OCCULTATION NEWSLETTER

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AN INTRODUCTORY STATEMENT

The Occultation Newsletter has these objectives:
1) to publish quarterly, but with the flexibility to issue intermediate unscheduled important notices;
2) to inform observers regularly of newly-discovered double stars, and of other occulted objects of particular scientific interest, including planets and asteroids;
3) to publicize new observing techniques;
4) to inform observers of progress with the analysis of observations, including summaries of published results;
5) to publish articles and notes contributed by observers, particularly those discussing observing techniques and unusual observations; and
6) to stay out of debt.

In meeting most of these objectives, we have been promised support of those astronomers who are working with occultation data at the U. S. Naval Observatory, the Royal Greenwich Observatory (H. M. N. A. O.), and the University of Texas at Austin. We shall need, and we earnestly solicit, literary contributions from observers.

We shall also need the financial support of observers, as all costs of publishing, after this first issue, will be paid-for thru individual subscriptions. We suggest that you send your $2.00 subscription check, payable to *Occultation Newsletter*, along with your new *Observer Information*

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PLANETARY OCCULTATIONS

Conducted by Mike Reynolds

Recent Observations

17 October 1973 - Occultation of Saturn by a 66%-sunlit Moon. The path of the southern limit of this occultation passed through Canada, near the U.S.-Canada border. Several of the Royal Astronomical Society of Canada Centers, in particular, Calgary and Winnipeg, set up expeditions for the event. The Calgary Center, expedition headed-up by F. J. Howell, set up for the occultation of the satellite Titan near Edmonton, Alberta. Clouds interfered with most observations, but toward the time of Saturn's third contact, the weather had changed enough to allow observers to view it. Right before 3rd contact of the rings (between 1 and 2 seconds), a faint glow was seen by one of the observers, which appeared like seeing "a campfire on the other side of a treeless hill on a dark night". Behind this glow came the rings of Saturn. The faint glow rapidly brightened and became bigger as the rings became visible following 3rd contact. The glow increased slightly in width and showed easily-detectable Moon limb curvature on its sharp edge, but at about 4 seconds after 3rd contact, the glow was indistinguishable against the increasing ring brilliance (from a summary of a letter to the editors of Nature by T. A. Clark, F. J. Howell, and G. Reed). Four stations set up. The Winnipeg Center expedition was headed-up by Richard

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(INTRODUCTORY STATEMENT, cont.)
Form, to David Dunham, by August 15th, as this will facilitate compiling the Newsletter's mailing list. After August 15th, any new subscriptions should be sent to *Occultation Newsletter*, 6 N 106 White Oak Lane, St. Charles, Illinois 60174.

If the list of paid subscribers is small, we will need to economize wherever we can, to try to maintain the $2.00 rate. With a large list, we may be able to use higher quality printing (including better reproduction of more contributed photographs), more pages, airmail distribution, and/or to extend the length of your subscription period beyond one year.

Although *Occultation Newsletter* is probably the name which gives the best clues as to the purpose and content of this publication, perhaps some other name might be less prosaic, while still being adequately descriptive. So far, we have received three suggestions: *The Occult Messenger*, *The Graze Gazette*, and *The Hidden Star*. If you have a suggestion, please include it when ordering your subscription. We will publish all reasonable suggestions, including the four above, in the second issue, along with a ballot form. The suggestion receiving the largest number of votes from subscribers will be used as the permanent name, beginning with the third issue.

H. F. DaBoll

(PLANETARY OCCULTATIONS, cont.)
Bochonko and B. F. Shinn. The group set up to the north of Winnipeg, near Gimli, for the partial occultation. However, poor weather set in, and no successful observations were made. Stations included 7 observers from Winnipeg and Jacksonville, Florida.

11 December 1973 - Occultation of Saturn by a 99%-sunlit Moon. The path of the southern limit of this occultation passed through W. Asia, N. Europe, Greenland, and N. E. of North America. Two observers in France, Jean Bourgeois and Jean Neirinckx, observed and timed the occultation. Both observers reported that the event was very difficult to observe.

(Next column)

Two other observers, A. Owen and J. Miller, also observed the partial occultation in France, with G. Nash, of Dorset, England. The weather was very poor, about 2 on the 1-10 scale, but contact timings (1st and 4th) were made.

7 January 1974 - Occultation of Saturn by a 98%-sunlit Moon. The path of the southern limit ran from North Carolina to Illinois, and on from there. Only one successful observation was received for this occultation. Kevin Wigell reports that he observed and timed the occultation from Bourbonnais, Illinois. He said that the rings were visible all of the time.

An expedition was led by M. Reynolds of Jacksonville, Florida, to Rocky Mount, North Carolina for the event. However, very poor weather set in, and even the Moon was difficult, if not impossible, to see. The expedition included C. Cain, R. Hill, and D. Talbert, all from Greensboro, North Carolina, and H. Carney, L. Heilig, G. Hogan, D. Reynolds, M. Reynolds, B. Roberts, D. Sisson, C. Stephens, and D. Wolters, all from Jacksonville, Fla.

1 March 1974 - Occultation of Mars by a 42%-sunlit Moon. The path of the southern limit passed across the mid-U. S. The Mars occultation was seen by many observers. Brad Schaefer reports that he observed and timed the event from Denver, Colorado. Byron Labadie, of Tulsa, Oklahoma, reports that he observed the near-partial occultation of Mars, 50 miles from the limit, near Chanute, Kansas. He timed the event, and then photographed the Moon and Mars right after the event, coming-up with some good shots. Roy Bishop observed the total occultation of Mars from his observatory in Nova Scotia,

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(PLANETARY OCCULTATIONS, cont.)
and timed two contacts. Hal Povenmire and Joe Huertas, from Indian Harbour Beach, Florida, set up for a total of Mars, near Rocky Mount, North Carolina, timed the event. They had hoped to time a grazing occultation of a 5th magnitude star after the Mars occultation, but were clouded-out. An expedition was led by M. Reynolds, of Jacksonville, Florida, to time the event. 9 complete stations were set up, and included D. Costanzo, from Wilmington, North Carolina, D. Green and J. Downs, from Boone, North Carolina, R. Hill, from Greensboro, North Carolina, and H. Carney, D. Reynolds, M. Reynolds, B. Roberts, K. Simmons, D. Sisson, and C. Vaughn, all from Jacksonville, Florida, and W. Green, from Orlando, Florida.

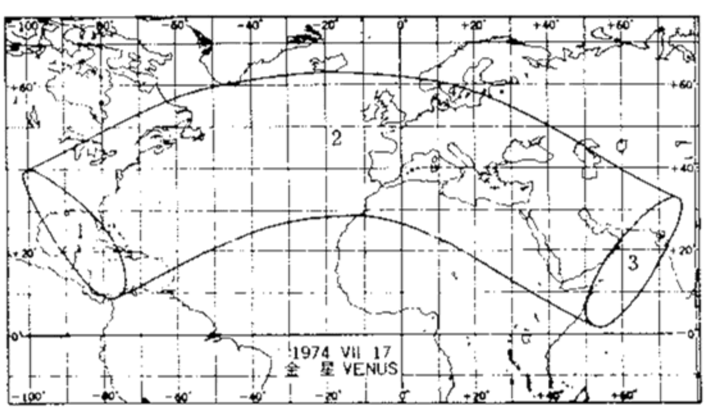
2 March 1974 - Occultation of Saturn by a 64%-sunlit Moon. The path of the southern limit passed from the northeast U. S.-southeast Canada, west through the mid-U. S. Reports of this event are limited, as weather was very poor along the occultation line. Roy Bishop observed what he described as a near-partial occultation from his observatory in Nova Scotia. Brad Schaefer observed the Saturn occultattion in daylight conditions near Denver, Colo.

If you attempt any planetary occultation timings, total or partial, and wish to submit a report to us, please send it to *Mike Reynolds, 1836 Birchwood Road, Jacksonville Beach, Florida 32250.* Please include the number of stations and names of all participants in case of an expedition, success of observations (report also if not successful), and general comments about the occultation. Good photos will be printed in future issues.

Upcoming Planetary Occultations

Occultation of Venus, 17 July, 1974, 6%-sunlit Moon. During Wednesday morning, July 17th, the third brightest celestial object will be occulted by the second brightest. This rare occultation of the planet Venus will occur for most of the eastern United States. However, low Moon altitude, twilight, or even daylight conditions will affect observations. The Moon will be a slender waning crescent, 6%-sunlit, while the disk of Venus will be 86%-sunlit, 11".9 in diameter, and of magnitude -3.4.

Path of Occultation of Venus - 17 July 1974
(Reprinted by permission from the Japanese Ephemeris 1974, published by the Hydrological Department of Japan)



In region 1, only the reappearance will be visible.
In region 2, both the disappearance and reappearance will be visible.
In region 3, only the disappearance will be visible.

(Cont. on pg. 4)

(PLANETARY OCCULTATIONS, cont.)
Predictions for the times of the total occultation and for the partial occultation can be obtained from Dr. Dunham.[Note added in press: This was true at the time Mr. Reynolds submitted his column, but due to late publication, you are advised to estimate your own times, from Dr. Dunham's article in June, 1974 Sky and Telescope] If you attempt either the total or the partial event, we would like to hear from you, even if you got no results.

The partial occultation of Venus, which occurs along the upper and lower lines, will be quite spectacular. The 19-mile wide path runs from Nebraska to near Sioux City, Iowa, on to Ontario, Canada. First contact will be difficult to time, due to irradiation extending the Moon's and Venus' apparent limbs. The second contact will be fairly easy to time, since Venus' surface brightness is so much greater than the Moon's. Third contact will be spectacular, and can be precisely timed, if one is looking in the right place. As Venus emerges, lunar mountains might be seen in silhouette. The fourth contact of Venus should be fairly easy to observe due to the fact that the Moon's edge will probably appear sharper than Venus' limb. During the partial occultation, which will last about 9 minutes, Venus can be seen sliding along the Moon. At central occultation, for a period of around 2 minutes, Venus will disappear completely, and may possibly reappear a few times in lunar valleys. This event will occur on the bright limb 1° from the cusp, but at 6%-sunlit, most events will occur against dark features, or against a thin cusp.

A major expedition is planned to Osseo, Wisconsin for the event. Interested observers will meet at the Osseo Central Park in downtown Osseo. Most observers will be set up on county roads, which are close to I-94. More information can be had by contacting Mr. Fox (8301 Isle Ave. S., Cottage Grove, Mn. 55016, 612/459-6360) no later than July 10th.

NEW DOUBLE STARS

by David W. Dunham

The table on page 5 lists double stars, or additional components of known systems, discovered during Lunar occultations since 1971 Jan. 1, and additions or corrections (shown by * after the SAO number) to the Univ. of Texas special double star list of 1974 May 9, copies of which were circulated to many observers. An updated version of the full list will be sent to all subscribers, and all receiving U.S.N.O. total or grazing occultation predictions, in late September, so please send me any of your own discoveries, or those discovered by others, to make the updated list as comprehensive as possible. New discoveries should be reported promptly so that more observations can be obtained. Due to the motion of the nodes of the Moon's orbit, favorable occultations of a star may be visible anywhere on the Earth's surface for only a few more months, and not again for almost 18 years. Dissemination of information about newly discovered or suspected double stars is one of the most important functions of this newsletter. Under M (method), P = photoelectric total occultation, V = visual total occultation, G = visual grazing occultation, C = correction, S = composite spectrum. Under N (new double star code), V = close double, separation greater than ".01, U = close double, sep. less than ".01; X = probably V or U; K = possibly V, but considerable doubt; O = visual double, orbit determined; A = visual double noted by Aitken; W = triple, U + A; T = triple, V + A; L = triple, V + V or U + V. MG1 and MAG2 are the magnitudes of the primary and secodary, respectively. SEP and PA are the separation (in arc seconds) and position angle (in degrees) of the secondary with respect to the primary, respectively. MAG3, SEP3 and PA3 refer to a third component, if any. No entry under PA means it is changing (significant orbital motion) or has not been determined (spectroscopic or spectrum binary). Of course, occultations only

(cont. on pg. 6)

New University of Texas Special Double Stars. Date: June 16, 1974

SAO	ZC	M	N	MG1	MAG2	SEP	PA	MAG3	SEP3	PA3	DATE, DISCOVERER, NOTES
75867		G	V	9.2	9.7	0.2	10				1974 Feb 01, R. Nolthenius, Tucson, AZ
76254		P	X	8.5	9.1	.051	220				1974 Jan 05, T. Moffett, McDonald Obs., TX
76601*	0656	V	X	5.2	5.2	0.1	110				1974 Apr 25, H. Povenmire, Daytona Beach, FL
76723*		G	V	9.7	9.7	0.05	0				1974 Mar 29, R. Nolthenius, Marana, AZ
76954	0761	V	V	7.4	7.4	0.4	91				1974 Mar 02, R. Sandy, Kansas City, MO
76965		S	V	9.1	9.1	0.05					
77564*	0879	S	T	8.9	8.9	0.05		10.6	1.6	85	A.D.S. 4378
77625*	0885	C	Y	5.9	7.2	0.01	270	12.0	15.0	232	Correct error; 12-MAG component of A.D.S.
77675*	0890	C	U	4.8	6.3	.0013					4474 belongs to Z.C. 885, not Z.C. 890
78304*		S	V	9.8	9.8	0.05					
78363*		S	V	9.4	10.5	0.05					
78421		V	K	9.3	9.3	0.1	83				1974 Apr 27, D. Dunham, Webberville, TX
78762*		P	K	8.8	12.0	0.2	149				1974 Mar 31, G. Ferland, McDonald Obs., TX
78507		P	X	8.5	9.1	.024	254				1974 Feb 04, S. Vogt, McDonald Obs., TX
79291*		S	V	9.5	9.5	0.05					
79294*	1110	P	O	3.5	8.2	6.975	Primary not sp.bin.				1972 Nov 24, S. Tramaine, Princeton, NJ (A.D.S. 5983)
92106		P	V	9.2	10.1	.131	222				1974 Jan 02, T. Moffett, McDonald Obs., TX
92120		P	X	9.2	10.1	.078	25				1974 Jan 02, T. Moffett, McDonald Obs., TX
92420	0207	P	X	9.5	10.4	.029	13				1974 Jan 30, S. Vogt, McDonald Obs., TX
92919		P	X	9.3	10.5	.037	101				1974 Jan 31, S. Vogt, McDonald Obs., TX
93033		P	V	7.5	8.5	0.3	70				1974 Feb 27, M. Overbeek, Glendower, R. S. Africa
94865*		S	V	9.7	9.7	0.05					
95555*		S	V	9.6	9.6	0.05					
96172*		S	V	8.9	8.9	0.05					
97687*		P	X	9.7	10.3	0.245	136				1974 May 26, S. Vogt, McDonald Obs., TX
98389*	1362	P	X	7.5	9.0	.0050	341				1970 Jun 09, W. Warren, Link Obs., IN
99413*		C	W	8.9	8.9	.0002		10.2	11.3	270	AM Leonis, ecl. var. (8.2-9.9); A.D.S. 8024
117851	1429	G	K	7.6	7.6	0.02	34				1974 Apr 03, D. Dunham, W. Lake Hills, TX
118577*	1590	P	X	7.2	8.5	0.012	135				1974 May 29, S. Vogt, McDonald Obs., TX
118831*	1652	P	U	5.9	6.5	.0034	155				1970 Jun 12, W. Warren, Link Obs., IN
138777*		C	T	8.7	9.3	0.021	141	9.3	0.7	131	Add distant component, A.D.S. 8024B.
146402*	3366	P	T	7.1	7.5	0.039	199	10.6	10.5	117	1972 Jan 20, S. Tremaine, Princeton, NJ; A.D.S. 16392
157584	1852	P	V	6.7	6.8	0.100	2				1974 May 04, S. Vogt, McDonald Obs., TX
157613		P	V	7.7	8.9	0.094	352				1974 May 04, S. Vogt, McDonald Obs., TX
158147	1970	P	L	6.5	8.2	0.039	149	8.4	.061	329	1974 May 05, S. Vogt, McDonald Obs., TX
159294*		S	V	9.2	9.5	0.05					
161468*		S	V	9.0	9.5	0.05					
161834*		S	V	8.6	8.6	0.05					
161883*		S	V	9.4	9.4	0.05					
184014	2290	V	L	3.5	5.5	.00001		3.3	0.1	335	1974 Apr 10, R. Nolthenius, Tucson, AZ (3rd star; Primary is one-line spec. binary.)
186461*		S	V	8.2	8.2	0.05					

measure the separation projected on to the P.A. of the event. A.D.S. refers to the number in Aitken's double star catalog. Several stars with composite spectra, not included in the May 9th list, are listed here. The components of such stars will usually be of comparable brightness, while their separations are unknown, but can be expected generally in the range 0".01 to 0".2 (0".05 has been arbitrarily selected for SEP).

Visual observers will not normally notice the duplicity of code U doubles, since the diffraction patterns of the two components will interfere, precluding definite "step" events. Visual observers should watch for disappearances or reappearances in distinct steps to signal the discovery of a close double. Continuous fades or brightenings are often due to diffraction of the star's light at the Moon's edge, a phenomenon noticeable at many favorable grazing occultations. Atmospheric seeing and, for faint stars, irradiation may also have an effect. When reporting the discovery of a double, give the date and P.A. of the occultation, the star's Z.C., SAO, or U.S.N.O. reference no., and an estimate of the time between steps and the brightness of the secondary relative to either the primary or the total light (primary plus secondary). Besides more double star observations (two or more observations of the same star usually permit a unique determination of sep. and P.A.)., negative observations under good conditions of "probable" or "possible" doubles are also welcome.

In. Mon. Not. A.S.S.A., Vol. 32, p. 42, M. D. Overbeek reports fadings seen during occultations of 6.9 mag. Z.C. 1152 (SAO 79558) at P.A. 87°, and SAO 118454 at P.A. 116°, indicating probable duplicity (these will be added to the special doubles list). He also notes 3 Pleiades stars, which will be reported after David Evans and Paul Bartholdi complete a review of all available data on these stars (the next Pleiades occultation will occur in 1986). He also reports visual observations of a light source extinguished in steps separated by from 0.01 to 1 second. They found it difficult to distinguish a stepped disappearance from a gradual fade when the time interval was less than 0.2 second. Also, he said: "It can be stated with reasonable confidence that the phenomenon is not a subjective effect." I might add that for total occultations more than 40° of P.A. away from being a graze, a fade event would more likely be due to duplicity than to diffraction, whereas the reverse would be true during a graze.

GRAZES OBSERVED IN 1974 REPORTED TO THE UNIVERSITY OF TEXAS

by David W. Dunham

The first 2 columns of the table (p. 7) give the Universal Time month and day numbers. Star numbers are usually Z.C. (4 digits) or U.S.N.O. reference (Z) numbers. The B.D. number is given for the non-SAO star observed March 31st. 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 (event codes 1-6) are counted (a "9" 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

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1974 Mo	Dy	Star Number	Mag	% Snl	CA	Location	# Sta	# Tm	C C	Ap cm	Organizer	St	WA	b
1	4	0399	5.7	75+	6N	El Cura,Gue.,Mex.	2	13	7	13	David Dunham	3S	10	-50
1	13	1713	5.8	69-	5S	Bryn Mawr, Calif.	2	6		11	Bob Fischer			
1	13	1713	5.8	69-	S	Midway, Arizona	1	8	9	15	Richard Nolthenius	2N		
1	13	Z11481	8.7	69-	S	Lukeville, Ariz.	1	1	5	15	Richard Nolthenius			
1	15	1944	5.6	48-	10S	Rochelle, Texas	5	26	8	6	Terry Boone	4S	189	63
1	28	3501	5.3	18+	2S	Maiden Rock, Wis.	2	2	7	25	James Fox	C8N	175	-64
1	29	0077	7.9	27+	2S	Hesperia, Calif.	3	5		13	Bob Fischer	CS		
1	29	Z00508	8.7	28+	N	Tucson, Arizona	1	4	6	15	Richard Nolthenius			
1	31	Z01989	9.1	48+	-1S	Sahuarita, Ariz.	1	1	7	15	R. Nolthenius	C20	177	-76
2	1	Z02722	8.8	60+	9N	Tucson, Arizona	1	14	9	15	Richard Nolthenius			
2	1	Z02763	8.8	60+	11N	Tucson, Arizona	1	5	6	15	Richard Nolthenius			
2	3	0789	6.9	79+	10N	Florida City, Fla.	1	1		15	Harold Povenmire			
2	4	Z05958	8.3	89+	12N	Uhland, Texas	1	2	5	25	David Dunham	1N	13	11
2	27	0296	7.7	22+	7N	Neoga, Illinois	1	9	8	20	John Phelps, Jr.	2N		
3	1	Z03276	8.0	42+	9N	Pearsall, Texas	2	4	6	10	Steven Griffith	S?	11	-26
3	1	0582	5.8	43+	10N	Ayoca, Nebraska	2	5	7	25	David Harvey	5N	10	-24
3	1	0582	5.8	43+	10N	Bethany, Missouri	2	6	8	15	Robert Sandy	5N	10	-24
3	1	Z03519	8.3	47+	N	Canberra, Austrl.	4	14	8	31	David Herald	0		
3	4	Z07021	7.8	77+	14N	Satellite Bch.,Fl.	1	2		41	Harold Povenmire			
3	11	1967	5.7	89-	N	Tortolita Mts.,Az.	1	2	5	15	Richard Nolthenius			
3	16	Z18233	9.0	44-		Oracle, Arizona	1	1	6	15	Richard Nolthenius			
3	17	2779	3.9	34-	2S	San Carlos, Ariz.	1	6	7	15	Richard Nolthenius	C	182	-17
3	17	2779	3.9	34-	2S	Demming, N.Mexico	1	2	6	10	Warren Odom	C	182	-17
3	17	2779	3.9	34-	2S	Van Horn, Texas	6	21	6	6	David Dunham	C5N	181	-17
3	28	Z02960	7.8	18+	11N	Houston, Texas	2	1	8	15	Paul Maley	3S	11	-50
3	29	Z03831	9.0	28+	N	Marana, Arizona	1	7	8	15	Richard Nolthenius			
3	30	Z04661	8.9	38+	11N	Satellite Bch.,Fl.	1	2		41	Harold Povenmire			
3	30	Z04899	7.5	39+	15N	Moore, Texas	1	0	8	15	Steven Griffith		16	8
3	30	Z04899	7.5	39+	15N	Moore, Texas	6	22	6	6	David Dunham	0	16	8
3	31	+21°354	9.4	50+	N	Satellite Bch.,Fl.	1	1		41	Harold Povenmire			
4	1	Z07904	9.1	63+	14N	Mt. Lemmon, Ariz.	1	9	6	15	Richard Nolthenius			
4	2	Z08729	8.0	72+	12N	Mims, Florida	1	4		15	Harold Povenmire		12	49
4	3	1429	6.8	83+	19N	W.Lake Hills,Tex.	8	29	7	25	David Dunham	1N	16	62
4	3	Z09755	8.7	83+	19N	Tucson, Arizona	1	2	4	15	R. Nolthenius	18S		
4	4	Z10426	8.5	91+	20N	Cedar Valley,Tex.	1	1	5	25	David Dunham	2S	14	67
4	10	2290	2.5	87-	-4N	Turnersville,Tex.	6	8	6	15	David Dunham	C4N	4	28
4	16	Z22780	8.9	33-	8N	Cortaro, Arizona	1	4	8	15	Richard Nolthenius			
4	25	Z03592	8.8	8+	16N	Daytona Bch.,Fla.	1	2		15	Harold Povenmire		15	-13
4	26	Z04433	8.6	16+	14N	Creedmoor, Texas	4	19	6	25	David Dunham	1S	16	6
4	26	Z04436	7.7	16+	12N	McLean, Illinois	4	10	8	15	Homer DaBoll	2S	15	8
4	27	Z05933	8.8	24+	15N	Fellsmere, Fla.	1	4		15	Harold Povenmire		17	20
4	27	Z05999	8.8	25+	14N	Webberville, Tex.	1	4	5	25	David Dunham	4N	17	21
5	11	2797	3.0	78-	4S	White City, Fla.	1	1		15	Harold Povenmire	C5N	182	-24
5	29	1587	6.0	56+	12N	Yates Center,Kan.	5	10	9	6	Richard Wilds	7N	11	74
5	29	1587	6.0	56+	10N	San Antonio, Fla.	6	27	7	20	Thomas Campbell	6N	9	74
6	18	0599	4.5	4-	5N	Limestone,Florida	3	12	7	20	Thomas Campbell		358	-14

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 U.S.N.O. prediction (without applying any correction based on the latitude libration), in 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°0). For a given star, the difference between the WA and the P.A. of graze changes only slightly. For comparison purposes, remember that CC depends on twilight, clouds, and other factors not indicated in the table. For example, clouds and strong wind had a much more adverse effect on the April 10th graze than the Moon's phase or the fact that the graze was on the bright side. 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 and Z 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. As mentioned in the section on double stars, 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. Grazes of Z.C. 0976 and of Z03626 have been observed this year, but complete reports are not yet available (they will be listed in the next issue). Eventually, I plan to distribute a list of the numbers of all stars, grazes of which have been observed.

For Z09755 on April 3rd, the AGK3 position of the star is 1"6 north of the SAO position, largely explaining the large shift observed.

Only two of the grazes listed were observed outside of the U.S.A., but reports of some non-U.S. grazes during the time period will almost certainly be received later. Subsequent issues of this newsletter will list all grazes observed after December 31, 1973, reports of which are received at the University of Texas after the previous list was prepared.

The most successful expedition (number of stations and timings) in the current list was for a marginal graze involving Z.C. 1429 on April 3rd.

There are no "top ten" grazes in the current list, such as the one for Z.C. 1489 last October 21st, where 4 expeditions totaling 35 stations, spread from California to Texas, made 173 timings.

Richard Nolthenius observed 19 grazes during the period January thru April, 1974 *(No attempts were clouded-out!)*, most of which are included in the list.

PAPERS ABOUT OCCULTATIONS PUBLISHED SINCE JANUARY 1, 1974

Compiled by David W. Dunham

H. A. Abt and S. G. Levy, "Period Variation of the Cepheid Zeta Geminorum", Ap. J. 188, L75. A new ephemeris of radial velocities for the star is derived to aid analysis of any photoelectric observations of occultations of the star.

W. I. Beavers and J. J. Eitter, "Lunar Occultation Stellar Diameter Measurements", Bull. Am. Astron. Soc. 6, 216. Results of their routine photoelectric observations include the following diameters: B.D. +23° 1518, ".0028; R Gem., ".0037; ν Cap., ".0028 in blue light, ".0036 in red; ε Gem., ".0018; and B.D. + 24°571, ".0018.

D. W. Dunham, D. S. Evans, and W. H. Sandmann, "The Angular Diameter of 87 Leonis", Astron. J. 79, 483. ".0041 was found for a cosine law (fully darkened to the limb) of darkening; the spectral type is K4III.

G. Hilaire, "Observations of Occultations of Stars by the Moon", Astron. and Astroph. Supp. Ser. 13, 395. Over 200 visual timings made at Besançon Observatory between Jan. 1969 and Sept. 1972 are reported.

J. T. McGraw and J. R. P. Angel, "An Angular Diameter and Effective Temperature for V Cancri from an Occultation Observation", Astron. J. 79, 485. At visual magnitude 11.5, near minimum light, this is the faintest star ever to yield a measurable angular diameter (".0028 for a cosine law of darkening). The observation was made with the 2.08-m telescope at McDonald Observatory. V Cancri is an S-type Mira variable.

G. Reed, F. J. Howell, and T. A. Clark, "Extended Glow Preceding Reappearance of Saturn during a Lunar Occultation", Nature 247, 447. This observation made about 1.5 sec. before 3rd ring contact at Ardrossen, Alberta, Canada, on Oct. 17, 1973, indicates an extension of faint material possibly 5000 km beyond Saturn's rings. A similar observation was made by Brock during a graze of Jupiter in 1968. See section on partial occultations, page 1, column 2.

J. L. Sowers, "Lunar Occultation Light Curves Perturbed by Random Limb Irregularities", Astron. J. 79, 321. The profile of the lunar limb is approximated by a sequence of uniformly random perturbations from the mean edge over a 40-m length. Conclusions are drawn as to the effects of this on photoelectric occultation measurements. The points raised for determination of stellar angular diameters are worth considering, but high-quality photoelectric traces of many essentially point-source stars and lunar exploration show that the problem is not severe.

S. D. Tremaine, E. J. Groth, and M. R. Nelson, "Observation of a Lunar Occultation of δ Geminorum", Astron. J. 79,649. They find that δ Gem A has no secondary component brighter than 2.4 mag. fainter than the primary with separation greater than ".017 in P.A. 315°, giving strong support to recent spectroscopic studies which indicate that the star is not a spectroscopic binary.

T. C. Van Flandern, "A Determination of the Rate of Change of G", Bull. Am. Astron. Soc. 6, 206. A new analysis of lunar occultations from 1955-1973 using Atomic Time gives a value for the empirical part of the secular deceleration of the Moon's mean longitude of $(-37\pm5)\ T^2$ (T in centuries). This differs from an earlier result principally due to the use of a numerically integrated lunar ephemeris. It also differs from other determinations which use the Sun's motion to determine uniform time, such as $-21''T^2$ from ancient Solar eclipses and $-19''T^2$ from meridian circle data. Hoyle has predicted that such a discrepancy will occur due to a secular decrease in the Universal Gravitational Constant G. For G not constant, the "solar motion" results (which are independent of G) must be interpreted as tidal (taken here to be $-21''T^2$), and the excess deceleration of $-16''T^2$ in the new result utilizing Atomic Time implies $\dot{G}/G=(-0.9\pm0.3)\times10^{-10}$/yr. Support for this interpretation comes from a number of sources (geophysical evidence and cosmological theories). The B.A.A.S. note is only an abstract, not much longer than this. An article giving more details, including a slightly improved determination, will be published soon.

J. Veverka, L. H. Wasserman, J. Elliot, C. Sagan, and W. Liller, "The Occultation of β Scorpii by Jupiter I. The Structure of the Jovian Upper Atmosphere", Astron. J. 79, 73. The light curves showed numerous sharp spikes attributable to density fluctuations in the Jovian atmosphere. Refractivity, density and temperature profiles of the Jovian atmosphere are presented. Typical temperature fluctuations amount to 2-10°K with vertical scales of about 10 km. The values of both temperature and temperature gradient are higher than current models predict.

J. Veverka, L. Wassermann, and C. Sagan, "On the Upper Atmosphere of Neptune", Ap. J. 189, 569. Reanalysis of the Mt. Stromlo observations of the occultation of B.D. -17°4388 by Neptune show that the upper atmosphere is not isothermal. Local 5°-10°K fluctuations some 10 km in extent are associated with the many spikes in the light curve.

OCCULTATION OF DELTA SCORPII, SEPTEMBER 21, 1974

By David W. Dunham

Saturday evening, Sept 20-21, an occultation of 2.5-mag δ Sco (Dschubba, ZC 2290) by a 28% sunlit Moon will be visible from much of western N. America. This will be the most spectacular occultation of a star from the U.S. in 1974. The D might be seen without optical aid, but at least binoculars are recommended. During an April occultation, Nolthenius apparently saw a 3rd mag. companion (see the list of new doubles), adding interest to the more favorable Sept. event.

A spectacular graze, occurring 11° to 13° from the south cusp on the dark side, will be visible near the southern limit, which extends from Baja California (2:31 UT) to Iowa (2:45 UT). Expeditions will probably be led from Ensenada, Baja Calif. (limit 17 mi S, Sun -11°, Moon +23°, R. Mitchell ldr; might be joined by southern Californians); Tucson, AZ (limit 20 mi S of Phoenix, R. Nolthenius ldr); Alberquerque, NM (limit 12 mi N, Moon +13°, S. Bourgeois); Santa Fe, NM (limit 5 mi S, W. Fellows); and Topeka, KS (limit 100 mi N, +3°, R. Wilds; may be joined by R. Sandy, Kansas City, MO). With clear skies, event should be visible at very low alt. On March 17, R. Nolthenius got good timings of a graze of ο Sag (ZC 2779) using a 6-inch refl. in AZ; he rated observing condition as 7, with star alt. only +3° at central graze, and Moon 34% sunlit. An expedition from Texas will join either an AZ or NM expedition.

In Mon. Not. R.A.S., vol 167, p 135, R. H. Brown et al. report observations of δ Sco, and many others, with the intensity interferometer at Narrabri, Australia. They find that δ Sco has a companion about 1.9 mag fainter than the primary, probably referring to the companion seen by Nolthenius, but the spectroscopic companion may be involved.