christchurch, New Zealand	RASNZ	2
Rb	Roberts, Steve	Canberra, A. C. T.	RASNZ	1
Ss	Sato, Isao	Tokyo, Japan		1
Sv	Sato, Tatsuo	Tokyo, Japan		1
Sc	Smith, Charlie	Woodridge, Queensland	RASNZ	15

We have received reports on two positive events so far this year. David Dunham will publish a complete analysis of the Australian event later.

(121) Hermione and SAO 186959, Mar. 8, 1988. Goffin's nominal prediction of this event placed the path over Victoria and New Zealand's South Island. Rob McNaught obtained two update plates which placed the event to the north. Observers were notified and the three leading asteroidal occultation observers, S. J. Hutcheon, P. E. Anderson, and C. Smith, were rewarded with 5-second extinctions. They were all located at Brisbane, which was between the two update paths.

(466) Tisiphone and SAO 137000, Apr. 3, 1988. Edwin

and Steve Lurcott, observing at West Chester, Pennsylvania (Lat. 40° 00' 40" N, Long. 75° 36' 19" W, 180 meters), recorded an occultation in twilight! Extinction was from 23:56:44.6 to 23:57:06.5. Clouds hindered observers throughout the area, but Edwin had practiced finding the star in twilight during the previous week, so they were successful on the event night.

Negative observations of earlier events which were sent elsewhere, and just received:

(83) Beatrix and SAO 210240, June 15, 1983. Greg Lyzenga on Mt. Baldy, California.

(510) Mabella and SAO 115666, Jan. 15, 1986. (*O.N. 4* (2), 26). Phil Somers at Colorado Springs, CO.

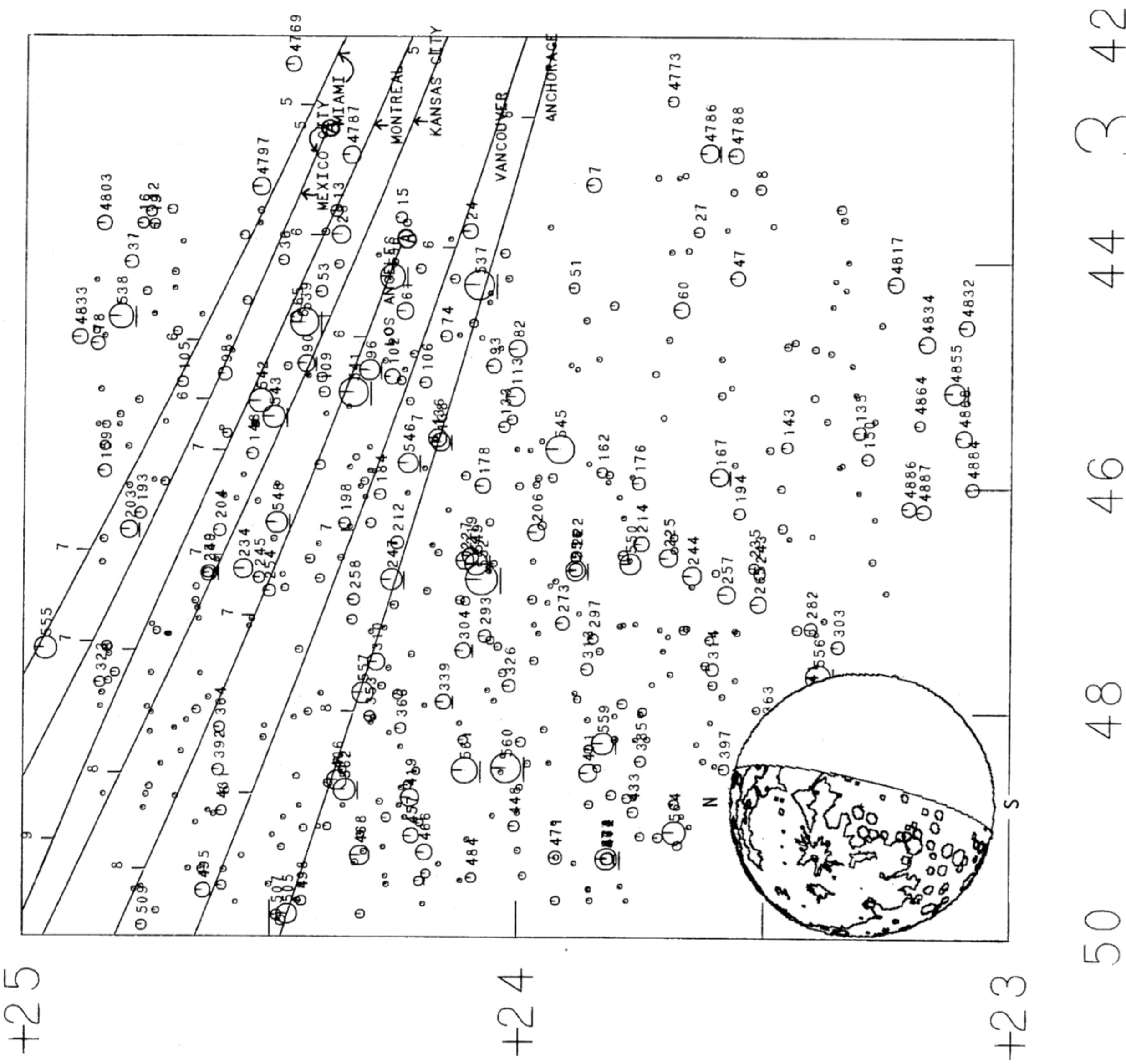
(1021) Flammario and AGK3 +13°1334, Mar. 22, 1986. (*O.N. 4* (2), 26). Francis Graham at East Pittsburgh, Pennsylvania.

THE PLEIADES PASSAGE OF 1988 SEPTEMBER 2

David W. Dunham

Around 6^h U.T. of Thursday night-Friday morning, September 1-2, the waning gibbous Moon will cross the northern part of the Pleiades cluster for viewers throughout North America. For general information about observing dark-limb reappearances of Pleiads, read *O.N. 4* (5), p. 99. This time, the Moon will be 59% sunlit, so there will be less glare than for the event last September.

Bad weather hampered many observers of last February's passage, especially in the eastern and northwestern states. But most of the Midwest had a good view, and Wayne Osborn, at Central Michigan University, photoelectrically recorded the disappearance of 4.4-mag. Taygeta (Z.C. 539). The trace showed step events, confirming the star's suspected close duplicity, which was noted visually by Robert Sandy and Harold Povenmire during a graze of Taygeta in August, 1969. Osborn is interested in high-time-



resolution data of this event obtained at other locations, so that the separation and position angle might be uniquely determined. In September, the star will be occulted throughout the contiguous 48 states and southern Canada. Recording reappearances photoelectrically is tricky; video records may be more successful.

The apparent-place chart of the Pleiades shows the topocentric paths of the Moon's center for several cities, like the one described on p. 158 of the last issue. The Moon diagram, produced by Bob Bolster, using a slightly modified version of John Westfall's MOONVIEW program, is oriented with north up. The p.a. of the north cusp will be 347° and the p.a. of the center of the bright limb will be 77°. In their August issue, *Sky and Telescope* will publish a less-detailed chart, and event times to mag. 8.5 for several cities.

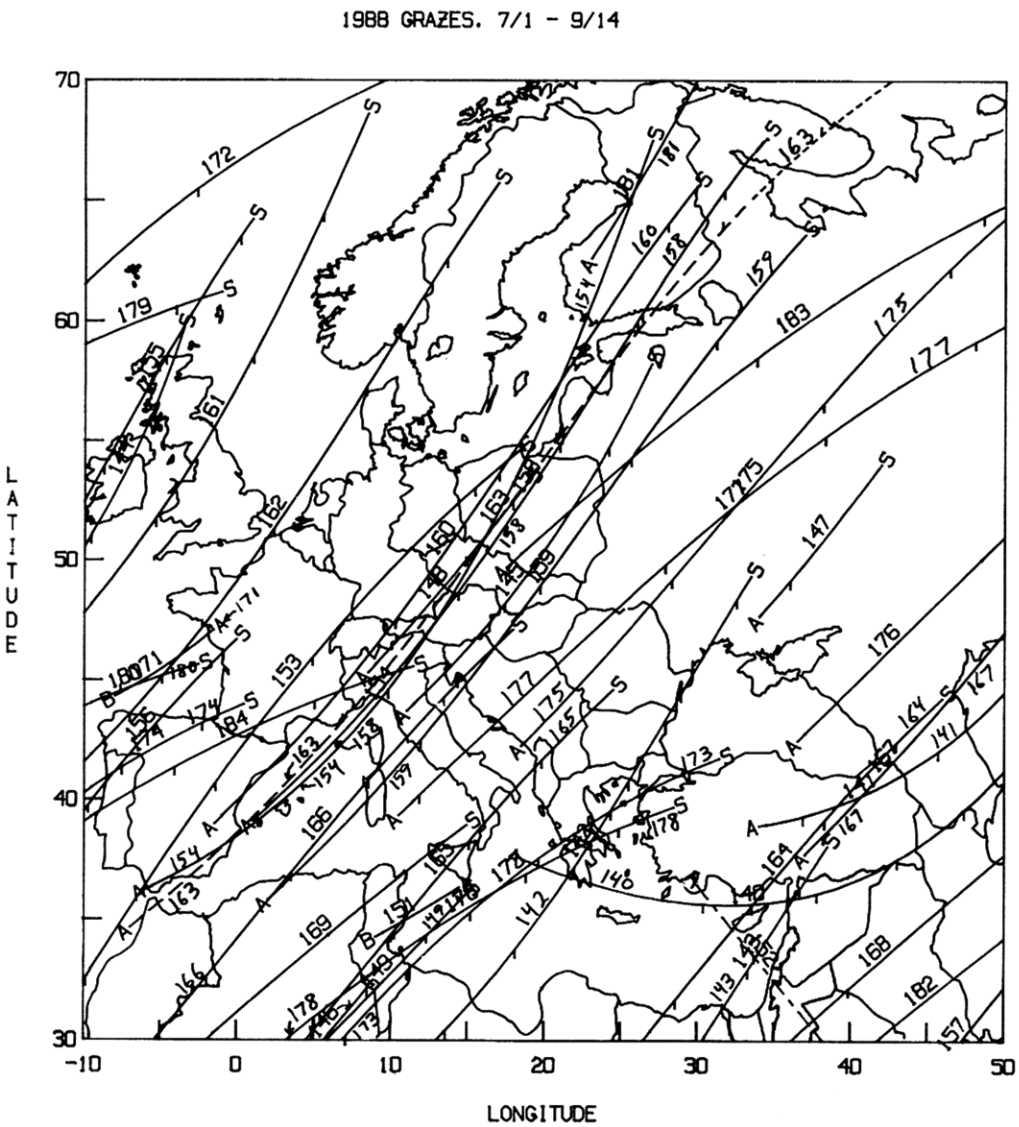
Northern-limit grazes occur on the dark limb near the north cusp. The paths of seven grazes of stars brighter than mag. 7.5 are shown on the maps in the RASC *Observer's Handbook*.

For grazing occultations, we expect northern limits to shift north by 0".3 to 0".4 (or about 0.5 to 0.7 miles on the ground), on the average, as they did last summer for waning-phase grazes. The IOTA occultation line, 301,495-9062, will be used to exchange expedition information; please phone in your plans. Also please contact me soon if you want detailed USNO total occultation predictions for planned graze sites. More information is in *O.N. 4* (7), 158.

EUROPEAN GRAZING OCCULTATION SUPPLEMENT FOR 1988

David W. Dunham

The paths for nearly 270 grazing occultations of stars as faint as magnitude 7.5 that are predicted to occur in Europe and nearby areas during 1988 are shown on six maps that were distributed with the last issue of *O.N.* to members of the European Section of IOTA. The format of the maps, and their corresponding tables, is virtually the same as that for IOTA's hemispheric grazing occultation supplement for either 1987 or 1988.



The main differences with the maps are their larger scale, the 10-minute interval between tick marks, and the compression of the longitude scale scale by the factor of the cosine of 50°, the middle latitude of the maps. The tables have four additional columns for double stars: MAG1 (magnitude of the primary star), MAG2 (magnitude of the secondary star), SEP (separation in arc seconds), and PA (position angle in degrees). If the star is triple, information about the third component is given on a second line, which is blank except for the last three columns.

The map, and associated table, covering July 1st through September 14th, are reproduced here. Note the good Pleiades passage on August 5-6; it will be much better than the one a month later in North America. Europeans who do not already have the European graze supplement can obtain a copy from IOTA/ES.

Others can request a copy from IOTA, at the address given in the masthead, free for IOTA members (although a SASE with 2-ounce postage from members in the U.S.A. would be appreciated) and costing $1.00 for others. Detailed predictions for these grazes can be obtained from: Hans-Joachim Bode; Bartold-Knaust Strasse 8; 3000 Hannover 91; German Federal Republic; telephone 511,424288 or 424696. For most grazes in regions I, U, and Z, Bode has information for computing profiles, but for most events outside this area, it will usually take more than a month to obtain data needed for generating a profile from the U. S. Naval Observatory.

1988 GRAZES, 7/1 - 9/14, EUROPE

NO.	YEAR	MO	DAY	USNO	SAO D	MAG	%SNL	L	W.U.T.	LONG	LAT	STAR NAME	MAG1	MAG2	SEP	PA
140	1988	JUL	2	3190	164644J	3.0	87-	N	20h 52m.6	35°	36°	DENEB ALGEDI-DELTA CAP.				
141	1988	JUL	4	3470	146765	7.0	68-	N	21 8.1	42	41	34 G. PISCIUM				
142	1988	JUL	6	64	109238	6.6	55-	N	0 38.8	24	39	116 B. PISCIUM				
143	1988	JUL	7	196	923880	6.9	43-	N	1 31.3	35	34	235 B. PISCIUM	7.4	8.0	0″.44	109°
144	1988	JUL	7	203	92407	6.9	43-	N	2 9.1	-7	55	241 B. PISCIUM				
145	1988	JUL	9	X 4031	75715	7.4	23-	N	0 25.0	19	50					
146	1988	JUL	10	X 5382	76472	7.5	14-	N	4 5.4	7	31					
147	1988	JUL	10	X 6319	76841	7.5	8-	N	23 51.1	39	51					
148	1988	JUL	11	746	76880A	6.8	8-	N	1 44.0	14	49		6.8	8.3	20.5	205
149	1988	JUL	11	756	76941	6.5	8-	N	3 21.7	11	33	38 B. (AURIGAE)/TAURI				
151	1988	JUL	23	2174	183269K	6.4	68+	S	22 15.0	12	35		7.1	7.1	0.03	0
152	1988	JUL	24	2287	183987W	3.0	75+	N	15 35.3	35	33	PI SCORPII	3.0	12.2	50.4	132
153	1988	JUL	31	3307	165134V	4.9	94-	N	2 9.6	5	46	SIGMA AQUARII	SPECTROSCOPIC			
154	1988	AUG	2	145	109623	6.7	70-	N	22 42.8	11	46	180 B. PISCIUM				
155	1988	AUG	3	166	109696	6.9	68-	N	2 6.7	-5	59	198 B. PISCIUM				
156	1988	AUG	5	438	756710	6.7	45-	N	4 9.3	-5	43	134 B. ARIETIS	7.4	7.5	0.5	261
157	1988	AUG	5	538	76137V	5.6	36-	N	23 43.5	48	31	18 TAURI	SPECTROSCOPIC			
158	1988	AUG	5	539	76140X	4.4	37-	N	23 40.1	20	54	TAYGETA (19 TAURI)	4.6	6.1	0.01	0
159	1988	AUG	5	542	76159	5.8	36-	N	23 53.4	21	50	ASTEROPE (21 TAURI)				
160	1988	AUG	6	543	76164K	6.5	36-	N	0 0.8	15	51	22 TAURI	7.3	7.3	0.1	0
161	1988	AUG	6	548	76183K	6.7	36-	N	0 35.6	-1	57		6.8	9.8	0.3	173
162	1988	AUG	6	X 4902	76194	7.5	36-	N	0 38.2	4	52					
163	1988	AUG	6	552	76199K	3.0	36-	S	0 13.7	18	53	ALCYONE (ETA TAURI)	3.0	4.6	0.03	207
164	1988	AUG	6	555	76206	6.8	36-	N	0 56.2	37	38					
165	1988	AUG	6	571	76272J	6.9	35-	N	2 19.3	15	38					
166	1988	AUG	6	574	76286K	6.8	35-	N	2 34.7	7	39		7.6	7.6	0.1	90
167	1988	AUG	6	701	76682G	6.5	27-	N	22 9.6	44	42		7.1	8.3	4.1	192
														8.3	0.05	0
168	1988	AUG	9	X 9481	78580C	7.4	11-	N	0 38.4	43	34		7.4	10.3	29.3	135
169	1988	AUG	9	1035	78710X	6.8	10-	N	3 31.1	7	35		7.6	7.6	0.12	90
171	1988	AUG	21	X22579	184612	7.4	62+	S	20 59.5	-5	46					
172	1988	AUG	30	105	109474	4.6	90-	N	2 32.5	0	67	DELTA PISCIUM				
173	1988	SEP	2	518	759990	5.9	61-	N	2 19.6	19	37	7 TAURI	6.6	6.7	0.62	0
174	1988	SEP	2	X 4688	76046C	7.5	60-	N	4 44.9	-5	42					
175	1988	SEP	3	797	77121J	6.3	42-	N	21 54.6	35	54	354 B. TAURI				
176	1988	SEP	4	X 8734	78191	7.4	32-	N	21 41.9	44	47					
177	1988	SEP	4	X 8907	78291	7.5	31-	N	23 39.6	34	53					
178	1988	SEP	5	996	78440V	6.8	30-	N	2 47.8	16	36	228 B. AURIGAE	7.5	7.5	0.03	275
179	1988	SEP	5	X 9275	78480	7.5	29-	N	4 34.1	-6	60					
180	1988	SEP	5	1008	78524	5.0	29-	N	5 22.4	-6	45	49 AURIGAE				
181	1988	SEP	5	1089	79142	6.8	23-	N	21 28.8	27	66					
182	1988	SEP	5	1105	79241	6.5	23-	N	22 59.5	46	32	134 B. GEMINORUM				
183	1988	SEP	5	X10805	79243	7.4	22-	N	23 32.5	38	60					
184	1988	SEP	6	1131	79405	7.2	21-	N	4 4.4	1	43					

LOCAL TIMES AND POSITION ANGLES FOR PLANETARY OCCULTATIONS

David W. Dunham

For occultations of stars by major planets, observers want to know the predicted times of disappearance and reappearance for their locations; a knowledge of the associated position angles is also useful. But only times and distances of closest approach, and central occultation durations, are given in the IOTA predictions. If the planet is assumed to be spherical, the closest approach data can be used with the central duration and the planet's diameter to calculate the desired quantities using the formulae below. Local U.T. and distance of closest approach, taken from the local circumstance/appulse predictions distributed by Joseph Carroll to IOTA members, should be used.

From the list of predicted planetary occultations published in *O.N.*, obtain the fllowing quantities:

D = diameter of planet in kilometers
PAm = position angle of motion
DURc = central occultation duration in seconds.

Calculate

R = D/2 = radius of planet in kilometers.

From the local circumstance predictions, obtain:

d = distance of closest approach in km
UTc = Universal Time of closest approach.

If the absolute value of d is greater than R, there will be no occultation at your location – only a close miss – and you should not attempt any of the calculations below. If there will be an occultation, calculate

theta = arc sine (d/R).

Then, the position angles of disappearance (PAd) and of reappearance (PAr) can be found:

PAd = PAm - theta if 0° < PAm < 180°
PAd = PAm + theta if 180° < PAm < 360°

PAr = PAm +180° + theta if 0° < PAm < 180°
PAr = PAm +180° - theta if 180° < PAm < 360°.

The local duration, dur, is then

dur = DURc × cosine(theta)

(divide dur by 60 to express it in minutes rather than seconds) and the Universal Times of disappearance (UTd) and of reappearance (UTr) are then

UTd = UTc -dur/2
UTr = UTc + dur/2.

As an example, calculate the data for the occultation of 136 Tauri (SAO 77675) by Venus on May 11th, as seen from Sandro Baroni's observatory in Milano Ovest, Italy, at longitude 9° 7' 2" east, latitude +45° 27' 19", height 138 meters. From pages 172 and 173 of the last issue of *O.N.*, D = 12220 km, PAm = 96°.3, and DURc = 2573 seconds. From the local circumstance predictions, d = -5308 km and UTc = 19^h 44.1^m. Then R = 6110 km and theta = -60°.3. The position angles are then PAd = 156°.6 and PAr = 216°.0. dur = 21.2 minutes, so UTd = 19^h 33.5^m and UTr = 19^h 54.7^m.

Since polar diameters are often used in the predictions, the local duration, dur, should be increased by the fraction, equatorial diameter divided by polar diameter (which assumes that the planet's equator is parallel to PAm). But this difference is not significant considering star position errors.

The position angle of the center of the planet's bright limb (PACBL, or the direction to the Sun) can be looked up in the *Astronomical Almanac* (or calculated with Floppy Almanac, or inferred from PAm and comments about graze cusp angle sometimes given in the notes for individual events in *O.N.*). Cusp angles can be derived by comparing PACBL with PAd and PAr.

LOCAL CIRCUMSTANCES OF ASTEROIDAL OCCULTATIONS

Leif Kahl Kristensen

The lists of asteroid occultations in *O.N.* now state all the information which determine the ground tracks. The critical quantities are the geocentric distance of closest approach (s), and the corresponding Universal Time (T); for the other quantities approximate 4-figure computations are sufficient. If the Earth did not rotate, then the ground track would be determined by s alone. The velocity of the shadow over the ground is in general much larger than the velocity due to the rotation of the Earth, so s will be a more important quantity than T, as will also be illustrated here by an example. Last-minute predictions concentrate on a determination of s, and concise last-minute information should always state s and maybe T.

A program for a TI-66 programmable pocket computer is conveniently used for the selection of events and the computation of their local circumstances. We first select a site which can be easily located on ordinary maps (here -10° W and 56° N will be used) and we assume that the event will be central at this site, and compute the necessary value of s. The wanted value should then be within 1"-2" of the long-term predictions for the event to be of interest in the particular region.

The program contains data registers R21-R29 which are constant:

R21 Greenwich sidereal time at Jan 0.0
22 365.2422 days in year
23 Geographic longitude west of Greenwich (here -10°)
24 cos ϕ } ϕ is geographic latitude, here +56°.
25 sin ϕ
26 Velocity (km/s) corresponding to the daily motion 1°/d at the distance Δ = 1 a.u.
27 Vertical distance to Earth axis as seen at distance 1 a.u. and expressed in sec. of arc. PQ_2 in the figure from *Astron. Almanac 1987* page K13.
28 Distance from crossing of vertical with axis to the equator. OQ_2 in the same figure as above.
29 The eastward velocity in km/s due to the rotation of the Earth.

For each individual event, the data are entered in registers R13-R20. The numerical example refers to the occultation on 1988 Sept. 16 by (415) Palatia. The following data are by courtesy of D. W. Dunham:

R13 Day in year (Sept. 16 = 260, leap year)
14 T in days ($0^h35^m.2 = {}^d.02444\cdots$)
15 α_{app} (°) ($6^h53^m.8$ = 103°.45)
16 δ_{app} (16°33' = 16.55)
17 daily motion °/d, here 0.489 °/d
18 Position angle (apparent) of motion P.A.= 94°.9
19 geocentric distance Δ = 2.033 a.u.
20 Diameter of the assumed spherical planet D = 92 km.

From the assumption that the occultation is central at the time t (which is entered in the display) program A performs essentially a parallax computation and computes the closest approach s and the time difference t-T and stops by R/S at line 131. The difference t-T was added to R14, stored in R03 and shown in the display. R04 gives the computed s (in sec. of arc) and we may check sin h in R09 to see whether the altitude h is positive and the star above the horizon. Usually we may assume that the long-term predicted T is accurate enough for a computation of the time t of the event. This is found by iterations pushing button A 1 or 2 times, conveniently starting with t_0 = RCL 14:

t_0 = $0^d.0244444$ (RCL 14)
t_1 0.0229066
t_2 0.0229063

When t is obtained the computations are continued by R/S. The display finally gives the major axis 2a = 389.93 km of the shadow ellipse (minor axis is 2b = D = 92 km). The other local circumstances are stored in R00-R12:

R00 parallactic angle. P.A. of zenith
01 h (°) altitude of star, no refraction.
02 Az (°), azimuth of star, reckoned from north through east
03 t, time of event in days, assuming that T in R14 is correct.
04 s", closest geocentric approach, in sec. of arc.
05 intermediate result of no interest
06 width of occultation zone in km.
07 direction of motion (bearing) of the shadow, from north through east.
08 velocity (km/s) of shadow
09 sin h
10 sin Az
11 cos Az
12 hour angle H.A. in degrees.

The actual contents after finishing the computations are copied at the end of the program, Table 2.

That T may be considered definitive is illustrated by changing it by $\pm 10^m$ corresponding to the quite impossible error $\pm 12''.2$:

T	t	s
$0^h25^m.20$	$0^h22^m.98$	$-3''.233$
0 35.20	0 32.99	-3.203
0 45.20	0 42.99	-3.173

That errors of order 12".2 in T correspond to 0".03 in s indicates the dominating influence of the latter on the location of the track.

We use a sign convention for s which makes s positive for retrograde events on the Northern Hemisphere. If s increases, the occultation zone will move to the right hand side in its direction of motion (in direction of bearing (R07) + 90°). In the present case the predicted value is $s_{pred.} = -3''.00$. The angular diameter D" = 0".062 corresponds to the width, 138 km, of the zone, so the prediction shifts the track 138×0".20/0".062 = 445 km in the direction 64°.7 + 90°, e.d. the predicted track is south of our central site. The direction between observers on the same chords is 64°.78 and equal times correspond to the conjugated diameters; in the present case they may be found to be 91°.70. The planning and a fast preliminary reduction of the observations may conveniently be done on the basis of ordinary (conformal) maps — especially the checking of the coverage of the observers in the 138-km-wide possible occultation zones. Local circumstances can be obtained from the data given here to large distances — more than 500 km — from the chosen central site. For instance, for each 111 km the observer moves in the direction Az towards the star, its altitude increases 1°.

For the preparation of observations and the selection of the site, observers are interested in the local circumstances well in advance, and by comparing the predicted with the wanted value of s they can obtain an idea of the likelihood of the event.

[Ed: Table 1, the TI-66 program, and Table 2, the results of the computation, are not included here as a majority of *O.N.* readers probably do not have this calculator. A copy will be supplied upon request to IOTA, address in the masthead; a SASE would be appreciated. European observers might write to Dr. Kristensen at Institute of Physics; University of Aarhus; DK-8000 Aarhus C; Denmark, for a copy. It would be useful if someone could write this program in Basic for use on a PC, or simply list the formulae used so that others could write programs for different calculators.]

OCCULTATIONS BY POSSIBLE MATERIAL IN SATURN'S OUTER MAGNETOSPHERE

R. Vasundhara

[Ed: Extracted from *J. Astrophys. Astr. 9* (1988), 63-65]

Anomalous dips in low energy plasma ion density in regions of Saturn's magnetosphere around 14 and 19 Saturn radii (R) were measured by Voyager 1, 2, and Pioneer 11 spacecrafts. Lazarus, Hasegawa & Bagenal (1983) suggested that these density dips may be arising due to absorption by long-lived particulate or gaseous material in the equatorial plane of the planet. Baron & Elliot (1983), from their CCD imaging of the region of magnetosphere between 10-35R, set an upper limit of +22 mag arcsec^{-2} for material distributed over a region larger than the 3 arcsec seeing disk in the *I* band. However such an imaging needs to be repeated at the time of ring plane crossings and with proper masks to ensure that the diffraction effects do not corrupt the frame.

Following predictions by Mink (1983), occultations of the star SAO 158913 (1984 March 24-26) and SAO 158763 (1984 May 12-13) were observed from Vainu Bappu Observatory at Kavalur and Uttar Pradesh State Observatory at Naini Tal. The 1984 March observations indicate radially symmetric distributions of absorbing matter probably in the form of a ring at 12.5R, although there was no evidence of any material at 14R (Vasundhara *et al.* 1984; Bhattacharyya & Vasundhara 1985; Vasundhara & Bhattacharyya 1987). The May 1984 occultations were observable from India when Saturn's magnetosphere at 19R occulted the star. A comparative study of the observations from the two stations in India indicate fragmented or clumpy matter in this region, rather than a continuous ring system (Mahra *et al.* 1985, Vasundhara, Bhattacharyya & Rozario 1986).

Further occultation observations will help in understanding this part of Saturn's magnetosphere. Therefore search was carried out in the SAO catalogue for occultations of stars by Saturn's magnetosphere occurring during 1988. In the search program, instantaneous apparent position of the star, angle of inclination of the ring plane to the line of sight, and position angle of the projection of the north pole of the planet on the sky plane were used.

Table 1. Predicted occultations by Saturn's magnetosphere during 1988.

UT date 1988	Mag.	SAO number	Sp type	Event*		U.T.	Dist. from Saturn
Nov 10-11	9.1	186063	K5	19R	Imm	01:31	98"
				19R	Em	14:57	123
Nov 10-11	8.9	186064	A0	19R	Imm	01:19	136
				12.5R	Imm	06:10	70
				12.5R	Em	12:44	53
				19R	Em	17:34	115

*R=60300 km; Imm:immersion; Em:emersion

A two-star multichannel photometer would be an ideal instrument to observe these events. Multicolour extinction measurements would directly lead to an estimation of the average size of the grains. Continuous monitoring of the star centred around the time of prediction is essential. In case of a single-channel photometer, simultaneous monitoring of a nearby star from an adjacent telescope (Mahra *et al.* 1985) would help in estimating sky transparency changes.

MEETING ANNOUNCEMENT
EUROPEAN SYMPOSIUM ON OCCULTATION PROJECTS - VII

[Ed: The complete ESOP-VII announcement, including registration and paper submission forms, is on hand. Europeans presumably already have copies; others may request copies from the conference secretary (see below) or from the *O.N.* editor (address in the masthead). Payment of all costs is requested before May 31st, but we hope that some exceptions will be allowed. The following extract does not include the detailed schedule of events and prices.]

The observatory in Valašské Meziříčí, Czechoslovakia, is proud to announce that the ESOP VII will be held here on August 9 and 10 in the name of European Section of International Occultation Timing Association — IOTA/ES.

The symposium is open to everybody who is interested in prediction, observation, or measurement of occultations between the bodies of the solar system and the stars. Contributions related to this subject are invited.

The congress languages: English and German.

IOTA/ES and the organizing committee hope that astronomers, both professional and amateur, from all over Europe, will make use of this opportunity to exchange their experiences. We hope that representatives will give short summaries of the occultation activities in their countries.

Organizing committee: Hans-Joachim Bode, Kyril W. Fabrin, Eberhard Bredner, and Bohumil Maleček.

Conference secretary: All correspondence relating to ESOP VII should be addressed to: HVĚZDÁRNA; 757 01 VALAŠSKÉ MEZIŘÍČÍ; CZECHOSLOVAKIA; telephone +42 651 21928.

THE MARCH 18TH SOLAR ECLIPSE ON BANGKA ISLAND

David Herald

The Northern-Limit Observations.

The site selected for the observations at the northern limit was at Matras Beach, a short distance north of Sungailiat, the seat of government for Bangka Island. The location was obviously a popular picnic spot – idyllic beach setting with drink stall, etc. To get there, Byron and Cathy Soulsby took a taxi from Koba, leaving at 4:00 a.m. On the way there, they passed through the central eclipse location, where the taxi had to dodge people sleeping with their heads in the middle of the road! Once at the site, they found several hundred others there to observe the eclipse, but as is usual at eclipses, little trouble from curious onlookers occurred.

At this site the cirrus cloud was perhaps thicker than at the other locations on the island, and Byron was unable to obtain a satisfactory projected image of the Sun (the safest way to observe the partial phases of the eclipse and the Baily's beads), and so had to make last-minute equipment changes to hold some aluminized mylar in front of his telescope's objective so that he could observe directly through the telescope. To add to Byron's problems, his tape recorder failed some minutes before totality. Fortunately his wife, Cathy, who was attempting to make the observations herself, was located nearby with another tape recorder, and Byron's observations, spoken in raised voice, were recorded on her recorder. Totality at this site lasted about 45 seconds.

As it turned out, Byron's observations are, at this time, the only known observations from the northern limit, and are thus crucial for the Baily's bead experiment. An American, Jim Vail, was also set up near Matras Beach, but had some major eqipment problems. Furthermore, whilst he tried to compromise by taking a series of timed photographs of the beads, enroute home he had all his photographic equipment (including films) stolen!

The Southern-Limit Observations.

The southern-limit eclipse site was intended to be near the town of Toboali, on the southern part of the island. Toboali is a large town, and many years ago used to be the provincial capital. When we arrived in Koba, we were advised that we might have some problems in getting to Toboali, as a 3-km. section of the road had "collapsed." We were told that round trips between Toboali and Pangkalpinang were taking about 18 hours rather than 5 hours, and a consequential shortage of supplies in Toboali had pushed prices there sky-high – e.g. $10 a litre for petrol! Unfortunately, the bad stretch of road occurred a few kilometres south of Koba, at a location where there was no alternative route.

We (Anne, Aaron and Judith, Andrew James, and I) left Koba at 2:00 a.m. in a four-wheel-drive vehicle kindly supplied by Koba Tin. The driver, who didn't speak or understand English, was given specific instructions before we left, by camp staff, as we didn't understand Indonesian. When we arrived at the problem stretch of road, we were able to get past some 20 or so vehicles waiting to try to get through the first of 3 "bog-holes," and in we went. The bog-hole was a good 100 metres long, and up to 1.5 metres deep! We would have made it through, OK, in the 4-wheel-drive had it not been for a truck which was well-and-truly stuck $^2/_3$ of the way along, with no way past it. Indeed, in a valiant effort by our driver to get past, mud flew everywhere, including all over the roof of our vehicle.

Having to give up on getting to Toboali, we had to make a rapid change in our plans, with a view to getting as far south as possible at some other location on the island. This was, of course, not helped by the language barrier between us and the driver, and hindered by our not having any detailed maps of other areas to cover such an eventuality. We decided to head eastwards, and we came to a camp run by Koba Tin at Lubuk-Besar. For a number of reasons, this was not a satisfactory site, so in desperation, our driver took us round to the camp manager's house, and got him out of bed (this was at 4:00 a.m.!). The manager was quite helpful, and took us down a road to where it forked. He explained that we could either proceed onwards, which would take us to the coast in what were apparently new developments (and thus not indicated on the maps we had access to), or turn left where the road would take us out to a point – Tandjung Berikat – except that somewhere along that road a bridge had been washed out some months previous, and only motorcycles could get past that point. Running out of viable options, we decided to head towards the point. The road (if it could be called that) definitely needed a 4-wheel drive to negotiate, but we were pleasantly surprised to find that the bridge had been recently repaired, and at 6:00 a.m., we burst out onto a small picturesque beach right at Tandjung Berikat.

Observations from this site were successfully made, again through thin cirrus cloud. Totality lasted some 2 min. 4 sec. In excitement, one of the observers (James) managed to knock over his telescope tripod during totality, with a resultant loss of observing time during totality, and of Baily's beads for a short time after 3rd contact, all of which serves to remind eclipse observers that any accidents during an eclipse can be disastrous.

[Postscript by David Dunham: Hans-Joachim Bode reports that the IOTA/ES expedition to Kalimantan

(Borneo) was successful, although he himself was not able to go due to flight reservation problems. They were planning to obtain video observations from a site near the southern limit. Bode hopes to return to Indonesia with a navigation satellite receiver in 1989 to accurately determine the geographical positions of their observations of this eclipse and the one they observed in November 1984.]

STRICTER RULES FOR TAX-DEDUCTIBILITY OF IOTA TRAVEL

David W. Dunham and Paul D. Maley

U. S. Internal Revenue Service Publication #17, issued last November, sets stricter rules for tax-deductibility of travel expenses for tax-exempt scientific organizations such as IOTA. Effectively, the publication strongly implies that if time is taken from the "business day" for sightseeing or any other pleasurable activity not benefiting the scientific or charitable organization, none of the expenses of the trip are tax-deductible. There is some ambiguity in the statements, and when we tried to get clarification from the IRS four separate times, we got conflicting opinions. Finally, we were advised to write to the office of the director of the IRS to get a ruling. We did, and finally got a response, a large package of detailed forms that needed to be completed and filed with a fee of over $200 to apply for an official ruling! At that point, we gave up. If anyone is audited for their 1987 or later taxes, he might inquire about these points, even if he claimed no trip deductions; let us know what happened, so we can pass it on.

Most graze trips, where you just travel to the graze site, make the observation, and return directly home that night or the next day, will clearly remain tax-deductible. The problem comes with longer trips, mainly to eclipses, which often involve sightseeing. An example is last September's IOTA trip to China, where we had to make arrangements through the Chinese office of tourism. Although that trip was made before IRS Publication #17 appeared, the rules apply for all travel during 1987, and later years, as part of the overall changes in tax laws. IOTA will try to arrange future long trips so that they comply with a reasonably strict interpretation of the rules to qualify the expenses as a "donation" to IOTA. Another problem with the new tax rules is that you cannot start deducting your qualifying IOTA donations, added to all your other charitable contributions, until this sum exceeds 2% of your gross income.

MY FIRST EXPERIENCES WITH IMAGE-INTENSIFIED VIDEO

David W. Dunham

Peter Manly and Gene Lucas drove down from Phoenix to attend one day of the Asteroids II Conference. On an earlier trip, I had given them an image intensifier bought surplus a few years ago. Manly took the intensifier (first generation) to Litton Electron Devices Company, where they tested it and found that it was virtually as good as new. I then bought a relay lens and housing from Litton. Gene Lucas delivered the result to me in Tucson. When I returned home, on the first clear night, I attached it between my 20-cm Schmidt-Cass and Ultricon low-light-level video camera. After getting some advice by phone from Peter Manly, I got the equipment adjusted and focused. Wherever I pointed the telescope, there were stars in the approximately 12' field of view! The Orion Nebula and M35 gave especially rewarding views. A check of a selected area readily showed a star with V = 11.6! The next night, I was able to record much detail on the dark side of the 11% waxing Moon. I recorded two unpredicted disappearances of 10th-mag. stars before recording the predicted immersion of an 8.6-mag. star. The system was reaching about 4 magnitudes fainter than without the intensifier, and it can record about a magnitude fainter than I can see with a good eyepiece. On subsequent nights, as the Moon and its glare brightened, contrast was reduced and disappearances of 9th-mag. stars could be recorded only with difficulty. I plan to follow Gene Lucas' suggestions for using black flocking paper on the inside of the telescope's baffle tube to decrease the glare (we plan to publish some details of this in the next issue, since like the light stop described by Overbeek in *o.N. 3* (3), p. 46, this can help visual observation, too). Due to the Moon's southern declination during our early spring waning phases, I have recorded only a few reappearances. The image intensifier facilitates their observation, since the edge of the dark limb and nearby lunar features serve as a convenient guide.

When setting up for videorecording a reappearance of 3.0-mag. Pi Scorpii from behind a highly gibbous Moon, without the intensifier (everything much too bright), I made a helpful discovery. The Moon's image is terribly overexposed with the Ultricon, with only some features at the terminator visible and hard to recognize. When moving around the telescope to check the drive, my head briefly passed in front, and I noticed the TV display change. I then moved the front-end cover to block much of the light entering the telescope, and suddenly maria and craters appeared on the TV in profusion. I was then able to identify where Pi should reappear, and caught it near the center of the screen. The new CCD cameras and the less-sensitive Novicon detectors do not give overexposed images of the Moon as does the Ultricon.

A MOTTO FOR IOTA

Peter L. Manly

It was in September of 1985 that an IOTA expedition went to the wilds of Utah to record the occultation of star SAO 058030 by Comet Giacobini-Zinner. The occultation was important because a few days after the event, the International Cometary Explorer spacecraft was to pass through the comet's tail, and we wanted to see whether there was enough dust in the tail to dim the star. Several groups observed the event, and David Dunham flew to Salt Lake City to meet with observers from the Saguaro Astronomy Club of Phoenix, Arizona, who had brought video equipment. The Ogden, Utah, Astronomical Society supported the project admirably with transportation, knowledge of local conditions, and observing site selection. The groups set out and the observations were a success (no appreciable dust was seen).

At about 02:00 local time, on the way back, Gary Liptrot's car started losing cooling water. Soon we found ourselves stranded beside the Utah interstate looking for water. Utah is not known for its abundant water, but lo, we happened to be right beside a lake. Unfortunately, this was the Great Salt Lake, and salt water does nasty things to engines. Ah, but just about a kilometer or so back, there was a rest stop. Surely there must be water there! The problem was how to get the water from the rest stop to the car. The dew cap on my telescope holds much less than a liter, and would require many trips. Preparedness, however, won out. I had brought a trash bag to throw over the telescope in the event of rain (and I haven't ever been rained on since I started carrying that trash bag around).

A brisk hike (it was cold) to the rest stop revealed that we'd have to get the water from a silly little trickle in a drinking fountain. Braving the stares of other nocturnal travellers, we filled the bag about $^1/_3$ full, and set out back down the freeway; thump-slosh, thump-slosh, thump-slosh. The triple-tandem trailers nearly blew us off the road, and I thought about the quick trip we'd have to make to the airport and a short flight home. I had to go to work in the morning. My mind snapped back to the windy highway as another 34-wheeler whizzed by. The bag became heavier. It seemed as though the car were at least ten kilometers away, in the eerie moonlight. The bag leaked a little as I limped along. The ghostly surf from the salt lake on the right echoed softly, and I noted by my watch that it was already 03:30. I might not make my plane! I walked faster, and the bag leaked more, soaking my shoe thoroughly. I pressed on; thump-squish, thump-squish, thump-squish, thump-squish. We reached the car, and wound up pouring more water on the ground than into the radiator.

Then, in the glow of the Moon, one of those rare flashes of inspiration hit. As I leaned against the car, pouring water out of my shoe, a line from a novelty song of the 1950s came to me. It was the plaintive cry of one of Custer's soldiers, who asked, "WHAT AM I DOIN' HERE?"

ASTRONOMY AND PERSONAL COMPUTERS

Joan Bixby Dunham

Maps for Spectacular Events. A map of the July 17 Regulus occultation for the continental U.S.A. will appear in the July issue of *Sky and Telescope*. This map gives curves of equal time, showing at specific intervals of time where the edge of the Moon's shadow lies. It has lines of equal altitude for the Sun and the Moon at the time of the events. We want some way of producing these maps more automatically. *S&T* did their maps with computations dome at 5° (and some at 2°) intervals of longitude and latitude, interpolating to find the plotting points. The curves were plotted manually. The computations were done using the equations given in Chapter 5 of Meeus' book *Astronomical Tables of the Sun, Moon and Planets*, which has Besselian elements of all of the occultations of first-magnitude stars and planets through the end of the century. There are some tricky parts to generating the curves for plotting. As the northern and southern limits are reached, the curvature of the lines increases, and more points are needed for accurate interpolation for the plots. The plotting points should be at fine enough intervals so that they can be connected with straight lines but still appear smooth.

This occultation-plotting problem can be divided into several parts: Writing software for computing the local circumstances with the equations given by Meeus, writing software to generate the coordinates for the curves of equal time, and writing or modifying software to produce the plots. Chapter 5 of Meeus' book should provide most of the information for computing the local circumstances, including worked examples (Meeus also included programs for programmable hand calculators, which may or may not be of much assistance). If we were provided with the coordinates for the curves in machine-readable form, we could plot them with some modifications to the graze map plotting software. It would be more desirable, however, to have a totally self-contained software package to generate the data and produce the plots in hard copy.

There is no particular machine or language desired for this software, but it would be nice if the programs were portable to more than one machine. If you are interested in this project, study the maps in the July *S&T*, get a copy of Meeus' book, and see whether you can duplicate his examples and some of the computations needed for the Regulus plot. *S&T* wants to publish a map for the November 30 Regulus occultation in that month's issue, which means that, if you want to be credited as the author of that map, it must be in their hands by September 1 (and they will need to know that it is comong earlier than that). Once you have mastered how to compute the data, let us know your ideas on how to generate the plots.

If you do not already have a copy of Jean Meeus' *Astronomical Tables of the Sun, Moon, and Planets*, it can be obtained from the publisher, Willmann-Bell; P.O. Box 3125; Richmond, VA 23235; phone number 804,320-7016. Their catalog #10 lists the book as selling for $19.95. They pay shipping costs for orders within the U.S.A., and Virginia residents will need to pay tax.

Progress in Asteroid Observation Reduction. Work has continued on finishing the reductions of the occultations by Pallas and Nemausa observed in 1983. Difficulties from the large number of observations and the lack of funding support have caused the long delay. We have used quite an array of computers in the course of doing the analysis. Currently, we are using an MS-DOS computer with the Lahey F77L FORTRAN compiler for the reduction software, and have created data bases of the observations with PC FILE +. In the end, we will have three data bases for each occultation, one of the observations, one for the observers who saw a miss, and one for observers who tried, but failed due (usually) to weather or sometimes to equipment or star identification problems. When creating the data base of observations, we started with the observation cards that are the input to the reduction process, and added information to each record giving the source of the data as well as other information of interest when interpreting the results. We also took the opportunity to recheck all of the observations, looking for typographical errors and duplicates in the data. Once this was completed, then the entire solution process was repeated. The corrections did make minor changes in the results. Once the paper has been accepted by a journal, we will provide the data bases and the reduction software to anyone who requests them.

The steps in processing are the following: The raw observation times are converted to locations on the Besselian sky plane with a FORTRAN program ASTEROID, which needs for input the observation times and locations, an ephemeris of the asteroid, and the star position. Recently, we corrected the program to compute a more accurate delta-T correction for conversion between the observers' times and ephemeris time. The sky plane coordinates are then used in ASTSOL to perform a least-squares solution to compute corrections to the asteroid's location and to fit an ellipse for the asteroid shape to the data. The normal equations solutions package in the FORTRAN program is a modification of software provided by Tom Van Flandern. The computed solution is used with the sky plane coordinates from ASTEROID in plotting programs to plot the observations and to plot the area of the sky plane around the asteroid which was searched for secondary events. One version of this software uses the plotting package PLOTRITE by Ed Hedman which plots to an Epson dot-matrix printer; the other uses my own subroutines to plot with an Enter Computer 6-pen plotter. Observations which disagree significantly from nearby observations can be deleted from the solution, but can still be plotted, and will be listed in the final papers.

New Computer Magazine. The parent society of the American Astronomical Society has started a combination magazine/scientific journal called *Computers in Physics*. This is intended to fill the gap between the magazines on computers, such as *Byte* and *PC TECH*, and scientific journals such as the AAS *Journal*. The first issues have contained articles on science software for the Macintosh, on a survey of technical word processors, and on applications of graphics to data processing. The May/June 1988 issue contained a paper on using spreadsheets in physics, and another on software for modeling nuclear processes. The magazine is issued 6 times a year. Individuals who are not members of AIP societies may subscribe for $25/year for domestic mail delivery, $35 for foreign surface. For more information, contact the AIP Marketing Services; 335 East 45th Street; New York, NY 10017-3483.

Selecting a Computer. Most of us consider a PC an expensive item to purchase for our personal (rather than business) use, and want to buy one that will serve our needs for a long time. We have many choices, and deciding among them can be difficult. The March 1988 issue of *Consumer Reports* offers an impartial assessment of PCs, considering the IBM family, the Apple family, the Atari ST, and the Commodore Amiga, but bases the comparison on the use of the computers for word processing. There are additional considerations when deciding on a PC for supporting efforts in astronomy.

The computer chosen should be one for which software will be widely available from many different places. The more publishers of software for a machine there are, the better and less expensive the software will be, as well as the more there will be related to astronomy. All of the computer models discussed in *Consumer Reports* are quite popular, and software should be available for them for years to come. To receive that software, the computer should have a floppy disk drive. The 5¼-inch is currently the most popular size, but an increasing number of PCs are sold with 3½-inch drives.

If the computer is going to be used for controlling a telescope or collecting data, then we need to be sure that it has the capability to communicate with telescope controllers or the observing equipment. If this is a potential use of the computer, then we should be sure that the communications capability can be added at some later point. The best options are standard means, such as via an RS-232 port. Not all computers have external communications capabilities, and many that do, have only one, which might limit the ability to use a printer at the same time. Many portable computers are not expandable. Computers which rely on game ports for external communications may need custom interfaces to telescope controllers and the like. Only a few expensive portables are currently designed to be rugged enough for outdoor use, so ability to withstand the elements is not a practical discriminant to use in selecting a PC. Instead, we should design some protection for machines used outdoors, to keep them warm and dry.

If we plan to write our own software or to convert software from mainframe computers, then we need to consider availability of compilers for various languages. This is less important for those who do not expect to write much software. There are BASIC interpreters for every PC, so small programs can be written on all PCs. The IBM computer family currently has the lead in the number of compilers and compiler sources for the major languages (Ada, C, BASIC, Pascal, FORTRAN, COBOL). Some form of these languages is available to other computers, but not from as many sources, a situation that often results in less capability and more expense. Of course, we can always make any PC do virtually anything if we program it in assembly language or machine code, but that is so time-consuming that we might not have time to observe.

When asked for a recommendation, I usually suggest a no-name clone of an IBM PC XT. I think these offer the most value for the money, as well as the capability to expand. Most of us will not need more computing power than the XT offers, and there is considerable software available for the XT type of machine.

We have made a few mistakes in buying computer hardware/software. We expected too much of the plotter we have bought. We find that it works rather slowly, and requires some fiddling with pens and paper to set up properly. It is so much more convenient to use the dot-matrix printer with graphics software that the plotter mostly gathers dust. Software we have bought and never used includes hosts of disk and hard disk utilities, spelling checkers, communications programs, calendars, desktop managers. There are many reasons why these purchases were mistakes, but usually, we bought them without thinking of how we would use them or why we needed them.

Designing a Computer-Equipped Office. Planning the office for our new home has given us a chance to think about the features that we find make a computer-equipped office usable. What has been important to us has been having sufficient room to spread the papers or books we are using while at a computer, but also having access to virtually all sides of the equipment to change cables, load paper, etc. We find stacking equipment can make access difficult. The most convenient arrangement is one with a table or desk and side tables that are about 10 to 12 feet long that are in the middle of a room with easy access to all sides of the desk. Our office will not be large enough to do that, so compromises are necessary. Space for papers is more important than access to the backs of the PC and printers, so we will probably use a table about 10 feet long with one side against a wall. If we needed to have a more-compact arrangement, we would consider a roll-around cart to hold all the equipment. Some are designed so that they can be closed and locked to protect the equipment inside from children, pets, or curious visitors.

Another consideration we find important is the location of windows and doors relative to the PC screen. We do not want windows located so that sunlight falls on the monitor, or so that the monitor is in front of a window. We have no desire to work in a cave, but sometimes in frustration from glare, we have covered all the windows and doors and created the same effect. All those fancy PC ads showing PCs on the beach or by the swimming pool notwithstanding, it is almost impossible to use a PC in sunlight for any length of time.

Constellation Boundaries. Nancy Roman published a paper in the *Publications of the Astronomical Society of the Pacific 99* (July, 1987), p. 695 that gives coordinates for the constellation boundaries. The article states that the boundary data, and a FORTRAN 77 program to use them, are available from the Astronomical Data Center in machine-readable form on computer tape or via SPAN. These boundaries can be used with a star catalog to generate star charts with the constellation identifications.

Software to Help Plan Observations. There is a need for software to help in planning observations, given a particular observing site's location and limitations. The software would have a "mask" it would apply to the sky that describes the viewing blockages from buildings, trees, etc. It could scan the prediction data and tell observers which events might not be possible from the observing location, and might include times of Sun and Moon rise/set, with an option to enter coordinates of any object and compute its rise/set/culmination. It could be combined with the precise predictions software described later.

Compute Total Occultation Predictions. We would like a PC program to compute total occultation predictions for local regions to use the regular iterative method for determining ocultation times. This could be done by converting a part of the Evans program used to compute the USNO total predictions to run on a PC. Part of the project would be to determine a means of reducing the size of the input data set needed so that the data will fit conveniently on a few floppies. There is a BASIC program to compute totals from a and b factors, similar to the FORTRAN program Walter Morgan uses to answer requests for standard coverage predictions.

Map Software. We would like to know how practical it is to use PC mice to help determine the coordinates of observers from USGS maps. This would require using a mouse to measure the offsets of observers' locations from the tick marks on the maps, and comparing the computed results with the ones generated by hand. We want an assessment of how much trouble it is to do the work as compared to doing it by hand, and whether or not the accuracy suffers.

Asteroid II Data Base. David has received the Asteroid II data base, three floppy disks of data on asteroids, including a tabulation of the asteroid names. This data base is in the public domain, but is not widely distributed yet. It can be obtained from the Astronomical Data Center on tape, or from the ADC via SPAN, as well as from us.

C Software. I have accumulated several C software packages, some designed to help learn C, some to help design specific functions in software, such as windows. I have a copy of MicroEMACS and a spelling checker from Jeff Gerber. These are all public domain or freely distributable software packages from PC SIG or bulletin boards.

Public Domain Software. To obtain the software, you may either send me diskettes and stamped, self-addressed mailers, or $1 for each floppy ($1.50 for two), which will cover the costs of the diskette, envelope, and U.S. postage. These are MS-DOS 5¼ DSDD diskettes.

1. Generate total occultation predictions, written in GWBASIC (2 diskettes)
2. Computerized ILOC forms, in Microsoft Basic under CP/M, provided to us as text files on an MS-DOS diskette. This is written by Peter Manly. (1 diskette)
3. Asteroids II data base (3 diskettes)
4. Six diskettes of public domain or shareware astronomy software, including ACE, Deep Space, Floppy Almanac, Cluster, and ProCalc.
5. Six diskettes of C software

PO Box 7488; Silver Spring, MD 20907; 301,585-0989

ADDITION TO ASTEROID PRIORITY LIST

David W. Dunham

The occultation of SAO 164745 by (63) Ausonia [Ed: U.T. date Aug. 12] has been identified as a priority event by both GEOS and Lowell Observatory. Other priority events are on p. 171 of the last issue, and still others will be in the next issue.

H. S. T. AMATEUR PROPOSAL DEADLINE NEARS

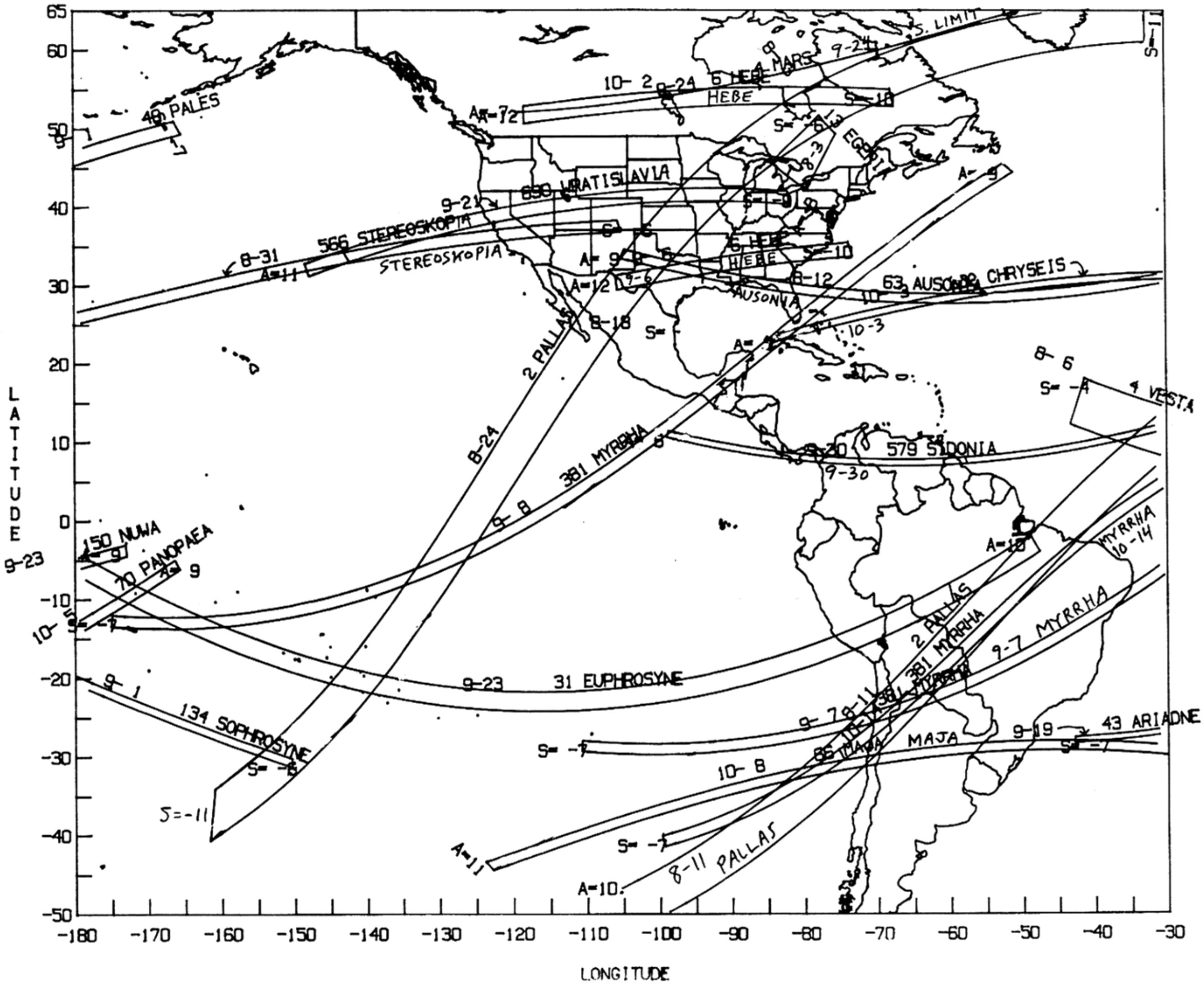
David W. Dunham

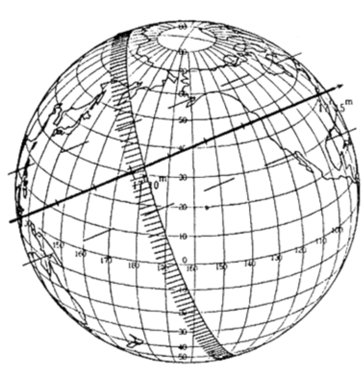
You are reminded that the deadline for receipt of proposals for amateur observing time on the Hubble Space Telescope is the date of the next Space Shuttle launch. Currently, this is expected in September, but delays are possible. Amateur proposal application forms are available by sending $1.00 and a large SASE to AAVSO headquarters. There have been complaints that the decision to extend the deadline beyond June, 1987, has not been publicized well enough, so we are doing our part. On June 11, members of the working group for the HST amateur astronomers' proposals, including Paul Maley and me, will hold a telephone conference to discuss current status.

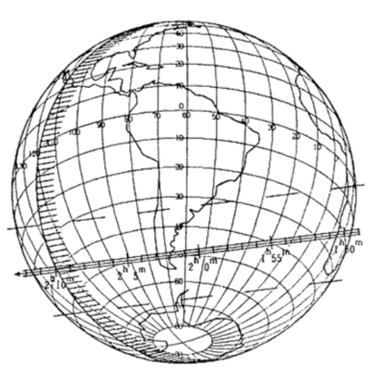
SOLAR SYSTEM OCCULTATIONS DURING 1988

[This is a further continuation of the article started in *O.N.* *4* (6), 148-156 and continued in *O.N.* *4* (7), 171-188. World maps are by Mitsuru Sôma. The hemispheric-coverage maps are by David Dunham. Finder charts are produced by David Dunham, with annotations and faint stars added by David Werner.

PLANETARY OCCULTATIONS. 1988 8/1 - 10/15







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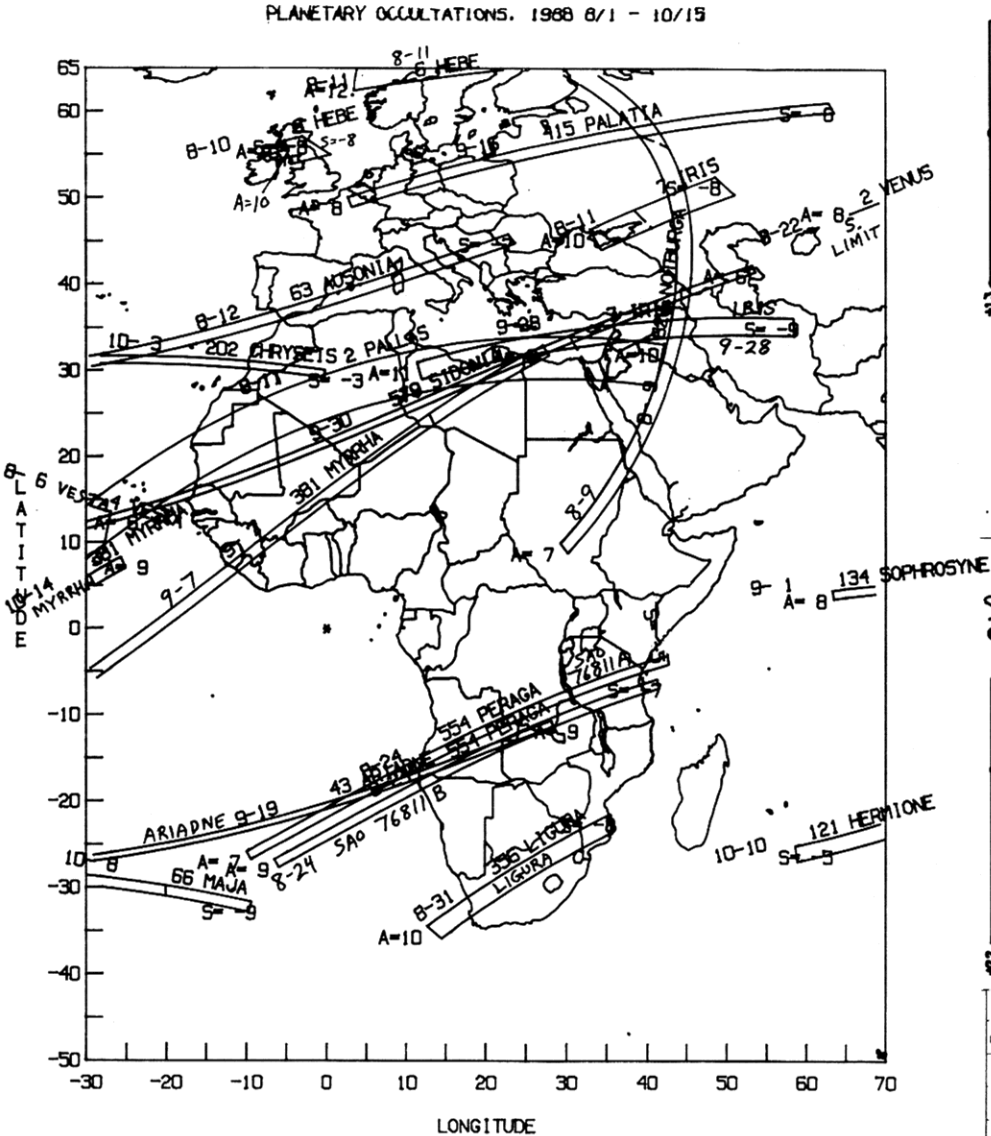
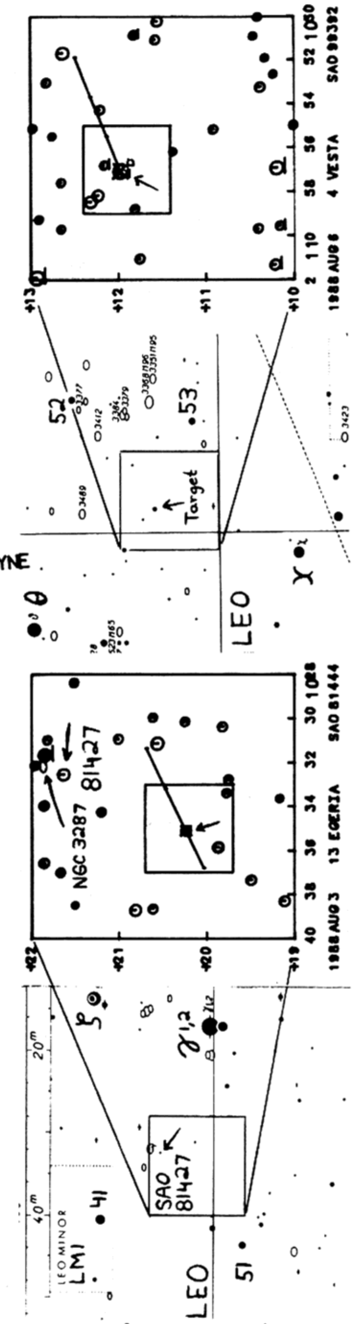
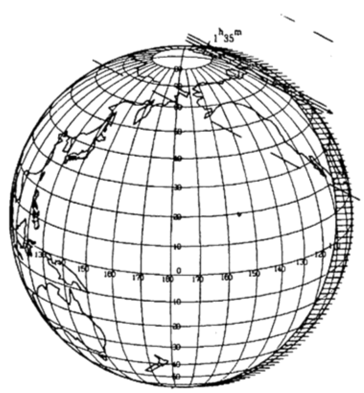
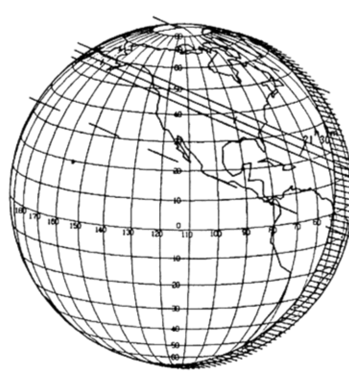


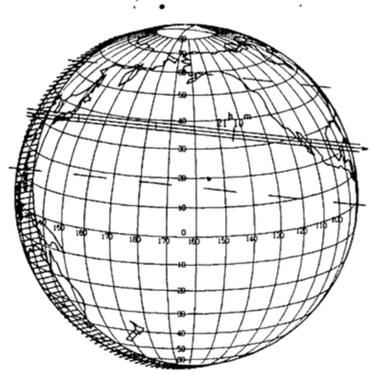




SAO 81444 by Egeria 1988 Aug 3

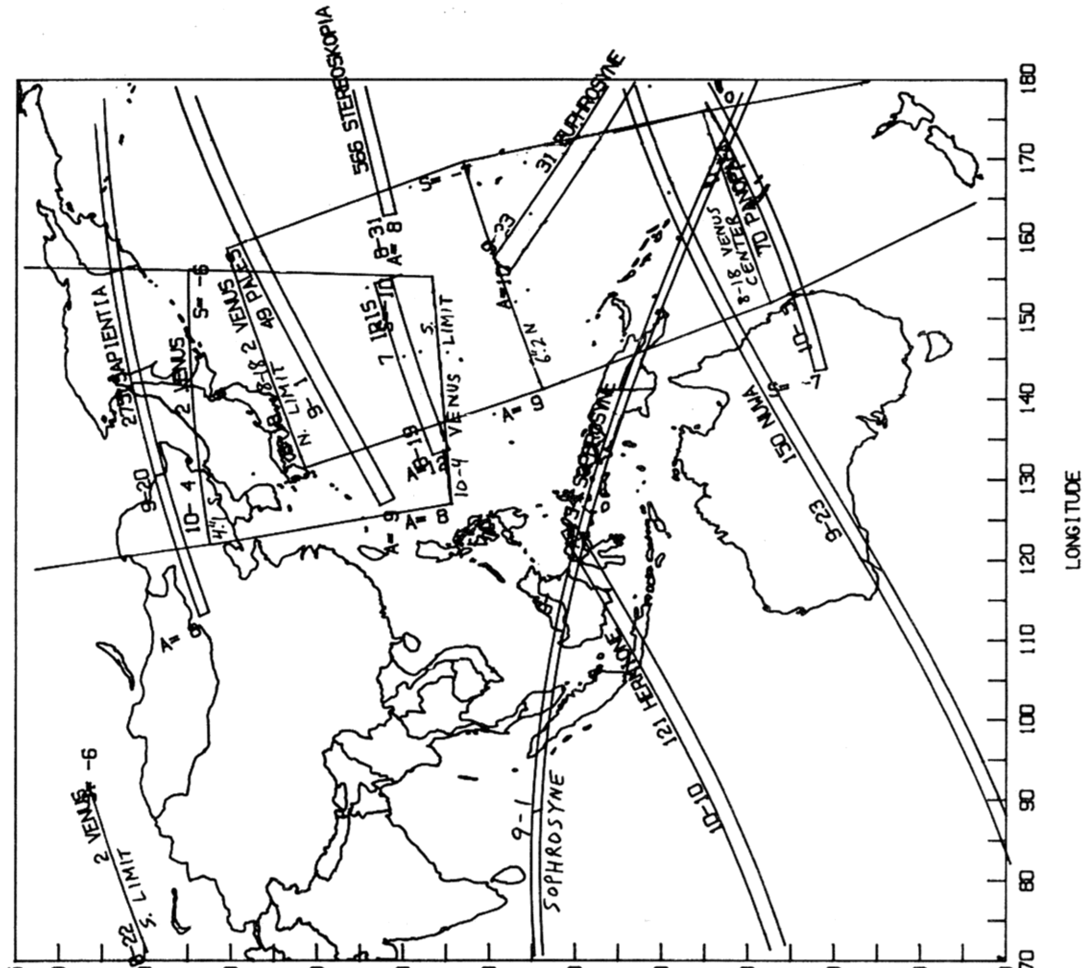


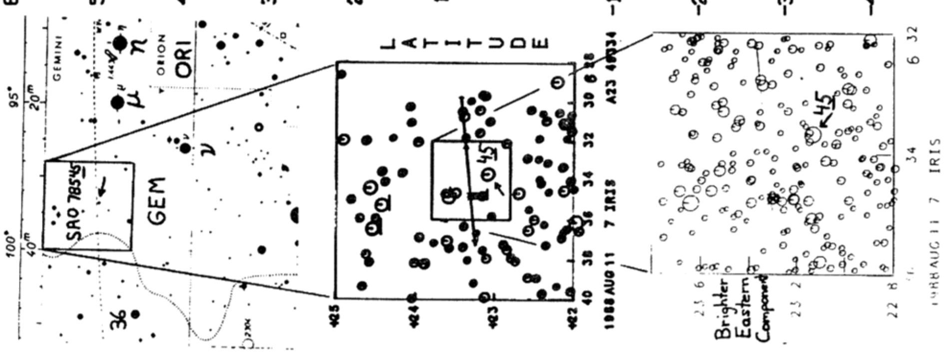
SAO 99392 by Vesta 1988 Aug 6



SAO 96189 by Juno 1988 Jul 30

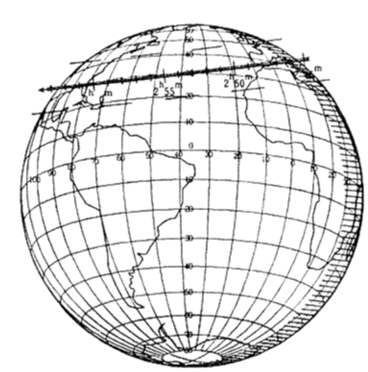
PLANETARY OCCULTATIONS, 1988 8/1 - 10/15





A1942301 by Venus 1988 Jul 31

A2349334 by Iris 1988 Aug 11



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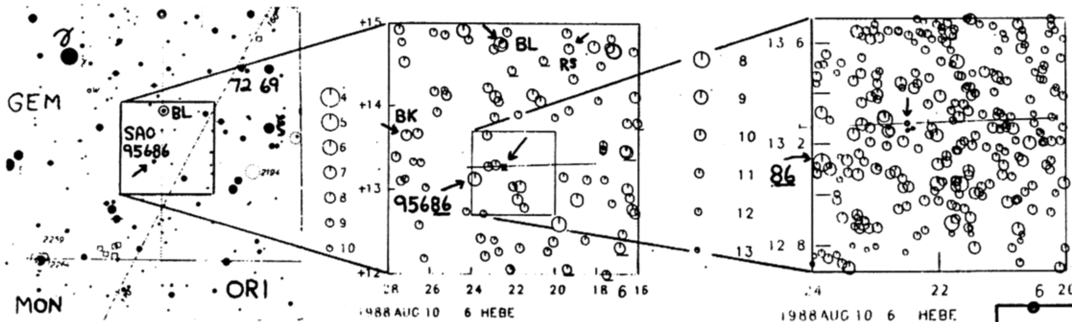
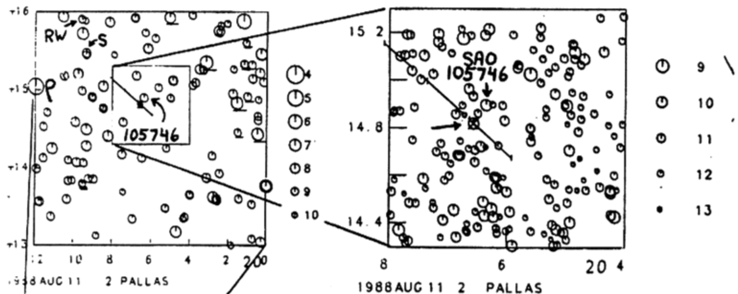
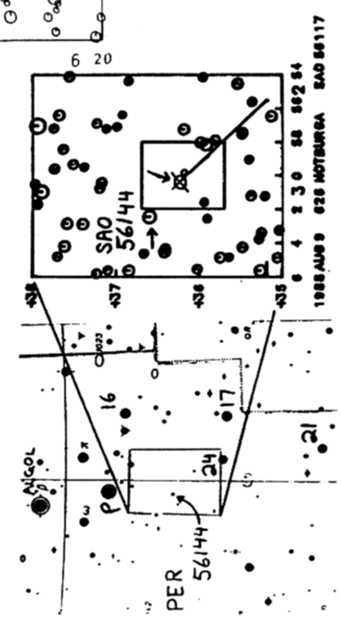
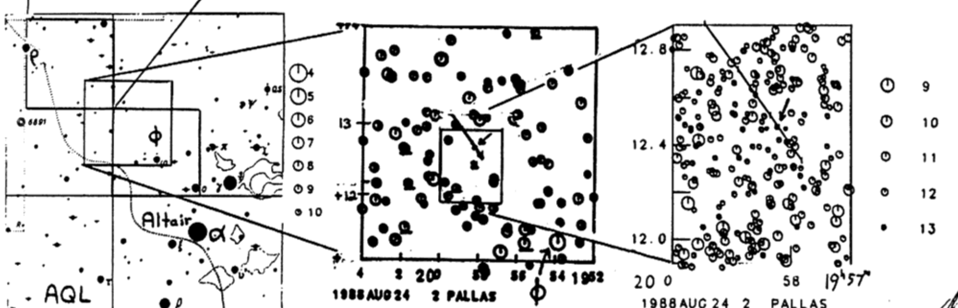
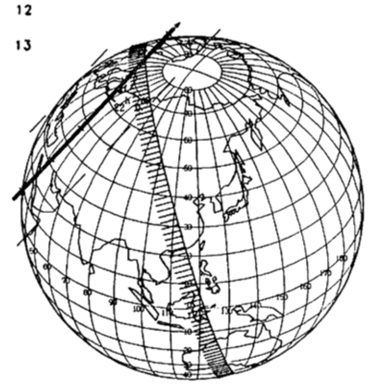


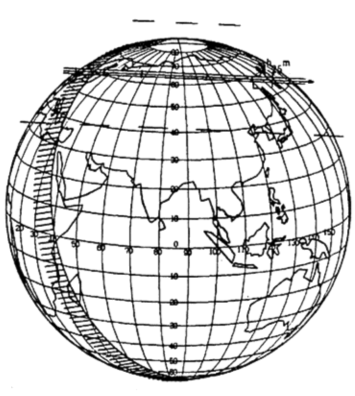




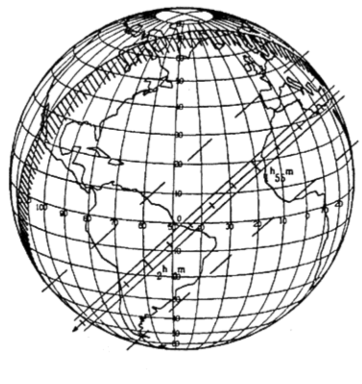




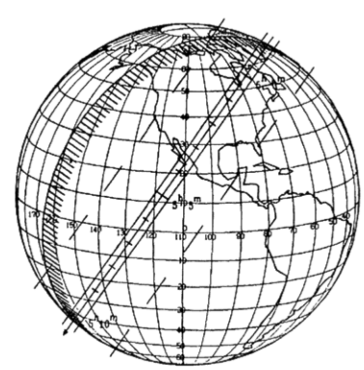
SAO 56117 by Notburga 1988 Aug 9



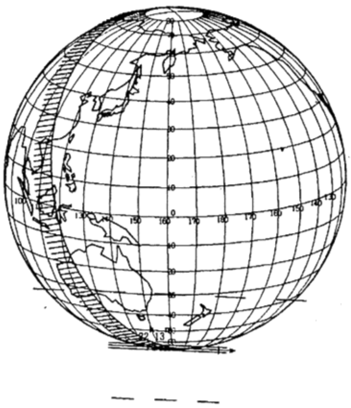
Anonymous by Hebe 1988 Aug 10



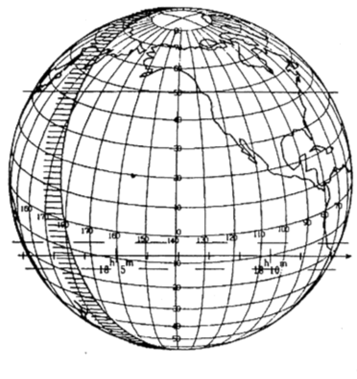
Anonymous by Pallas 1988 Aug 11



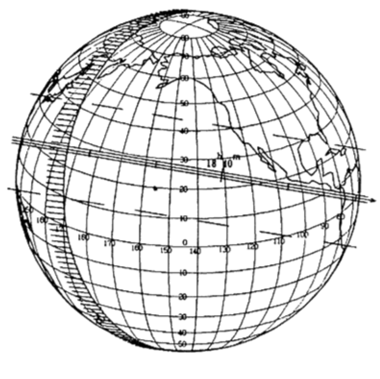
Anonymous by Pallas 1988 Aug 24



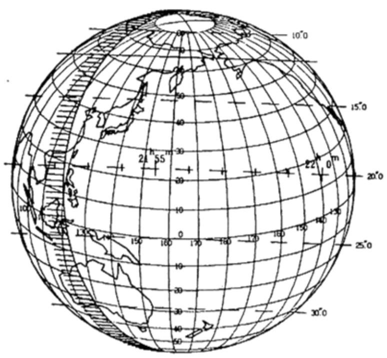
Anonymous by Hebe 1988 Aug 12



L 1 1552 by Venus 1988 Aug 18



Anonymous by Iris 1988 Aug 19

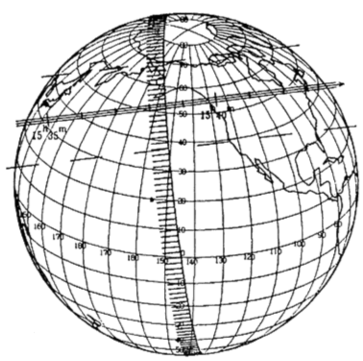


SAO 96380 by Venus 1988 Aug 22

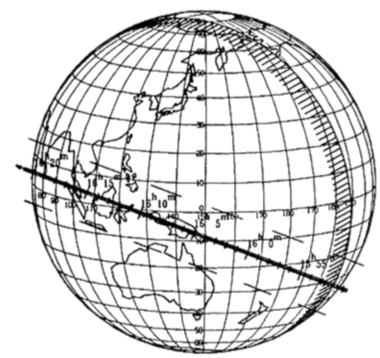
SAO 76811 by Peraga 1988 Aug 24

Anonymous by Pallas 1988 Aug 30

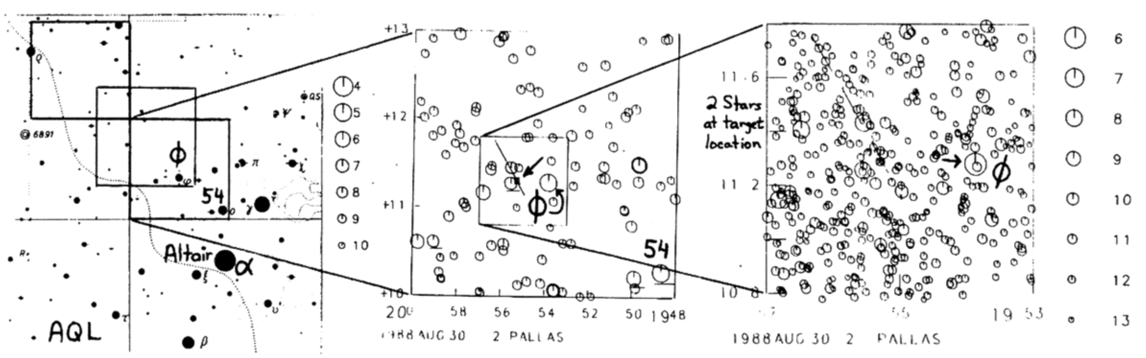
+30°1094 by Ligura 1988 Aug 31

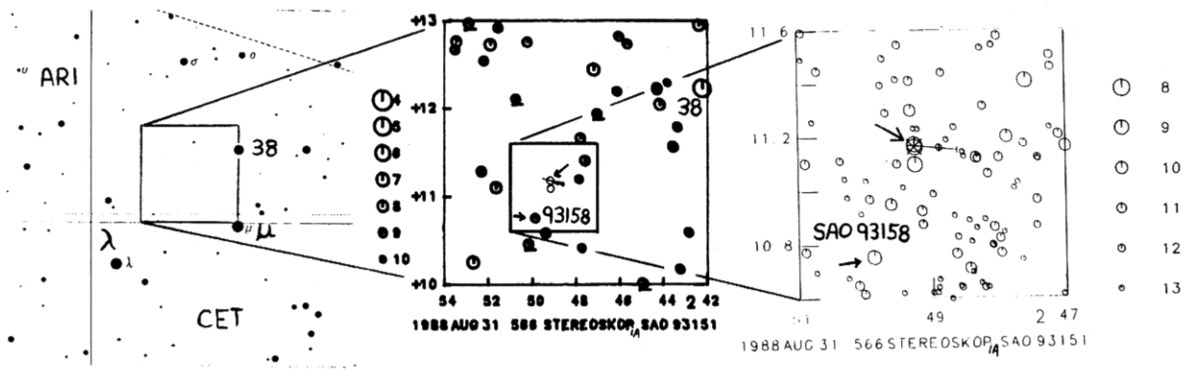


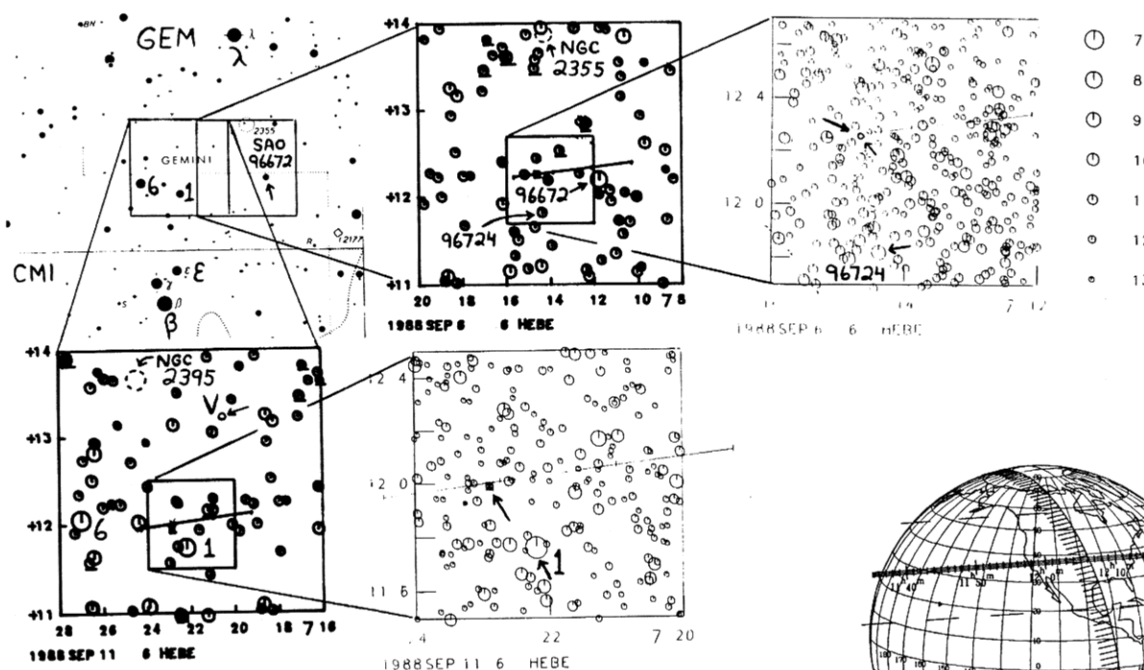
SAO 76780 by Pales 1988 Sep 1

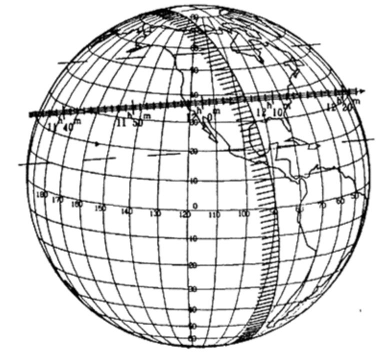


SAO 109465 by Sophrosyne '88 Sep 1



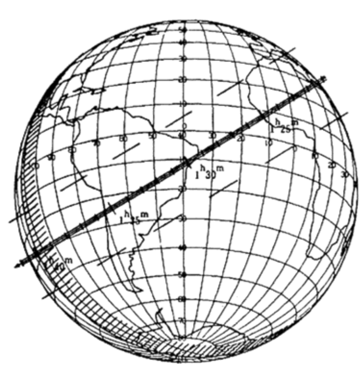






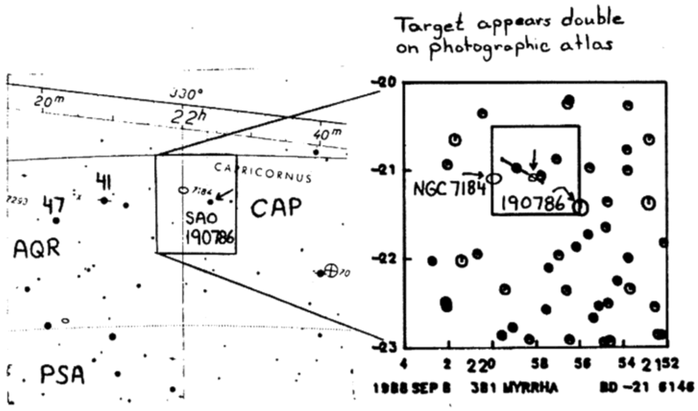
SAO 93151 by Stereoskopia 88 Aug 31

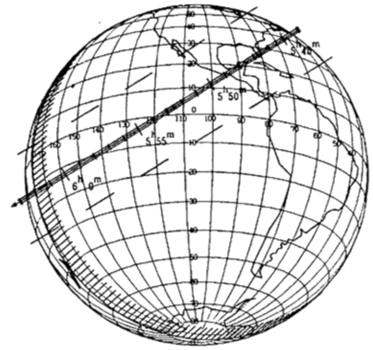
Anonymous by Hebe 1988 Sep 6



SAO 190834 by Myrrha 1988 Sep 7

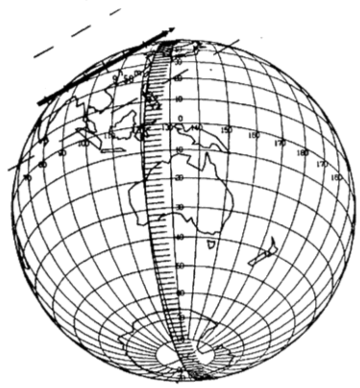
Anonymous by Hebe 1988 Sep 11





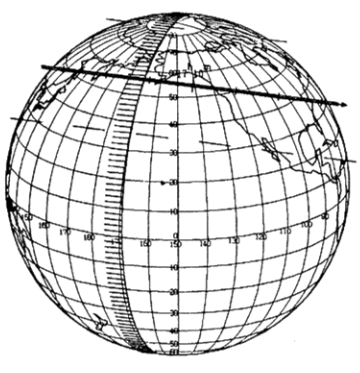
-21°6146 by Myrrha 1988 Sep 8

SAO 96257 by Palatia 1988 Sp 16



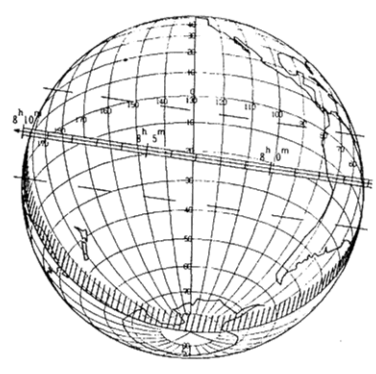
SAO 210318 by Messalina '88 Sep 17

SAO 185447 by Ariadne 1988 Sep 19



SAO 96561 by Sapientia 1988 Sep 20

A2250203 by Wratislavia '88 Sep 21



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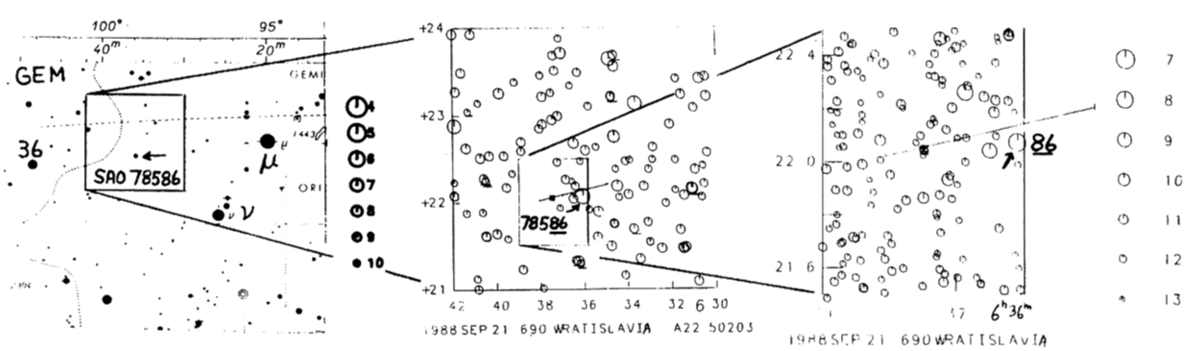
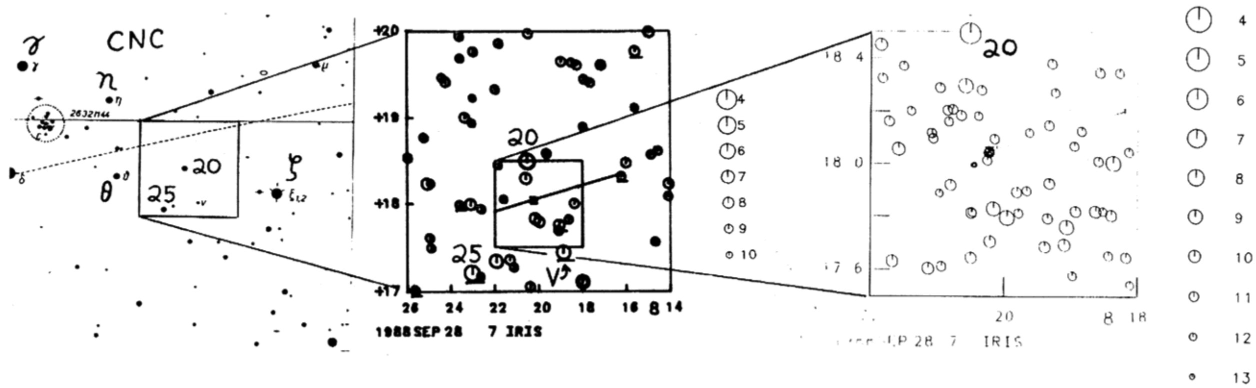
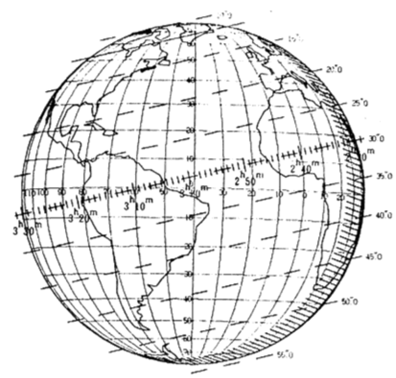


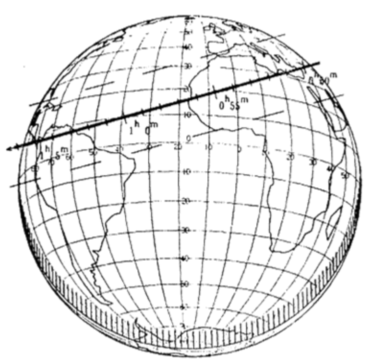


SAO 146096 by Nuwa 1988 Sep 23



SAO 128806 by Mars 1988 Sep 24

Anonymous by Iris 1988 Sep 28



SAO 147307 by Sidonia 1988 Sep 30

Anonymous by Hebe 1988 Oct 2

SAO 96403 by Chryseis 1988 Oct 3

PARALLEL OBSERVATIONS OF LUNAR OCCULTATIONS

Dietmar Büttner

I. Introduction. If a lunar occultation occurs, normally it is timed by a number of observers at various locations on the Earth. These observations of the same occultation should be understood as parallel observations in this article. Compared with any other accidentally chosen occultation, they are characterized by the special circumstance that errors in the position of the Moon and the star are nearly constant (but not necessarily zero) for all observations of the same event. Hence, the residuals O-C are mainly affected by errors in the timing process, the observer's position, and the limb correction only. This should result in a smaller standard deviation (s.d.) of the O-C concerning observations of the same occultation.

I investigated parallel observations in order to demonstrate such effects. For detailed explanations of the meanings of the reduction quantities, see *O.N. 4* (5), 105-6.

II. Data Base and Distribution of Observations.

All observations and reduction results used have been taken from ILOC's "Report of Lunar Occultation Observations, the Observation and Reduction in 1983," which turned out to be a very useful data source for such an analysis. I analysed 23 occultations I observed in 1983, and found 476 parallel observations, altogether, related to them. Four of the stars were doubles, and were investigated in an appropriate manner. All stars were of magnitude 7.7 or brighter.

Typically, about 20 parallel observations per occultation were obtained, with a range from 3 to 56. Examining the ILOC report, it becomes evident, however, that the number of parallel observations decreases drastically for stars fainter than about 8th or 9th magnitude. In all cases for which there were only a very few observations, at least one reason for the low number was found (low altitude, twilight, event near full or new Moon, clouds).

Parallel observations of the same occultation covered arcs of up to 50° at the lunar limb, as derived from the extreme position angles KM. The parallel observations were made within periods from ten to forty minutes duration (with one exception of 2.5 hours!).

III. Analysis and Results for Occultations of Single Stars.

1. For each occultation, the s.d. of the residuals of all observations is about 0".1 smaller than the s.d. of the residuals of my own observations for the whole year (about ±0".5). This seems to show that in case of parallel observations, the number of quantities leading to different O-C is smaller than for occultations of different stars at different dates.

2. Differences in O-C of one observation from the mean of all parallel observations are typically ±0".2 with maximum differences of ±0".5. Most of such deviating O-Cs connected to my own observations were found to be explained by difficult observing conditions.

3. In case of more than one occultation per night, there is a chance to compare the mean O-Cs for the several occultations. Partly, good agreement in O-C or dL or dB (see item 7) was found with means varying within ±0".05 from each other. This accords with that which is expected, due to the nearly constant errors in the Moon's position within a few hours. However, results for some occultations deviate by ±1" or more from those of other events shortly before or after. This denotes problems in the relative positions of the stars in the overall framework (for example, see item 4).

4. One occultation (ZC 2032, 1983 July 17, DD) resulted for all observations in an unusually large O-C of -1".7, with a rather small s.d. of ±0".25. This large O-C differs by more than 2" from the occultations of ZC 2033 a half hour later. The star is not listed as a double. The example implies that a large O-C does not necessarily express any error in the observation (timing, observer's position). Apparently, an error in the star's position is responsible in this case. It is only possible to track down the cause by comparing all parallel observations at least of this occultation, but even better, of any occultations near the event in question. A single observation of a single event gives no answer in such a case.

5. The limb correction WH is included in the O-C given by the ILOC. I reexamined the observations without applying the limb corrections. Standard deviations of the original residuals including limb corrections for each occultation are significantly 0".3 smaller than the s.d. for the re-corrected residuals excluding limb corrections. The efficacy of limb corrections in making the residuals more realistic is evident.

6. A dependence of the O-C on the position angle KM is partly evident. Around a given value of KM, the O-Cs of observations of the same occultation are nearly equal. One or two degrees away, however, the O-Cs have rather different values, forming a new group with very small internal differences. Residual differences between such groups are up to 0".5. Presumably, this effect could be explained by discontinuities in the limb correction system for areas a few degrees apart.

7. Using the appropriate values of K-R (angle between point of occultation and direction of the Moon's motion) projections of all O-Cs into the direction of the Moon's path (dL) and perpendicular to it (dB) were computed. The s.d.s of dL with respect to dB are about 0".1 smaller than for the O-C. This difference is small, as parallel observations are spread out over a limited range of K-R (see section II) but it shows the dependence of the O-C on K-R. For example, a Moon's position error in latitude does not matter in case of a central occultation, but leads to considerable values of O-C if the contact point moves to one of the lunar poles. Thus, observations of the same event at differing K-R result in differing residuals.

8. The s.d.s of residuals derived from parallel observations of reappearances are nearly equal to those of disappearances. Although this seems to imply an equal uncertainty in observing disappearances and reappearances, one should consider that reappearances are timed mostly by more experienced observers.

IV. Results for Double Star Occultations. Four of my observations in 1983 involved double stars with components separated far enough to produce two events visible as single steps. I even saw two of them with a 63-mm telescope. The number of observers who reported two timings is very low; For three occultations each observed by from 30 to 50 observers, only three to five double timings are listed, or about 10%. Probably, many observers did not expect two events, and were unable to record two times. As ILOC reduced double star timings as two single events for the same star position, the difference in the two corresponding O-Cs gives the observed distance in the position angle of the occultation. Due to the small range of KM, no true distances and PAs may be derived from parallel observations. Two occultations with considerable differences in KM are needed. However, it is possible to transform the observed distances into components in common directions of right ascension and declination for comparison purposes.

Within the few parallel observations for each double star, the separations in the direction of occultation as well as the projected separations (in RA and Decl.) differ by up to 0".7 in the groups for each star. Considering the mean of the separations (0".1 to 0".3), these are uncertainties of more than 100% in some cases, showing the difficulty of deriving reliable separations of close double stars from only a few visual occultation observations.

V. Conclusions. Using real data, I have shown some relations between occultation circumstances and reduction results, as well as the order of magnitude for some quantities regarding distribution of observations.

Frankly, the statements are of limited or no scientific value, or need to be confirmed by further investigations. Anyway, it becomes evident that a number of parallel observations provide some information not achievable from a single timing. Due to the many possible sources of errors, a large number of observations involving both the given star and neighboring stars is needed for the utmost accuracy in analysis.

In case of any double star occultation (see double star code in the predictions), two separate events should be anticipated by the observer; he should be prepared to time two events. Besides, one should be alert for stepwise events of previously unknown doubles.

Future investigations of parallel observations could be of interest in connection with observations with large O-Cs and double star occultations.

W SAGITTARII

George Wallerstein

The primary of this close double star [Ed: Z.C. 2609] is also a Cepheid variable. We are working to obtain a spectroscopic orbit. If the separation and p.a. could also be determined from occultation data, we could get an accurate distance to the system, and the star could then provide the best calibration for Cepheid variables. Accurate observations of the current series of occultations would be most valuable. Please report any observations quickly to David Dunham. A good occultation occurs in the U.S.A. in August [Ed: U.T. date Aug. 23].

A CHANCE TO ATTEND THE I.A.U. GENERAL ASSEMBLY IN BALTIMORE

David W. Dunham

Generally, only a limited number of professional astronomers who receive invitations attend the triannual meetings of the International Astronomical Union (IAU). But this year's general assembly in Baltimore is being organized by the Space Telescope Science Institute and Johns Hopkins University, which desperately need many volunteers to help run the meeting. They have appealed to IOTA and the local amateur and professional astronomical community to help fill jobs during the meeting, such as ushers, projectionists, meeting-room monitors, and messengers. They are looking for "conscientious people who will keep their time commitments and don't mind taking orders." The IAU general assembly lasts from August 1 to 11; a minimum of 10 hours or 2 half-days of volunteer time is requested, in exchange for various benefits, including attendance on the days worked. More information is available from me at 301,585-0989; those seriously interested should telephone Marguerite Ingalls at Johns Hopkins, at 301, 338-7963, before June 15.

MULTIPLE STAR CODES

[Ed: Reprinted from USNO's "Notice to Observers" of 1976 September 30]

The following is a complete list of codes in current use. For "triple," three stars are usually meant, but there may be other known stars in the system. Visual observers will not normally notice the duplicity of stars with codes J or U.

A - Listed by Aitken or Burnham
B - Close double, with third star nearby with separate XZ entry
C - Listed by Innes, Couteau, or other visual observers
D - Primary of double, secondary has separate XZ entry
E - Secondary of double, primary has separate XZ entry
F - Following component
G - Triple: A or C, with secondary either J, U, or V; third star's data referred to secondary
H - Triple: J or U or V, and M
I - O, with secondary either J, U, or V; third star's data is referred to secondary
J - One-line spectroscopic binary, separation probably < 0".01
K - U or V, but duplicity doubtful
L - Triple: J or U, and V; or all V; or all J
M - Mean position of close pair
N - North component
O - Orbital elements available
P - Preceding component
Q - Triple: J or U or V, and O
R - Triple: O and O
S - South component
T - Triple: V, and A or C; or all A and/or C
U - Separation < 0".01 (usually a double-line spectroscopic binary)
V - Separation > 0".01 but not visual
W - Triple: J or U, and A or C
X - Probably a close double, not certain
Y - Triple: K or X, and A or C
Z - Triple: O, and A or C or V or X or L
$ - Triple: M, with secondary either J, U, or V; third star's data referred to secondary

PLEASE REPORT YOUR CHANGES

Whenever the data about you change – particularly your address, phone, coordinates, travel radii – please report them to the IOTA secretary-treasurer, at 6 N 106 White Oak Lane; St. Charles, IL 60175; U.S.A. It is not necessary to send the new data to anyone else or anywhere else in IOTA; the information will be forwarded to the proper agencies within IOTA. That process is not designed to work in reverse! Other information is not as urgently needed, but for our records, we would like to know your USNO station code, the aperture of the largest telescope and the largest portable telescope you will use (in cm), and whether you have photoelectric and/or video timing capability. If you wish, we will be happy to send you a new observer information form, but we will also accept the information in a note.

Supplement for Europe, the British Isles, the Middle East, and India

THE PLEIADES PASSAGE OF 1988 AUGUST 5-6

David W. Dunham

The 36%-sunlit waning crescent Moon will make a dramatic sight Saturday morning, August 6, as it passes centrally through the Pleiades. This will be visible throughout Europe, the British Isles, and the Middle East. The beginning of the passage will be visible from India shortly before sunrise.

The apparent-place chart of the Pleiades shows the topocentric paths of the Moon's center for 9 cities, like the one described in *O.N. 4* (7), p. 158. The Moon diagram, produced by Bob Bolster using a slightly modified version of John Westfall's MOONVIEW program, is oriented with north up. The position angle of the lunar north pole is 348°, and of the north cusp, 349°. The p.a. of the center of the bright limb will be 79°.

The paths for 10 favorable grazes during this passage are shown in *O.N. 4* (8), p. 196. Especially important events visible from central Europe will be the southern-limit graze of Alcyone (path 163) and the northern-limit for the close double star Taygeta (path 158). For grazing occultations, we expect northern limits to shift north by 0".3 to 0".4 (or about 0.8 to 1.1 km on the ground), on the average, as they did last summer for waning-phase grazes. More information is in *O.N. 4* (7), p. 158.