Occultation Newsletter

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FROM THE PUBLISHER

For subscription purposes, this is the first issue of 1979.

O.N.'s price is $1/issue, or $4/year (4 issues) including first class surface mailing, and air mail to Mexico. Air mail is extra outside the U.S.A., Canada, and Mexico: $1.20/year in the Americas as far south as Colombia; $1.68/year elsewhere. Back issues also are priced at $1/issue. Please see the masthead for ordering address.

IOTA membership, subscription included, is $7/year for residents of North America (including Mexico) and $9/year for others, to cover costs of overseas air mail. European (excluding Spain and Portugal) and U. K. observers should join IOTA/ES, sending DM 10.-- to Hans J. Bode, Bartold-Knaust Str. 6, 3000 Hannover 91, German Federal Republic. Spanish, Portuguese, and Latin American occultation observers may have free membership in IOTA/LAS, including *Occultation Newsletter en Español*; contact Sr. Francisco Diego Q., Ixpantenco 26-bis, Real de los Reyes, Coyoacan, Mexico, D.F., Mexico.

PRELIMINARY REPORT OF OBSERVATIONS MADE NEAR THE EDGES OF THE 1979 FEBRUARY 26 TOTAL SOLAR ECLIPSE

David W. Dunham

Plans to make observations near the edges of the path of totality were described on pp. 102 and 103 of the January issue of *Sky and Telescope* and in *O.N. 2* (1), p. 5, and (2), p. 11. A detailed 9-page bulletin was prepared by IOTA and sent to about 3 dozen observers who had responded to the above articles, as well as to over 200 high schools, newspapers, and television stations in cities and towns near the edges of the eclipse path.

Overcast skies foiled the attempts of some observers west of the Continental Divide, but many in Washington and Oregon were fortunate, and observed totality through breaks in the clouds. Thanks to the promotional efforts of Richard Linkletter, President of the Olympic Astronomical Society, most of the edge observations were made in those areas. A few observations also were made from Montana, North Dakota, and Saskatchewan, where thin cirrus hardly affected edge phenomena. A very preliminary assessment indicates that the eclipse path was about two miles narrower than expected, as if the solar radius were larger relative to the lunar radius by about 0".3 from the predicted values. However, a careful review of the observations, perhaps including an assessment of the photospheric level sampled by each observer, is needed before any firm conclusions can be drawn. This is probably especially true at the northern limit, since the smaller-scale features at the moon's northern limb produced less abrupt limb phenomena than those seen at the southern limit.

Perhaps the most successful expedition was led by Robert Hall, Physics Dept., Oregon State University, Corvallis. Nineteen people observed from eight stations spread over a four-mile range at the south edge near Madras, Oregon. The southernmost observer had only a fraction of a second of totality, thus defining the actual southern limit very accurately. He was one mile north of our predicted south edge or 5 miles north of the USNO Circular 157 limit, which does not include refinements such as the effects of deep lunar valleys. Several 35-mm slides and a 16-mm movie recorded the bead phenomena well. Shadow bands and the flash spectrum also were studied.

Another large successful effort was organized by Robert Mitchell, Physics Dept., Central Washington University, Ellensburg, Washington. Eleven stations were spread over a distance of ten miles; the observed totality ranged from 41.5 to 85.4 seconds. In addition, a group of amateur astronomers set up four stations near Cle Elum, 20 miles northwest of Ellensburg, and two stations at nearby Roslyn saw shadow bands but had no totality. The northern station at Cle Elum had only "an instant" of totality, while the southernmost had 46 seconds.

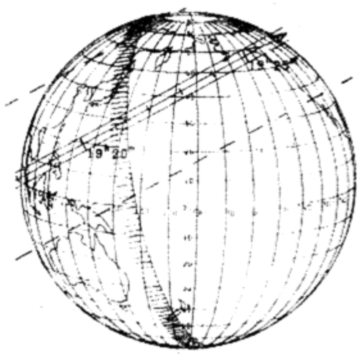
Also in Washington, observations were obtained successfully from four stations near Odessa. The expedition was comprised of students from the Hawthorne High School, Ritzville. Donald Calbick timed 21^s of totality at Moses Lake, while Walter Morgan (from Las Vegas, NV) photographed a very close miss from his brother's farm at Quincy. Farther east along the northern limit, John Howell (from Calgary, Alta.) reported an eclipse temperature of -2° F. at Lang, Saskatchewan. Totality lasted about 35 seconds, but absolute times were lost when the sound track failed on the movie camera mounted to an 8-inch Celestron. James Bruton (West Chester, PA) observed from Zeneta, Sask., near the Manitoba border.

At the southern limit, totality was timed by students at Wheeler High School in Fossil, Oregon, and also by students in Worden, Montana. Harold Povenmire (Daytona Beach, FL) observed from Sawyer, ND, 15 miles southeast of Minot.

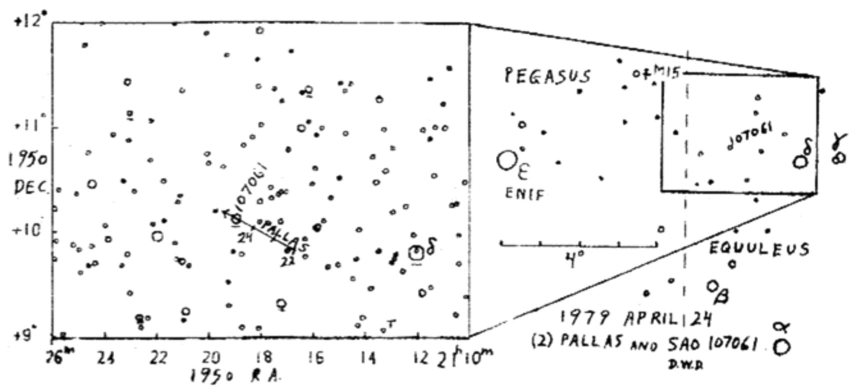
Based on Sunday weather forecasts, Joan and I changed our original plans and flew into Minot, ND, late that evening. In the meantime, my brother, Douglas, had driven from Duluth, with three friends from the University of Minnesota at Duluth, to Rugby, ND, where there is a monument marking the geographical center of North America. Douglas and Joan took timed photographs from a motel parking lot in Rugby, while I projected the sun's image using a 60-mm refractor at a site 5 miles east of town. I timed dozens of Baily's beads events visually during the few minutes around totality, but within about thirty seconds of totality, the bead events were too complex and rapidly changing to describe; it was the ultimate grazing occultation! One timed photograph of the projected image shortly before totality shows detailed bead structures. Totality lasted 14 seconds, showing that I was only half a mile from the southern limit. Shadow bands were faintly seen, but were stronger in Rugby, where the cirrus clouds were a little thinner and where totality lasted about 40 seconds. We were sorry that we did not have movie cameras or other equipment to properly record the fantastic detail which we saw. We had not made extensive arrangements to observe "the eclipse which probably would be clouded out," but which turned out to be one of the best of the four total solar eclipses we have seen.

Many observations were made from locations, such as Minot and Winnipeg, which were far from the center line but more than 15 miles from the path edges. Although limb effects were enhanced only slightly at these places, bead observations and contact timings made there, and from central sites, will be useful for an overall analysis planned by IOTA and USNO. Reports of Baily's beads and contact timings should be sent to: Nautical Almanac Office, U. S. Naval Observatory, Washington, DC 20390, U.S.A.

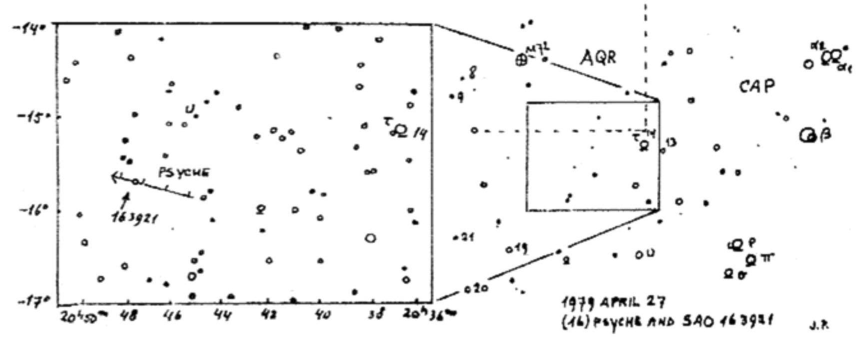
The figures below and on the next page are a continuation of the article PLANETARY OCCULTATIONS DURING 1979, which appeared on pages 16-20 of the last issue.



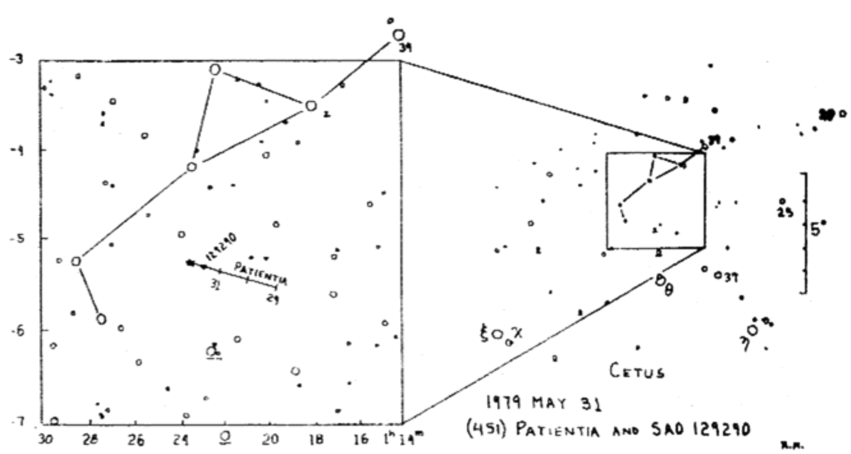
SAO 107061 by Pallas, 1979 Apr 24



SAO 163921 by Psyche, 1979 Apr 27



SAO 129290 by Patientia, 1979 May 31

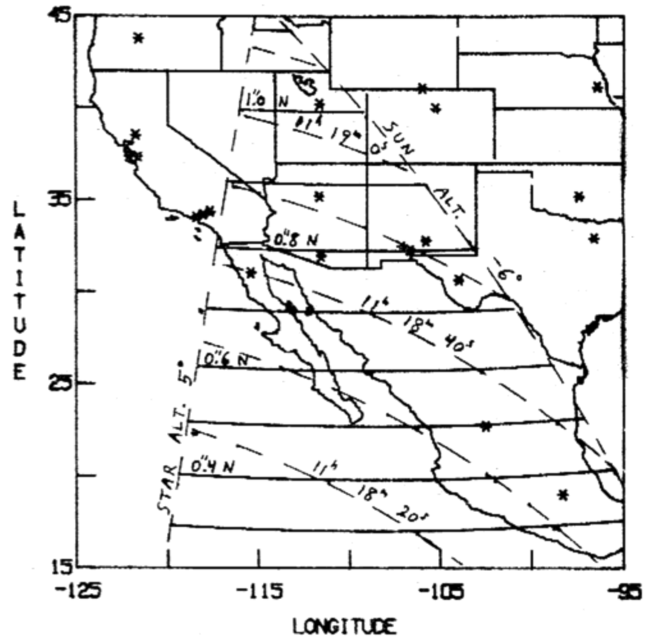


ON THE ACCURACY OF COORDINATES OF OBSERVERS OF GRAZING OCCULTATIONS

David W. Dunham

Glen Rowe, a surveyor in Gisborne, New Zealand, published an article about the determination of geographical coordinates for occultation work in Circular C78/5 of the Occultation Section of the Royal Astronomical Society of New Zealand (inquiries about this publication should be addressed to Graham Blow; R.A.S.N.Z. Occultation Section; P.O. Box 2241; Wellington; New Zealand). He describes a standard procedure for measuring coordinates from a large-scale topographic map, and notes that this is sufficient for stations from which total occultations are observed. But for grazing occultations, he feels that it is necessary to have the observation sites surveyed, and gives comprehensive formulae for the calculation of longitude and latitude from the surveyed measurements. Although the information he uses is for New Zealand, the procedures and formulae are applicable to other geodetic datums. My thoughts about these matters are given below.

Occultation of SAO 129290 by (451) Patientia
1979 May 31
Diameter 327 km = 0".13



Glen Rowe's article, "Co-ordinating Telescope Sites," is certainly interesting and informative, but I am afraid that some of his statements, and the complexity of the formulae for calculating precise coordinates, might discourage observations of grazing occultations in New Zealand. The fact is, an accuracy of one second of arc (1") in latitude and longitude is currently adequate for nearly all graze observations, so that the map scaling method he describes for total occultation observation sites is sufficient. Since the moon is about 60 earth radii away, a geographical uncertainty of 1" corresponds to an error of less than 0".02 on the celestial sphere (that is, this is the size of a geographical uncertainty of 1" subtended at the moon's distance). Even the best available star positions have uncertainties greater than 0".05, and most are uncertain by more than 0".1. The uncertainties in star positions likely will be reduced by future sophisticated observations, such as those planned with the Large Space Telescope. An even more serious error source is the specification of individual points, and large areas, of the moon's limb with respect to its center of mass. This exceeds 0".2, and I know of no future projects, except the ultimate analysis of graze data, to reduce this error. Consequently, an accuracy of 1" in geographical position is sufficient for making studies to improve our current knowledge of star positions (and associated stellar reference frames) and of the moon's limb by nearly an order of magnitude. Improvements in the mathematical specification of the moon's motion, and fitting these improved theories to lunar laser ranging and occultation observations, have considerably reduced the lunar ephemeris error relative to the other two error sources described above.

Geographical accuracies better than 1" are sometimes useful, and are needed to specify the observations as accurately as the timings can imply. In the case of favorable circumstances, when events occur at relatively flat areas of the moon during a graze, two observers only 5 meters (about 0".2 in geographical position) apart can notice differences in their timings of a few tenths of a second, enough to be resolved by the usual methods of visual observation. At present, there is no use for such fine-scale information about the moon's limb (except for future occultation events which may occur in that lunar area), but knowledge of observers' *relative* locations to 5-meter accuracy can be useful for obtaining very accurate information about close double stars. In such a case, the height above sea level should also be known to this accuracy. A survey, as Rowe recommends, would normally be needed to achieve this accuracy, but as only the relative positions are needed this accurately, the coordinates of one station could be scaled from a topographic map, and the coordinates of the other stations specified with respect to that position to 0".2 (5-meter) accuracy. There is a case in which similar *absolute* accuracy would be worthwhile, which is alluded to above: Grazes of the same star might be observed in the same lunar limb area during different months. This effectively eliminates absolute star position and limb errors, so that precise observations could be used for refining the star's proper motion (in an absolute sense) and would also be an extremely accurate test of the lunar motion. Observers might keep this in mind when observing grazes of bright stars, future observations of which would be likely. In such cases, observers should keep careful records of where they were, to at least 5-meter accuracy, so that Glen Rowe's procedures could be used to establish precise geographical positions if future observations make this worthwhile. When possible, observers can position themselves close to geodetic horizontal control stations, whose precise latitudes and longitudes already have been established; then, the procedures for ob-

SAO 164174 by Interamnia,19May1979

SAO 78148 by Parthenope, 23May1979

taining accurate coordinates described by Rowe could be avoided.

INSIGHTS INTO THE NATURE OF COMETS FROM THE DISCOVERY OF MINOR PLANET SATELLITES

T. C. Van Flandern

[This is an abstract of a paper presented at a poster session of the 153rd meeting of the American Astronomical Society held 1979 Jan. 7-10 in Mexico City. It is reprinted here with permission of the author from *Bull. Am. Astron. Soc. 10*, 660 (1978).]

The photoelectric confirmation of the existence of a satellite of the minor planet (532) Herculina on 7 June 1978 has been followed by the discovery, from other occultations of stars by minor planets, that such satellites are both numerous and commonplace. All 7 minor planets which have been observed to occult stars have shown evidence of having satellites; and there are now 22 known or suspected companions of these 7. If comets are thought of as systems of orbiting bodies like minor planets, differing only in that their gas and dust-sized "satellites" have not yet been expelled by solar radiation pressure, then many puzzling features of comets are simultaneously explained. Comet comas *contract* as they approach the sun and *expand* as they recede because the comet's gravitational sphere of influence does likewise. Splitting of comets represents gentle escapes of satellites. The gas and dust of comas is orbiting material, and therefore accompanies a comet even at aphelion; hence no solar heating is required to produce them. New comets lose much more material than old ones because of the first-time shrinking of their spheres of influence. The same process spreads meteors into the comet's orbit. This model therefore explains away the principal criticisms of both the "dirty snowball" and "particle swarm" comet models.

OTHER LATE 1978 ASTEROIDAL OCCULTATIONS

David W. Dunham

(12) Victoria and SAO 161878, October 25. An observation of this occultation from Battelle Observatory, Richland, WA, was reported on p. 7 of *O.N. 2* (1). James McMahon reports that he observed a blink using a 10-inch reflector at China Lake, CA. Although there were some cirrus clouds in the area, he feels that the sudden event was probably not atmospheric. An observer using the guide telescope in the same observatory, and another observer a few miles away, claimed that no blink occurred. But McMahon asked each observer to point out the star he was watching, and in each case it was the wrong star. McMahon is confident that he had the correct star in view, as he saw the faint asteroid approaching it before the images merged.

(10) Hygiea and SAO 187163, November 4. Jan Hers and other South African observers reported that large patches of clouds prevented observation.

(10) Hygiea and SAO 187576, November 17. Richard Nolthenius reports that cloudy skies prevented observation of this event from California. As far as I know, no astrometric updates were made for the two November Hygiea occultations. The southern declination and relatively small elongation from the sun virtually ruled out astrometric observations from England or from the U.S.A.

(511) Davida and SAO 190782, November 21. Astrometric plates obtained at Lowell Observatory during the several days preceding the event continued to indicate a considerable north shift, as noted on p. 7 of *O.N. 2* (1), but with a considerable scatter due to the southern declination. An approaching storm prevented observation from the West Coast of the U.S.A. The asteroid was observed to merge with the northern side of the star's image at Lowell Observatory, AZ, and Tortugas Observatory near Las Cruces, NM, confirming that the path did go well to the north. Jack Drummond, New Mexico State University, reported measurements of plates of the appulse taken at their Tortugas station. My calculations from these data indicated that the path was far to the north, probably off the earth's surface. The Davida event clearly illustrates the need for good astrometric observations from the Southern Hemisphere. Such a capability also would be useful for refining predictions of asteroidal occultations expected to occur in the Southern Hemisphere.

(29) Amphitrite and SAO 146788, December 6. Maps and updates to the prediction for this event were published on pp. 6 and 7 of *O.N. 2* (1). Later in November, William Penhallow obtained a plate of the star. This measurement, combined with his earlier update on Amphitrite's ephemeris indicated that the center of the occultation path would be 0".18 south of the nominal prediction (crossing the English Channel, Belgium, northern Germany, Poland) with the event 1½ minutes late. We estimated that the prediction could be 0".5 in error. I prepared IOTA Special Bulletin No. 6 about the event and this astrometric result, noting that a last-minute update might be obtained from Gordon Taylor, and distributed the bulletin to many groups of observers in western Europe. Taylor obtained a plate with the two objects about a degree apart. His prediction based on this plate put the path near the Canary Islands and across northern Africa, apparently near 2" south.

Observing conditions at the time of the event were very favorable in the northeastern U.S.A. In the Washington, DC, area, the sun was only 7° below the horizon at the time. Due to a lack of bright stars near the asteroid readily visible in the twilight, I was unable to locate the objects until nearly twenty minutes after the conjunction, although I had familiarized myself with the star field the previous evening. I recommend two approaches for future events of this type in bright evening twilight: 1) Use an equatorial mount, aligned well with the celestial pole, and good setting circles to offset from first magnitude stars to the desired star field, or 2) Use the technique that has been used successfully for making some daytime lunar occultation observations at small elongations from the sun (when the moon could not be seen without optical aid): Observe a star which has approximately the same declination as the star to be occulted, at a time during a previous evening when it will be at the same hour angle as that predicted for the event to be observed. Mark the orientation of the telescope axes with masking tape, and the tripod legs with stakes driven in the ground. The masking tape can be cut to disassemble the telescope, and the cut ends matched to reassemble it in the correct orientation just before the possible occultation.

Needless to say, the telescopes at the U.S. Naval Observatory do have good setting circles, so that T. Van Flandern and R. Schmidt were able to locate the star and minor planet several minutes beforehand and monitor the appulse photoelectrically. No drops occurred in the light curve, and the objects were clearly separated at closest approach. Charles Worley obtained plates of the approach with the double star camera on the 26-inch refractor. Measurements of these plates showed that closest approach was 1".75, about 4 minutes later than the nominal prediction. Since the 0".9 north path went through Washington, the occultation path must have been at 0".85 south, so that the following cities should have been in, or very near, the path: Lisbon, Portugal; Madrid and Barcelona, Spain; and Rome, Italy. I have not heard from observers in those areas; perhaps it was cloudy (they were sent copies of IOTA Special Bulletin No. 6). No occultation was reported by observers in Massachusetts and in Belgium (where the seeing was poor).

(41) Daphne and SAO 111443, December 11. Penhallow made astrometric observations of the star and Daphne in late November. My calculations using these data indicated a 1".6 north shift, indicating that the path might cross southern India and the Philippines. Penhallow obtained more exposures on December 7, when the star and Daphne were about a degree apart. Although there was some scatter, the mean result indicated a 1".5 north shift with the event 4½ minutes early. When I telephoned Gordon Taylor a day in advance to discuss astrometry for the Melpomene occultation, I gave him Penhallow's measurements for the Daphne event, suggesting that it might be worthwhile to notify observers in southern India and the Philippines. A long run of poor weather had prevented Taylor from making astrometric observations for the event.

NEW DOUBLE STARS

David W. Dunham

The table lists additions and revisions to the special double star list of 1974 May 9 not listed in previous issues. The columns and general format were described on p. 3 of *O.N. 2* (1).

The most interesting double star discovery since the last list was published is SAO 114159, whose duplicity was discovered during the occultation by Melpomene as described on p. 13 of the last issue. The values given in the table were determined largely by the visual observations of the occultation which indicate sizeable limb irregularities, the existence of which is supported by photoelectric rotational light-curve data on Melpomene. The irregularities introduce an uncertainty of about 0".005 in the relative positions of the stellar components. If some of the visual occultation observations are ignored, producing a more regular shape for Melpomene, the separation of the stellar components decreases. The accurate relative positions of the stars is important for proper interpretation of the secondary occultation events reported outside the main occultation path, indicating possible satellites of the asteroid. The relatively large stellar separation poses some problems for the satellite model of some of the secondary occultation events, in the sense that with such a separation, some of the secondary events should have been confirmed at other stations, but were not. An accurate relative position of the two stars independently determined would be very useful. Unfortunately, the star is in Monoceros, far from the ecliptic, where it can not be occulted by the moon. Another star in this category is SAO 120836, which was occulted by (2) Pallas on 1973 February 6 as seen from parts of western North America (*J.R.A.S.C. 67,* 198 (1973)). No conclusions were drawn from the conflicting observations. Van Flandern feels that the data can be explained by stellar duplicity (approximate parameters given in the table) and a satellite of Pallas, as described in his and Binzel's article, "Minor Planets: The Discovery of Minor Satellites" in *Science 203*, 904 (1979 March 2). Independent observations of the stellar duplicity would be valuable for checking Van Flandern's hypothesis. Speckle and spectroscopic observations of both of these stars for duplicity would be useful.

The brightest new double is SAO 110408 = Z.C. 327 = ξ^1 Ceti, which is now being occulted. Roger Griffin writes that his analysis of spectroscopic data indicates a period of 1640 days and an amplitude of about 6 km/s, so that "the secondary should have non-negligible mass," and possibly be detectable during an occultation. A couple of grazes of the star have been observed visually, with no reports of possible duplicity, but the separation may be too small to resolve without a high-speed photoelectric record.

All of the new non-SAO doubles were reported in the I.A.U.'s Commission of Double Stars Information Circular No. 76 (1978 October) and No. 77 (1979 March). BD +15°269 = K 1015 = AGK3 N15°155, BD +15°340 = K 1348 = N15°211, and BD +15°409 = K 1593 = N16°260 are in USNO's XZ catalog; the others are in neither the AGK3, XZ, or K catalogs. The anonymous star is at 1950 R.A. $7^h45^m.2$, Decl. +15°34½', 1' south of SAO 97258. Newly determined orbits are given for four of the stars in our list, mostly from Circular No. 74.

C. L. Morbey, J. M. Fletcher, and G. Edwards have published some notes about known or suspected doubles based on photoelectric occultations recorded at the Dominion Astrophysical Observatory, Victoria, British Columbia, in the *Journal of the R.A.S.C., 72*, 305-309 (1978 December). They resolved the spectroscopic binary SAO 158489 = Z.C. 2053 = λ Virginis on 1977 July 24, obtaining a separation of 0".006 and a magnitude difference of 1.4 in blue. Since the separation is more than an order of magnitude larger than the spectroscopic nominal angular separation, I think there is a possibility that the star is triple. SAO 94865 was observed on 1978 April 15. There was evidence for a 0".015 separation for this spectrum double. An observation of SAO 158489 = Z.C. 2826 = ρ Sagittarii on 1977 July 29 showed no evidence for duplicity. This, combined with a good photoelectric record by R. Radick at the University of Illinois, also showing no duplicity, casts considerable doubt on the possible duplicity of the star reported in previous issues. Repeated frustrations with Murphy's laws led one of the authors to write an ode entitled "O Occultation", which was included in the *JRASC* article.

SAO 92996 is the only new double reported by W. Beavers and J. Eitter in a recently received preprint of a long article giving results of their photoelectric occultation observations made from 1974 to 1977. No evidence for duplicity was found for several stars reported as double by other occultation observers, usually at McDonald Observatory, TX, including the following stars: SAO 78666, SAO 93835, SAO 97120 = ZC 1158, SAO 97843 = ZC 1271 (a high-quality record; the star's originally claimed duplicity has been questioned according to other observations reported in recent *O.N.'s*), SAO 109262 = ZC 68 (1975 Nov. 15, p.a. 39°.7; good record with strong fringes showing no evidence of second or third member"), SAO 146239 = Z.C. 3326 ("geometry apparently unfavorable"; the star is a known close visual double, Kuiper 114, probably very close to periastron in 1974-1975), SAO 146307 = ZC 3340, and SAO 164213. SAO 162512 = Z.C. 2826 = ρ Sagittarii is noted as a "possible double" according to data obtained at p.a. 49°4 on 1976 Sept. 4, but other observations noted above indicate no duplicity. Improved component magnitudes are given for the following known doubles: SAO 77313 = Z.C. 843 + ADS 4200, mags. 7.8 and 8.1; SAO 77423 = ADS 4277AB, 9.3 and 10.0; SAO 159090 = Z.C. 2172 = ADS 9532Aa, 5.0 and 6.2; and SAO 163645 = Z.C. 2995, 6.8 and 7.2 (the components as listed in the Lick IDS need to be reversed, so that at 1975, the p.a. is 347°4, not 167°4).

The two errors which I have corrected in the list were discovered when the graze computors requested double star data for stars which are not in their 1977 lists, and I tried to supply the information. Joe Senne recently pointed out a *variable* star error, for 8.2-mag. SAO 161257 = WZ Sagittarii. The magnitude at minimum light was given as 0.9 in the USNO data, when it should have been 10.9. Don Stockbauer noticed that the same data are given in our lists for SAO 98614 and 98615. SAO 98615 is the 7.7-mag. primary; 98614 is the 8.0-mag. secondary 14″2 from 98615 in p.a. 242°.

Jim Van Nuland writes, "In studying your new Double Stars Article in *o.N.* 2, 4 (1), col. 1, under *Other Stars*, I noticed the same SAO number, 184336, given for ZC 2609 (line 2) and for ZC 2349 (line 12). Other issues of *o.N.* list 184336 = ZC 2349, so I conclude that the SAO number in line 2 is wrong. Presumably the correct number for AC 2609 is 186237, as given in the table at the head of the page." His presumption is correct.

[Note added Apr. 9] Van Flandern has retracted his published interpretation of the 1973 Feb. 6 occultation of SAO 120836 by Pallas, since astrometric observations show that the main occultation path crossed part of western Canada, not Colorado. The short occultation recorded in Alberta involved a light drop 85% of that expected, indicating that the star is probably double, but the separation and p.a. are unknown, since no occultation of the secondary star seems to have been recorded.

NEW DOUBLE STARS, 1979 APRIL 9

SAO/BD	ZC	M	N	MG1	MAG2	SEP	PA	MAG3	SEP3	PA3	DATE, DISCOVERER, NOTES
78135*	0946	V	Q	3.4	5.4	0″03		8.8	1″08		1978, 3rd* orbit by Baize, IAU Circular 76 (ADS 4841)
78349*	0983	I	V	6.5	6.9	.055	160°				1976.860, H. McAlister, Kitt Peak Observatory, AZ
92996		P	X	9.3	9.3	.041	37				1976 Mar 6, J. Eitter and W. Beavers, Ames, IA
93076		V	C	8.4	10.7	0.9	339				1978.9, W. Heintz, Swarthmore, PA
93433		V	O	8.7	10.2	0.30					1979, orbit by Baize, IAU Circular 77
93524	0523	T	K	7.3	7.3	0.1	90				1977 Nov 25, A. Osipov, Kiev, Ukraine
93731		V	C	9.8	9.8	0.2	22				1978.9, W. Heintz, Swarthmore, PA
93803	0618	P	V	7.3	10.0	.037	80				1978 Oct 19, B. Smith, McDonald Observatory, TX
94288		T	X	9.6	9.6	0.3	91				1979 Apr 2, J. Van Nuland, San Jose, CA
94922		T	K	9.3	9.3	0.1	270				1978 Oct 21, P. McBride, Green Forest, AR
95728		P	V	9.6	9.7	.041	138				1978 Nov 18, D. Evans, McDonald Observatory, TX
96267		T	K	9.4	9.4	0.1	270				1977 Sep 8, A. Zhitetski, Kiev, Ukraine
96343*		C	T	9.1	9.1	0.6	270	9.1	40.8	48°	Correct error
97222		T	K	8.6	8.6	0.36	90				1978 Dec 17, P. McBride, Green Forest, AR
97782		T	X	8.8	9.3	0.2	93				1979 Apr 6, D. Dunham, Silver Spring, MD
109039		T	V	8.6	8.6	0.2	90				1977 Nov 20, A. Zhitetski, Kiev, Ukraine
109355		T	X	9.1	9.1	0.1	90				1977 Dec 18, B. Sincheskul, Poltava, Ukraine
110183		T	V	9.7	9.3	0.3	270				1977 Sep 1, A. Zhitetski, Kiev, Ukraine
110295	0300	P	V	8.2	9.2	.028	228				1978 Nov 13, D. Evans, McDonald Observatory, TX
110359	0315	T	X	8.3	8.8	0.3	221				1979 Feb 3, R. Nolthenius, Mountain View, CA
110398		T	K	9.1	10.1	0.2	277				1979 Feb 3, R. Nolthenius, Mountain View, CA
110408	0327	S	J	4.7	6.7	.012					1979, R. Griffin, Cambridge, U. K.
114159		X	V	8.6	10.1	.051	27				1978 Dec 11, T. Van Flandern, U.S.N.O., Washington, DC
118443*	1564	V	O	6.7	8.0	.378					1978, orbit by Heintz, IAU Dbl. Star Circ. 74 (ADS 8887)
120836		X	X	9.4	10.3	0.2	320				1973 Feb 6, T. Clark and E. Milone, Priddis, Alberta
139175	1886	T	K	6.5	6.5	0.1	90				1977 May 1, A. Zhitetski, Kiev, Ukraine
145537*	3166	I	V	5.0	8.0	.033	123				1977.4819, H. McAlister, Kitt Peak Observatory, AZ
146047		T	K	10.1	10.1	0.5	90				1978 Nov 9, P. McBride, Green Forest, AR
146088	3296	T	X	9.5	9.5	0.3	90				1978 Nov 9, P. McBride, Green Forest, AR•
146289		P	V	8.9	9.4	.017	259				1978 Oct 13, L. Coleman, McDonald Observatory, TX
161107		T	V	9.4	11	1.0	10				1978 Oct 8, R. Giller, Engadine, N.S.W., Australia
161426*		C	A	8.1	11.4	8.0	46				Correct error
162777	2856	G	X	6.8	8.5	0.2	347				1978 Dec 3, D. Steicke, Murray Bridge, South Australia
163666*	2997	V	O	7.9	7.9	.231					1978, orbit by Heintz, IAU Dbl. Star Circ. 74 (ADS 13961)
164233		T	K	9.7	9.7	0.1	90				1977 Dec 14, A. Zhitetski, Kiev, Ukraine
164482		P	X	9.3	10.9	.042	236				1978 Nov 8, B. Smith, McDonald Observatory, TX
187251*		V	O	8.7	9.2	.398					1978, orbit by Heintz, IAU Dbl. Star Circ. 74 (ADS 11643)
+17°1043b		T	V	9.8	10.0	0.8	155				1979 Apr 3, J. Van Nuland, San Jose, CA
+15 269		V	C	9.4	11.5	0.8	120				1978.9, W. Heintz, Swarthmore, PA
+15 340		V	C	9.8	11.0	2.5	53				1978.8, W. Heintz, Swarthmore, PA
+15 409		V	C	9.9	11.1	4.1	197				1978.9, W. Heintz, Swarthmore, PA
+15 1612		V	C	10.6	10.6	0.7	4				1978.2, W. Heintz, Swarthmore, PA
+15 1640		V	C	9.5	10.6	2.8	102				1978.2, W. Heintz, Swarthmore, PA
+15 1682		V	C	10.5	10.5	0.2	54				1978.2, W. Heintz, Swarthmore, PA
+15 1692		V	C	10.3	10.4	0.4	116				1978.2, W. Heintz, Swarthmore, PA
+15 1746		V	C	10.2	10.7	1.5	65				1978.2, W. Heintz, Swarthmore, PA
Anonymous		V	C	10.5	11.2	3.4	42				1978.2, W. Heintz, Swarthmore, PA

POSSIBLE OCCULTATION BY PLUTO ON 1980 APRIL 6

Gordon E. Taylor

The star concerned is about 12th magnitude and its 1950.0 position is R.A. $13^h40^m45^s.1$, Dec +8°34'48". The occultation, if it occurs, will be seen from a track about 6000(?) km wide, between longitudes E 90° and W 60°. Note that it cannot be seen from observatories in North America, Australasia or east Asia. The present indication is that the chances are lower in Europe and higher in S Africa (where an occultation would be seen in a dark sky at a high altitude above the horizon).

I propose the following schedule:

January 1979 Pluto within 1°.3 of the star. I intend to take plates at Herstmonceux.

February I will issue preliminary predictions in a Bulletin.

March-May I hope that U.S. astronomers will determine spectrum and magnitudes of the star - if it is still likely to be occulted.

August IAU meeting in Montreal. We could discuss planning of observations and any necessary expeditions.

December Pluto within 1° of star. I intend to take plates at Herstmonceux.

January 1980 I will issue revised predictions in a Bulletin.

end of March Pluto 0°.3 from star. I intend to take plates at Herstmonceux.

April 1-3 I will issue final predictions by telex or telephone.

April 6 Occultation.

[D.W.D.: T. Van Flandern has supplied the following additional information, largely based on ephemeris data for Charon supplied by R. Harrington at USNO. The occultation is expected to occur about 23^h U.T. of April 6. At that time, Charon, the satellite of Pluto, is expected to have a separation of 0".76 from Pluto in position angle 355°. Consequently, an occultation by Charon is more likely in Europe and less likely in southern Africa. Since Pluto's horizontal parallax will be 0".3, it is possible that Charon's shadow could narrowly miss the north polar regions while Pluto's shadow could miss the south polar regions, but hopefully, we won't be that unlucky. Although the star is faint, Pluto will be about two magnitudes fainter, so that an occultation could be observed visually with a large telescope.]

MORE ON JUNO

Yaron Sheffer

Since the article by Dunham and myself (*o.N. 2* (2), 12) was written, I have learned of two more attempts to observe last July's occultation of SAO 144070 by (3) Juno from Israel. A. Lerrer used a 6-cm refractor to observe the occultation from Ramat Hasharon, 9 km southwest of my location and only 2 km south of a line parallel to the motion of Juno's shadow passing through my site. Since he had only one stopwatch, he only timed the disappearance, at $23^h01^m19^s.5$ U.T., $1^s.0$ earlier than my timing. However, the disappearance should have been $0^s.7$ *later* at his site. I believe that the discrepancy can be explained by different personal equations, and stopwatches with different mechanisms perhaps running at slightly different rates and with different zero-settings (stopwatch jumping at start, and/or different personal equations when stopping watch to time signals). Lerrer did not see the secondary occultation which I observed, either because he was not observing at the time (he had difficulties in finding the star in strong moonlight) or because the satellite occultation shadow passed north of him (the event was grazing at my site; this would imply that the star was occulted by the southern edge of the object).

I. Shlosman observed the appulse visually with the 102-cm telescope of Wise Observatory. The objects merged, but no fading was detected. If Juno's diameter is 256 km, as implied by my observed chord, and if the occultation was central at my location, Wise observatory would have been about 30 km south of the actual southern limit of the occultation.

WWV IN ERROR

According to the National Bureau of Standards Time and Frequency Bulletin No. 253 (1978 December), there was an approximately 1.2-millisecond time error in WWV's transmissions at all frequencies on 1978 November 29 between 13^h10^m and 15^h05^m UTC. Inquiries about the Bulletin should be addressed to: Sandra L. Howe, Editor; Time and Frequency Division; National Bureau of Standards; Boulder, CO 80303.

GRAZES REPORTED TO IOTA

David W. Dunham and Robert A. McCutcheon

Report forms for grazing occultation observations are available from either the IOTA Secretary-Treasurer or from me. Completed reports should be sent to me at: P.O. Box 488; Silver Spring, MD 20907; USA. If possible, a copy of the report should also be sent to: H.M. Nautical Almanac Office; Royal Greenwich Observatory; Herstmonceux Castle; Hailsham; Sussex BN27 1RP; England, the world center for reporting all occultation observations, as designated by the International Astronomical Union. Please indicate on your report whether copies have been supplied to IOTA and/or HMNAO. If this is not done, we will assume that no copy has been sent to the other.

New graze report forms, prepared in a form ready for direct keypunching (as are HMNAO's total occultation forms), are nearly completed and will be distributed to IOTA members within a few months. Since they also will make the job of transcribing previous reports to forms for keypunching much simpler, that project is suspended until the new forms are ready. Don Stockbauer, Victoria, TX, and students at the Bruce Peninsula District School, Lion's Head, Ontario (under the direction of Doug Cunningham) are commended for transcribing a large fraction of the previous reports onto keypunch forms. Completion of the new forms will add impetus to IOTA's long-delayed effort to produce a manual on grazing occultations.

The first 2 columns of the table give the Universal Time month and day numbers. Star numbers are usually Z.C. (4 digits) or SAO numbers (6 digits). The B.D. number is given for non-SAO stars. The B.D. and C.D.

are components of the DM catalog, but the moon will not occult CD stars during the next few years. A number prefixed by a letter is a USNO reference number, but in general, starting with this issue, they will not be used unless there is no B.D., SAO, or Z.C. number available. Solar system objects will be identified by name. The previously used USNO Z numbers are being superseded by X numbers for 1979, and they in turn likely will be replaced within about five years by another catalog when the SRS program is completed. The more widely used ZC, SAO, and DM numbers will remain unchanged. In case of close double stars, the combined magnitude is given. Under the next column, the percent of the moon's apparent disk sunlit, + signifies waxing, - waning phases. Next is the cusp angle in degrees from the north or south cusp. Only the number of stations reporting useful data (including possibly one station reporting no occultation) is given under # Sta. Next is the number of timings, which counts ½ for "possibly spurious" events and nothing for "most likely spurious" ones. Only contact timings (extended HMNAO codes 1-6 and 15-18) are counted (a "10" event would be counted if the time for the implied event can be inferred to within about 2 seconds). Totals involving halves are rounded up. CC is the best observing condition code (numerically highest) reported by any observer in the expedition. Ap cm gives the aperture, in centimeters, of the smallest telescope in the expedition which achieved the observing code listed under CC (in case more than one observer achieved it). St gives the estimated shift from the USNO prediction (without applying any correction based on latitude libration), in

Mo	Dy	Star Number	Mag	% Snl	CA	Location	# Sta	# Tm	C C	Ap cm	Organizer	St	WA	b
1976														
7	21	2601	8.4	33-		St.Llorenc,Spain	1	6		20	Raimon Reginaldo			
7	24	095127	7.6	8-	3S	Cocoa, FL	1	2		31	Robert Wood			
1977														
3	12	160534	8.4	50-	5S	Earthquake, CA	1	1	5	15	Richard Nolthenius	C	184	-50
3	15	163504	8.8	19-	-1N	Ocean Beach, CA	1	1	4	15	Richard Nolthenius			
8	5	0284	7.4	62-	6N	Silverdale, N. Z.	2	6		20	Graham Blow			
9	17	158863	9.1	18+	10S	Auckland, N. Z.	1	3		50	Graham Blow			
10	4	095009	8.2	61-	7N	Burlington, IL	1	1	3	20	John Phelps	8S	356	71
10	18	161482	8.3	34+	7S	Descanso, CA	1	1	5	15	Richard Nolthenius	C	168	-61
10	19	2826	4.9	44+	3S	Walnut, CA	2	9	7	15	Richard Nolthenius	C	177	-60
10	20	2969	3.2	56+	-6N	Bangor, WI	1	7	7	25	Berton Stevens	3S	355	-58
10	22	3362	5.9	83+	S	Guntsville, Ont.	1	3		20	Robert Radko			
11	06	118524	8.7	27-	-1N	Ocean Beach, CA	1	1	7	15	Richard Nolthenius	C	357	+40
1978														
1	29	1795	7.1	71+	7S	Lakeside, CA	1	4	8	25	John Hildebrand			
2	17	0829	7.0	70+	7N	Sun City, CA	2	8	8	20	Richard Nolthenius	5N	5	68
3	17	095461	7.8	57+		Cooma, Australia	1	1		32	David Herald			
3	17	095985	7.9	59+		Marinha Gr.,Port.	1	5	4	20	Joaquim Garcia			
3	20	1271	5.9	80+	7N	Bondville, IL	3	5	7	13	John Phelps	7S	2	64
3	21	1458	5.9	85+		Agueda, Portugal	1	2		10	Jose Osorio			
4	11	0692	1.1	17+		Ferté-St.Aubin,Fr.	8	56		26	Jean Schwaenen			
4	14	1091	6.7	45+		Sezimbra,Portugal	1	2	3	16	Joaquim Garcia			
4	14	1096	5.3	45+	N	Sonderholm,Denmark	4	5		6	Kyril Fabrin			
5	11	0944	5.7	14+	N	Nashville, Ont.	3	7	5	16	Andreas Gada			
5	14	1381	6.3	45+		Malda, Spain	3	18		14	Pedro Manosa			
5	14	1381	6.3	45+		Mollerussa, Spain	1	6		8	Domenec Barbany			
6	7	095715	7.8	3+	4S	Johannesburg, RSA	2	3	8	8	Jan Hers			
6	29	0257	4.5	33-	6N	Pretoria, R.S.A.	2	7	9	8	Jan Hers	C	184	-50
7	2	0692	1.1	7-	3S	Orinda, CA	5	49	5	15	James Ferreira		175	
7	2	0692	1.1	7-	3S	Concordia, CA	7	25	8	8	Raymond Bryant			
7	9	1474	7.1	14+		Michelago,Austrl.	9	46	8	6	David Herald	C	3	30
7	14	2033	4.3	61+	5S	Goulburn,Austrl.	11	26	8	20	David Herald	C	175	-40
7	14	2033	4.3	61+	5S	Jamberoo, Austrl.	6	23	9	8	Roger Giller			
7	14	2033	4.3	61+	5S	Kiama, Australia	4	10	8	6	Andrew Dixon			
7	28	0496	7.9	35-	3N	Rochester, IA	1	6	9	20	Frank Olsen			
7	28	0496	7.9	35-	3N	La Grange, WI	2	2	8	20	Homer DaBoll	3N	356	60
7	29	0618	7.2	27-	1N	Mifflinburg, IA	3	8	6	20	David Dunham		357	67
7	29	0627	6.8	26-	2N	Berthoud, CO	3	8	5	20	Derald Nye			
7	29	0627	6.8	26-	2N	Berthoud, CO	3	15	7	20	Paul Asmus	C	354	67
7	31	0862	7.5	13-	4N	Lanseria, R.S.A.	2	7	8	8	Jan Hers		351	62
7	31	095487	8.0	9-	S	Canberra, Austrl.	2	4	3	20	David Herald	1S	172	60
8	7	119009	9.1	12+		Nigel, R.S.Africa	1	0		31	L. Pazzi			
8	8	Venus	-3.8	14+	0N	Brownsville, TX	8	16	6	5	Paul Maley			
8	15	161562	8.3	85+	8S	Ocean Beach, CA	1	1	7	15	Richard Nolthenius		170	-58
8	26	0692	1.1	45-	N	Inverness,Scotland	1	4		5	Graeme Nash			
8	26	0729	7.2	41-	7N	Maxwell, TX	1	10	8	15	Don Stockbauer		353	70
8	26	0729	7.2	41-	N	Rayville, LA	7	18	5	11	Ben Hudgens	0	353	70
8	26	094177	9.0			Collinston, LA	1	1	5	25	Ben Hudgens			
8	26	0764	5.0	38-	5N	Kaitaia,N.Zealand	2	5		6	Gordon Herdman			
8	28	095740	8.3	24-	5N	Englewood, FL	1	0		15	Harold Povenmire			
8	28	095759	7.7	23-	5N	Woodsboro, TX	1	0	6	25	Don Stockbauer	5+S	352	71
8	28	095866	8.3	23-	5N	Ricardo, TX	1	0	8	25	Don Stockbauer	9+S	352	69
8	29	1158	5.2	13-	1N	Kaitaia,N.Zealand	1	1		13	Gordon Herdman			
9	8	159095	8.6	28+	4S	La Jolla, CA	1	4	6	15	Richard Nolthenius	C	174	-45
9	9	2308	7.6	39+	7S	Bloomington, TX	1	4	7	25	Don Stockbauer	C	172	-55
9	11	2596	7.3	60+	7S	Laurel, FL	1	0		15	Harold Povenmire			
9	22	0667	5.3	68-	7N	Carr, CO	1	2	6	20	Paul Asmus		356	71
9	22	0667	5.3	68-	7N	Henrietta, MN	6	10	8	10	James Fox	3S	355	71
9	22	0667	5.3	68-	7N	Bayfield, WI	1	5	7	20	Homer DaBoll	10N	356	71
9	22	0692	1.1	67-	-5S	Riviera, TX	1	4	7	15	Don Stockbauer		178	67
9	22	0692	1.1	67-	-5S	Citrus, FL	18	89	9	25	Tom Campbell	2N	184	67
9	24	0934	6.4	49-	9	Teatable Key, FL	2	9		15	Harold Povenmire			
9	24	0944	5.7	49-	7N	Tranquility, CA	3	22	7	15	Richard Nolthenius	3N	352	73
9	24	0944	5.7	48-	8N	Kerman, CA	10	47	6	20	James Van Nuland	CS	352	73
9	24	0944	5.7	48-	7N	Wheatland, WY	2	8	6	25	Paul Asmus		353	73
9	24	0944	5.7	48-	6N	Cambridge, MN	9	32	8	10	James Fox	3S	354	73
9	24	0944	5.7	48-	6N	Hayward, WI	1	3	7	20	Homer DaBoll	3N	354	73
9	24	095554	7.8	48-	6N	Tranquility, CA	2	0	8	15	Richard Nolthenius	C	355	71
9	24	0975	6.8	47-	-1S	Devil's Den, CA	2	2	6	15	R. Nolthenius	10N	182	70

tenths of a second of arc on the predicted profile. N and S indicate whether the observed graze shadow passed north or south of the predicted one. C indicates the Cassini region, where Watts' limb data are not available. WA is the Watts angle of central graze, and b is the latitude libration, in tenths of a degree (e.g., "-50" signifies -5°). For a given star, the difference between the WA and PA of graze changes only slightly. For comparison purposes, remember that CC depends on twilight, clouds, and other factors not indicated in the table. When expedition leaders report their observations, it would be helpful if they reported all quantities listed in the table, in addition to the ones on the forms. A copy of the predicted profile sometimes helps. Report SAO or DM numbers for non-Z.C. stars. Observations of grazes of the same star during two or more months can be especially helpful in studies of the moon's shape and motion, since the uncertainty in the star's position can be largely removed. So if you see a graze of a star listed in the table in your upcoming predictions, try to assign the event special priority. There may be opportunities to observe occultations of a particular star for only a few more months, and then not again for many years, so prompt reporting of observations is encouraged. Also, observers of upcoming grazes of a previously observed star might be alerted to a significant star position shift and thereby improve their prediction. This works better when the WA's of the observed and predicted graze are closer to each other.

Mo	Dy	Star Number	Mag	% Snl	CA	Location	# Sta	# Tm	C C	Ap cm	Organizer	St	WA	b
9	25	1045	8.1	43-	N	Matadepera, Spain	1	4		20	Joan Genebriera			
9	26	1190	7.1	30-	6N	Forbes, MO	2	14	7	15	Robert Sandy	5S	351	64
9	26	1190	7.1	30-	5N	Lockport, IL	5	26	7	13	John Phelps	3N	352	64
9	27	1314	8.1	21-	10	Land O' Lakes, FL	1	3		15	Harold Povenmire			
9	28	1409	5.1	14-	5N	Simpson, IL	1	2	7	13	Robert Hays	4N	351	43
9	28	1409	5.1	14-	3N	Beltsville, MD	16	40	8	15	David Dunham	5N	353	43
9	28	1409	5.1	14-		Little Creek, DE	3	8	7	8	Emil Volcheck			
10	5	2253	8.1	15+	0N	Coleman, FL	1	1	2	20	Tom Campbell	2N	173	-52
10	7	2460	6.1	29+	4S	Young, Australia	1	4			R. Price		173	-70
10	7	2460	6.1	29+	S	Wyong, Australia	3	21	9	15	Roger Giller			
10	9	161850	7.0	46+	7S	Cocoa, FL	1	1		32	Harold Povenmire			
10	10	163051	8.8	59+	6S	Aurora, CO	2	4	4	25	Paul Asmus		176	-52
10	11	163851	8.0	69+	6S	Lenkerville, PA	1	5		20	Robert Young			
10	12	3188	5.4	79+	S	Crandall, TX	1	4	9	20	Paul Newman			
10	12	3188	5.4	80+	5S	Albany, NY	1	11		10	M. D. Overbeek			
10	21	0934	6.4	71-	N	Toba City, Japan	2	8	6	7	Moto Kawabata	6S	352	71
10	21	0934	6.4	71-	N	Zushi City, Japan	1	0	7	10	Yushihiro Musash		352	71
10	21	0934	6.4	71-	N	Ohami Town, Japan	8	33	8	7	Toshio Hirose	6S	352	71
10	22	096160	8.0	65-	2N	Aloe, TX	1	1	7	25	Don Stockbauer	1N	359	67
10	23	097083	7.6	56-	8N	Green Lake, TX	1	4	8	25	Don Stockbauer	0	352	63
10	26	1442	5.0	31-	N	Reddensburg, RSA	1	8		10	G. N. Walker	12N		
10	28	118879	8.1	15-		Castellbisbal,Sp.	5	0		14	Carles Garcia			
11	2	159919	7.2	6+		Bentonia, MS	1	6		25	Ben Hudgens			
11	7	163641	7.0	43+	4S	Oak Grove, MD	1	2	4	25	David Dunham	2N	176	-45
11	16	0692	1.1	98-	-25S	Lake City, FL	4	10	8	20	Tom Campbell	6N	173	68
11	16	0692	1.1	98-	-25S	Callahan, FL	3	14	8	11	Karl Simmons			
11	27	2033	4.3	8-	-1S	Cabuyao,Phil.Is.	2	7		8	Oscar de las Alas			
12	2	2787	6.4	10+		Callahan, FL	1	0			Karl Simmons			
12	3	2856	6.6	13+	1N	MurrayBdg.Austrl.	4	11	6	25	David Steicke	3N	357	-63
12	5	3238	7.0	38+		Springfield, MO	2	5	7	15	Robert Sandy	6S	178	-19
12	5	3238	7.0	38+		Rolla, MO	2	4	8	20	Joseph Senne			
12	19	1409	5.1	79-	4	Venice, FL	1	3		15	Harold Povenmire			
12	22	118917	7.9	57-	-1S	Randburg, R.S.A.	1	2	8	20	Jan Hers			
12	22	1740	7.6	50-	3N	Renmark,Australia	1	12	2	15	David Steicke	0	356	-17
12	23	138887	8.5	43-		Buena Vista, MD	1	5	7	20	Wayne Warren	2S	187	-65
12	23	1808	7.0	43-	2N	Baker, CA	1	1	5	15	Richard Nolthenius			
12	26	Venus	-4.3	14-	0S	Colorado Spgs.,CO	4	5	9	6	Paul Asmus	N		
12	26	Venus	-4.3	14-	3S	Benton, AR	8	43	6	15	Paul Maley			
12	26	Venus	-4.3	14-		Lake City, FL	2	14	8	11	Richard Van Etten			
12	26	Venus	-4.3	14-	4S	Ormond Beach, FL	1	6		25	Joe Reggin			
1979														
1	6	0327	4.5	66+		Poppenweiler, GFR	2	5	3	7	Gutekunst			
1	9	0692	1.1	88+		Edefors, Sweden	1	5		15	N. P. Wieth-Knudsen			
1	31	3430	5.7	11+	0S	Marye, VA	5	22	8	20	William Stein	0	183	40
2	2	110180	8.4	38+		Hannover, G.F.R.	5	6	9	15	Hans-Joachim Bode			
2	3	0298	7.2	39+	2	Westover, Ontario	2	5	5	20	Andreas Gada			
2	3	110316	7.6	40+	2N	Waynesboro, OH	1	1	9	15	Robert Clyde			
2	5	093636	8.9	61+	4S	Mountainview, CA	1	5	5	15	Richard Nolthenius			
2	5	0692	1.1	69+	-4N	Paicines, CA	1	4	8	15	Richard Nolthenius	N		
2	25	164138	8.3	3-	1S	Plettenbg.Bay,RSA	1	2	8	20	Jan Hers			
3	21	160980	7.6	50-	6S	Wabasso Beach, FL	1	3		15	Harold Povenmire			

More grazing occultations of Aldebaran (ZC 692) have now been observed than of any other star. Observers consequently should be especially careful in determining geographical positions for grazes of this star, as noted in the article on accuracy of positions for grazes on p. 22. Peter Espenschied calls our attention to the fact that the locations of buildings shown on U.S.G.S. maps are not accurate, and are specifically exempted from national map accuracy standards. Hence, buildings should be avoided for positional reference; measurements with respect to road intersections would be preferred when using United States Geological Survey maps.

Unusually cold weather was encountered during the graze of Venus on 1978 December 26. Maley reported 24° F. (-4° C.), rather cool for the Texas observers in Arkansas. Dunham observed with Paul Asmus' expedition at Colorado Springs, where the wind was blowing and the temperature was 6° F. (-14° C.). But time signal reception was our most serious problem there; being about 130 miles from the WWV transmitter, we were too far for line-of-sight, but so close that we got very unfavorable reflection from the ionosphere. And WWVH was blocked by the Rocky Mountains to the west. Richard Nolthenius led a small expedition to a site near Vernal, Utah, to attempt the Venus graze from a high-elevation site, with Venus low in the east. They saw an occultation about four minutes long, but obtained no timings, as their tape recorders froze, in spite of being in sleeping bags with them. The temperature was -11° F. (-24° C.). Dr. Wieth-Knudsen had to take special precautions for observing the graze of Aldebaran near the Arctic Circle in a sparsely populated area of northern Sweden on January 9. He observed from the house closest to the northern limit, and south of it, which he could find in the area, although this was a few kilometers south of the limit in a low area of the profile, not promising for multiple events. The temperature was -28° C. The method of timing used was "eye-and-ear by quartz crystal clock, of which the beats of its stepping motor were rendered audible by a microphone, amplifier, and headphones, and which were referred to UTC by time signals.

With solar activity increasing, short-wave time signal reception will become increasingly less reliable in many parts of the world, so that secondary time standards, such as that used by Wieth-Knudsen, will need to be used. Accurate digital watches with seconds display can now be used for this purpose, as long as they are compared with short-wave time signals within a day or so before and after the event. It certainly would be useful for our work if someone would manufacture and sell a digital watch which could be set to emit audible pips at, for example, 10-second intervals, with a double pip at the beginning of each minute. [Ed: For a do-it-yourself version, see *O.N. 1* (10), 100.]

Twenty-two stations were set up near Dixon, CA, for the graze of Aldebaran on March 4-5. Although occultations of some Hyades stars were timed at some stations earlier in the evening, the graze itself was clouded out. Skies remained clear only 50 miles to the south.

Dunham's generally tight schedule delayed 1979 graze predictions. He prepared the 1979 graze data tapes and sent them to the graze computors at the end of last November. Delays in the mail and at USNO during the Christmas season delayed the profile calculations (data input for which needs to be produced at USNO after the computors have computed the limit predictions), so that most observers didn't receive their first-quarter predictions until early January. The Latin American section suffered the longest delays, since the graze tapes for their regions did not arrive in Mexico City until after January 13. Standard-coverage total occultation predictions for North America also were delayed, as Walter Morgan didn't receive the necessary data tape from USNO until January 5.

DOUBLE AND VARIABLE STARS IN THE J-CATALOG, by David Herald

I have compared a listing of the J-catalog, supplied by D. Dunham for epoch 1900, with Kukarkin's variable star catalog and with the Lick Observatory Index of Variable Stars. Not all SAO stars in Table 1 are identified in the SZ catalog (or XZ) as being variable; only variables with a magnitude range greater than 1.0 generally were identified as variable when the SZ catalog was created.

Table 2 lists double stars in the J-catalog by the "J" cat. No., and the Discoverer's number as listed in the Lick I.D.S. Also included are some stars coded in J as double, but for which the code is apparently erroneous. Dunham hopes to incorporate the variable star data and appropriate double star codes into the J-catalog for the extended predictions for 1980.

Table 1

USNO J#	SAO #	ZC #	Variable	Range Max.	Min.
85	93876	ZC 640	V696 Tau	5.20	5.26
336	94027		α Tau		
700	94164		V480 Tau	5.09	5.11
1087	94604		DV Tau	9.8	10.3
1106	94628		CE Tau	6.1	6.5
1263	94779		DY Tau	10.8	11.5
1382	94837		EU Tau	8.6	9.1
1495			SU Tau	9.5	16.0
3720	96407		NP Gem	5.89	6.02
4898			WX Sag	9.6	11.3
5133	161257		WZ Sag	8.46	10.14
5262	161376		Y Sag	6.00	7.14
5411			V355 Sag	9.4	10.0
5426	161444		XX Sag	9.5	10.6
5530	161502		V2349 Sag	8.4	9.0
5620	161562		V3508 Sag	7.73	7.92
5621	161563		V Sag	Constant	
5651	161571		U Sag	6.35	7.08
5867	161870		YZ Sag	7.8	8.9
5929	161972		UX Sag	8.9	9.6
6340			SVS 5772	9.5	10

(▯ signifies an SAO or ZC star.)

Table 2

J#	Discoverer		J#	Discoverer	
31	HJ 3254		3537	"C" not IDS	
34	BUP	▯	3605	A 2460	
136	BUP		3614 }	{ "E". Is	▯
184 }	STF 545	▯	3616 }	{ a triple	
186 }			3725	J 358	
313	OL 107		4372	RST 3061	
359	BUP	▯	4380	RST 3063	
369	HU 1218		4436	FOX	
500 }	ST 2	▯	4493	HO?	
502 }			4502 }	{ "M", but	
560	HZG		4505 }	{ also E.	
700	BUP	▯	4556	HU 171	
737	BRT 2323		4575	"A" cf "E"	
799	HJ 3269		4643	BRT 624	
810	HJ 3270		4649	HLD 138	
820	J 1251	▯	4782	FEN 25	
821	J 1043		4891	RST 3140	
845	J 1817		4898	RST 3144	
849	STF 665		4952	HJ 2818	▯
893	J 2729		4980	J 2197	▯
1070 }	{ BU 891	▯	4982	S 700 ?	▯
1072 }	{ HJ 3275	▯	4984 }	triple	▯
1143	J 248	▯	4986 }		
1168	HJ 3276		5041	B	
1207 }	STF 759		5061	RST 3167	
1208 }			5096	FOX	
1216	HJ 3277	▯	5107	B 1885	
1253	STF 774		5141	HJ 2826	
1254	STF 774		5167	HWE 42	▯
1257	BU	▯	5176	WHC 16 ?	
1335 }	BRT 2329		5177	J 2206	
1336 }			5253	J 1627	
1380	HJ		5275	BRT 1531	
1444?	BU		5357? or }	J 2210	
1447?	BU 892		5365? }		
1493 }	BAR		5375	I 1365	
1495 }			5399	"E" wrong	
1531?	J 944		5403	{or J 2128	
1567	J 1910			J 2127	
1577	STF 806		5477	FEN 30	
1578	J 677		5504	RST 3181	
1583	J 1819		5519	RST 3182	
1700	STF 813		5622	"K", but SEE	
1879	J 958		5645	HU 243	354
2073	J 1049		5655	RST 3186	
2136	"C" Not IDS		5664	RST 5116	
2147	BRT 1195		5689	J 2216	
2169	J 1260		5822	HLD 146	
2295	J 968		5823	HJ 2835	
2353	J 19		5846	RST 4020	▯
2368	J 683		5847	HJ 2838	▯
2392	J 684		5864	HJ 2840	
2397	J 2740		5873	HWE 44	▯
2430	J 1934		5878'	HLD 148?	▯
2511	J 973		5891	HU 255	
2523	A 2516		5903	HU 257	
2578	J 1349		5904	RST 4021	
2800?	BRT 2352		5905	RST 4022	▯
2819	STT 141		5931	HJ 2844	▯
2829	HO 340	▯	5939	J 1661	
2858	BRT 1203		5944	HJ 2845	
2905	{or J 1956		5965	RST 3209	
	J 1958		5978	HU 260	
2917	J 1960		6003	DON 944	
2977	BRT 1207		6244 }	BAL 638	
3036	J 1964		6258 }		
3100	J 2396		6327 }	HJ 5411	
3143	J 989		6328 }		
3278	BRT 2361		6330 }	BRT 525	
3314	J 992		6331 }		
3447	J 1056?		6403	RST 4728	