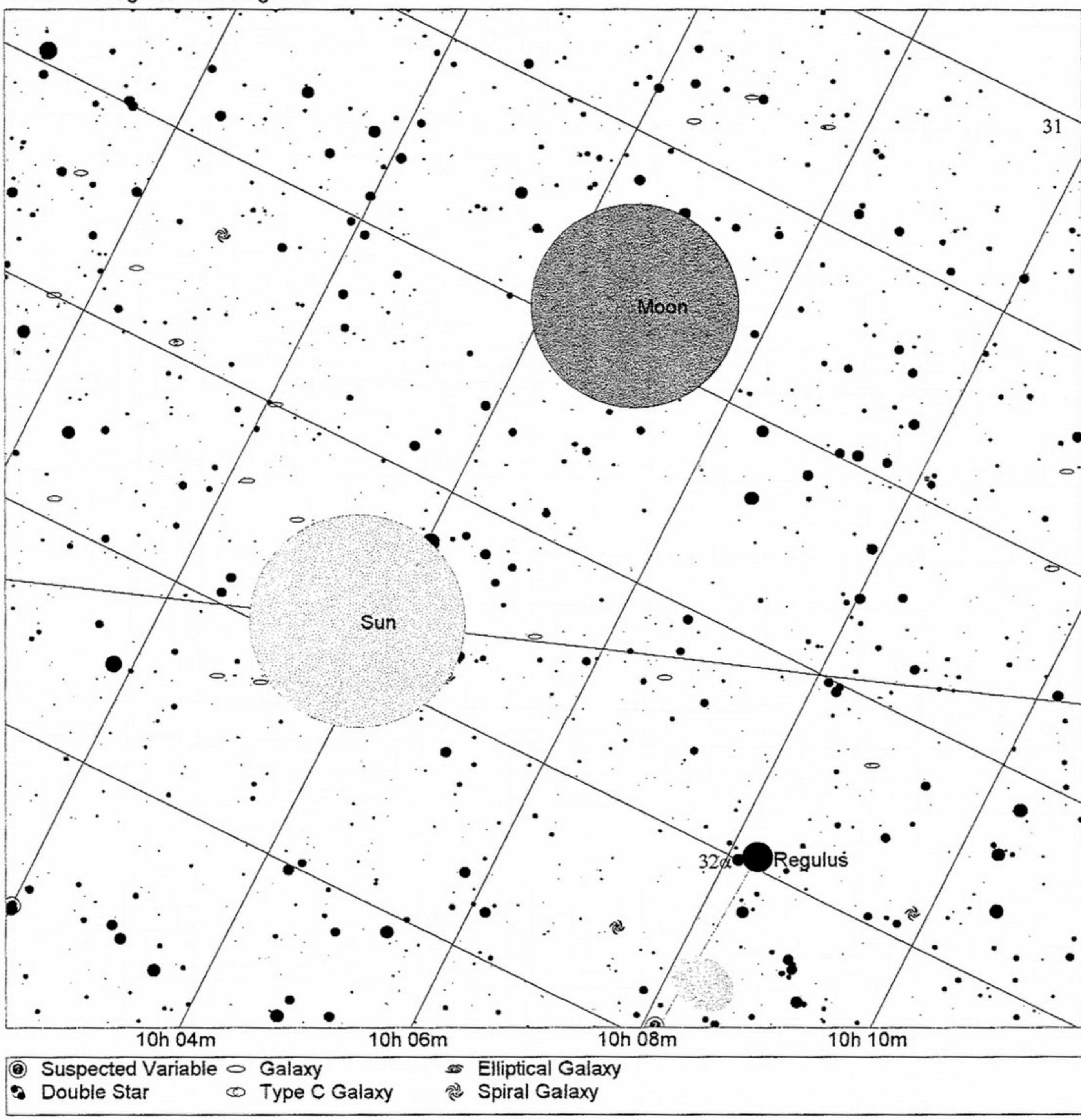
Occultation Newsletter

Volume 7, Number 2 July 1998 $5.00 North Am./$6.25 Other

Sun Moon Regulus 1998 August 22



Center RA:10h 05m Dec:+11d 27' 8/22/98 2:00 AM Width:02d 37' Latitude:+50d 00' 0.0" Longitude:-10d 00' 0.0"

In This Issue

For subscription purposes, this is the fourth issue of 1997.

The deadline for the next issue is September 30, 1998.

On the cover: An attempt to view Regulus 1 degree from the Sun on 1998 August 22 from Witten, Germany. See page 15 for more details. (East longitude is negative.)

What to Send to Whom

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

Craig A. and Terri A. McManus
Secretary & Treasurer
2760 SW Jewell Ave
Topeka KS 66611-1614 USA
Email: IOTA@inlandnet.net

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

Rex L. Easton
Editor for *Occultation Newsletter*
2007 SW Mission Ave, Apt. 1
Topeka KS 66604-3341 USA
Email: SkyGazer@inlandnet.net

Send Lunar Grazing Occultation reports to:

Dr. Mitsuru Sôma
V.P. for Grazing Occultation Services
National Astronomical Observatory
Osawa-2, Mitaka-shi
Tokyo 181-8588, Japan
Email: SomaMT@cc.nao.ac.jp

Send interesting stories of lunar grazing occultations to:

Richard P. Wilds
3630 SW Belle Ave
Topeka KS 66614-4542 USA
Email: DarkMatter-at-HART@worldnet.att.net

Send Total Occultation and copies of Lunar Grazing Occultation reports to:

International Lunar Occultation Centre (ILOC)
Geodesy and Geophysics Division
Hydrographic Department
Tsukiji-5, Chuo-ku
Tokyo, 104-0045 Japan
Email: ILOC@cue.jhd.go.jp

Send Asteroidal Appulse and Asteroidal Occultation reports to:

Jim Stamm
V.P. for Planetary Occultation Services
11781 N. Joi Drive
Tucson AZ 85737-8871 USA
Email: JimStamm@aztec.asu.edu

Send observations of occultations that indicate stellar duplicity to:

Henk Bulder
Insteek 44
NL-2771 Boskoop
The Netherlands
Email: HJJBulder@compuserve.com

Membership and Subscription Information

All payments made to IOTA must be in United States funds and drawn on a US bank, or by credit card charge to VISA or MasterCard. If you use VISA or MasterCard, include your account number, expiration date, and signature. (Do not send credit card information through e-mail. It is not secure nor safe to do so.) Make all payments to **IOTA** and send them to the Secretary & Treasurer at the address on the left. Memberships and subscriptions may be made for one or two years, only.

Occultation Newsletter subscriptions (1 year = 4 issues) are US$20.00 per year for USA, Canada, and Mexico; and US$25.00 per year for all others. Single issues, including back issues, are 1/4 of the subscription price.

Memberships include the *Occultation Newsletter* and annual predictions and supplements. Memberships are US$30.00 per year for USA, Canada, and Mexico; and US$35.00 per year for all others. Observers from Europe and the British Isles should join the European Service (IOTA/ES). See the inside back cover for more information.

IOTA Publications

Although the following are included in membership, nonmembers will be charged for:

- Local Circumstances for Appulses of Solar System Objects with Stars predictions US$1.00
- Graze Limit and Profile predictions US$1.50 per graze.
- Papers explaining the use of the above predictions US$2.50
- IOTA Observer's Manual US$5.00

Asteroidal Occultation Supplements will be available for US$2.50 from the following regional coordinators:

- **South America**--Orlando A. Naranjo; Universidad de los Andes; Dept. de Fisica; Mérida, Venezuela
- **Europe**--Roland Boninsegna; Rue de Mariembourg, 33; B-6381 DOURBES; Belgium or IOTA/ES (see back cover)
- **Southern Africa**--M. D. Overbeek; Box 212; Edenvale 1610; Republic of South Africa
- **Australia and New Zealand**--Graham Blow; P.O. Box 2241; Wellington, New Zealand
- **Japan**--Toshiro Hirose; 1-13 Shimomaruko 1-chome; Ota-ku, Tokyo 146, Japan
- **All other areas**--Jim Stamm; (see address at left)

ON Publication Information

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IOTA 1998 Annual Meeting

David Dunham

This year's annual meeting of the International Occultation Timing Association will be held in Nashville, Tennessee, on Saturday, September 12 and Sunday, September 13. The meeting will begin at 3:00 PM (EDT) Saturday, to give observers of that morning's grazing occultation of Aldebaran time to recuperate or to travel from possibly distant locations. An informal reception will start at 1:00 PM for those already in the Nashville area. The Aldebaran graze passes only about 20 miles northwest of Nashville and there will be a local expedition that others can join, weather permitting. The meeting will last until 10:00 PM, with a break for dinner. The after-dinner part of the meeting will probably be conducted as an occultation workshop. The formal meeting will resume at 9:00 AM Sunday morning, concluding by 12:00 PM to give attendees a chance to return home that afternoon and evening. Scott Degenhardt (email dega@nashville.com; phone 615-895-0244) is the local organizer for the meeting, more information about which will soon be available on IOTA's web site (http://www.sky.net/~robinson/iotandx.htm). Earlier, we had considered Memphis for the meeting, but the airline connections to Nashville are just as good from most areas, and the distance from the Kansas City and Topeka area is only a little greater due to more direct Interstate routes from there to Nashville. Scott's diligent work with IOTA promises to make this a good meeting, and it also might give us a chance to see his observatory.

As an additional draw, there is a rare chance to observe 3 grazes the morning of September 12. First, at 0:53 AM (EDT), 6.7 mag. ZC 680 has a graze about 30 miles northwest of the Aldebaran graze path in Tennessee; it will occur 7 deg. from the northern cusp on the dark side of the Moon, which will be 9 deg. above the horizon. Next is the Aldebaran graze almost two and a half hours later at 3:15 AM EDT, giving plenty of time to travel between the two sites with portable equipment. The Aldebaran graze might be seen even without optical aid, occurring 10 deg. from the northern cusp of the 58% sunlit Moon, which by then will be 37 deg. above the horizon. Finally, about 25 miles northwest of the Aldebaran path and almost two hours later, at 5:10 AM EDT, there will be a graze of 8.3 mag. SAO 94056 9 deg. from the northern cusp on the dark side, an event that should be visible with 4-inch and larger telescopes.

Due to low altitude, it will be difficult to observe the ZC 680 graze west of the Nashville region. But to the east, that event will be better, with the path reaching a minimum distance from the Aldebaran path of only about 4 miles in central Pennsylvania, then extending northeastward to a short distance inland from the coast of Maine (where the Aldebaran path is mostly offshore). The SAO 94056 path crosses the Aldebaran path west of Charleston, W.VA.., then draws south of Aldebaran as it crosses southeastern Pennsylvania, New York City, Long Island Sound and southern Cape Cod.

Observing three grazes in one night is not just a stunt; timings of such events provide more details of the lunar profile with different tracks for each observer for each graze. A Metonic cycle ago, on Sept. 12, 1979, an almost identical geometry occurred in southern California, with the ZC 680 and Aldebaran paths intersecting near a place called Weed Patch several miles south of Bakersfield. A large expedition, including myself, observed from that location. Richard Nolthenius was also there, living in Los Angeles at the time, and on his way back, he successfully observed the SAO 94056 graze, one of the few "triple headers" known. With adequate planning, several of us could do it this year, and this time with video.

Schedule of Events

Saturday, September 12
00:53 AM (EDT) ZC 680 graze
03:15 AM Aldebaran graze
05:10 AM SAO 94056 9 graze
01:00 PM Informal reception
03:00 PM Meeting begins
06:00 PM Dinner break?
10:00 PM Meeting ends

Sunday, September 13
09:00 AM Meeting begins
12:00 PM Meeting ends

Elections

This is an election year for IOTA. Below is the proposed slate of officers for the next three years, for this year's election that will be held at the IOTA meeting. Nominations are now open for others for the election; send nominations to David Dunham by August 1 to be included in the ballot, which will be mailed to the IOTA membership before the election. Nominees must be members of IOTA and only members can participate in the election.

President	David Dunham
Executive V.P.	Paul Maley
Executive Secretary	Richard Nugent
Secretary	Craig McManus
Treasurer	Terri McManus
V.P. for Grazing Occultation Services	Mitsuru Soma
V.P. for Planetary Occultation Services	Jim Stamm
V.P. for Lunar Occultation Services	Walt Robinson
Editor for *Occultation Newsletter*	Rex Easton

Contact Scott Degenhardt
Email: dega@nashville.com
Telephone: 615-895-0244

International Occultation Timing Association, Inc. (IOTA)

IOTA Annual Meeting Registration Form

(This form is also located on the web at http://nashville.com/~dega/register.txt)

After completing form (preferably by August 1, 1998), please:

1) Email to: Scott Degenhardt dega@nashville.com
   CC to: David Dunham dunham@erols.com

or

2) Mail form to Scott Degenhardt; 3409 Mary Ave; Murfreesboro TN 37127.

The 1998 annual meeting of the International Occultation Timing Association will be held on:
Saturday September 12, 3:00 PM to 10:00 PM CDT (with a break for dinner)
Sunday September 13, 9:00 AM to 12:00 PM CDT

MEETING PLACE:
Vanderbilt University's Arthur J. Dyer Observatory located at 1000 Oman Dr., Brentwood Tennessee 37027-4143 (615-373-4897).

```
          NAME:
 EMAIL ADDRESS:
POSTAL ADDRESS:


     TELEPHONE:

DATE AND ESTIMATED TIME OF ARRIVAL:
DATE AND ESTIMATED TIME OF DEPARTURE:
INTERESTED IN GIVING A *PRESENTATION?  SUBJECT:
   * IF YES, PLEASE DOWNLOAD AND SUBMIT THE LECTURE PROPOSAL FORM AT:
                            http://nashville.com/~dega/lecture.txt

NUMBER OF PEOPLE IN YOUR PARTY THAT ARE IOTA:
    MEMBERS:                        NON-MEMBERS:
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                              ACCOMMODATIONS (optional)
(check out the accommodations page at: http://nashville.com/~dega/meet.htm)

AIRLINES AND AIRPORT ARRIVING/DEPARTING FROM:

HOTEL NAME AND LOCATION:

PLANNING ON JOINING THE GRAZE EXPEDITION IN THE MIDDLE TENNESSEE AREA ON FRIDAY NIGHT THE
11 AND MORNING OF THE 12 OF SEPTEMBER?
      *YES:_____        NO:_____
      *SEE http://nashville.com/~dega/graze98.htm for details and maps.

I hope to learn more about the following topics at the meeting:
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International Occultation Timing Association, Inc. (IOTA)

IOTA Annual Meeting Lecture Proposal Form

(This form is also located on the web at http://nashville.com/~dega/lecture.txt)

- Please submit the following form by August 15, 1998 with a brief title and description of your talk.
- You have until September 1 to submit a short abstract on your subject.
- Please bring the full text of your presentation to the meeting so it can be collected for printing in *Occultation Newsletter*. It is understandable that one might need to modify ones paper after the presentation and discussion that follows. Completed papers can be submitted as late as September 30.
- Presenters will be notified no later than the first week of September of the time of their presentation.

1) Email: Scott Degenhardt dega@nashville.com
 CC to: David Dunham dunham@erols.com

or

2) Mail Scott Degenhardt; 3409 Mary Ave; Murfreesboro TN 37127.

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NAME:
EMAIL ADDRESS:
POSTAL ADDRESS:

TELEPHONE:

DATE AND ESTIMATED TIME OF ARRIVAL:
DATE AND ESTIMATED TIME OF DEPARTURE:

LECTURE TITLE: ____________________

CO-PRESENTERS NAMES (if applicable): ____________________

DATE/TIME PREFERRED TO GIVE PRESENTATION: ____________________
LENGTH OF TIME REQUIRED TO PRESENT: __________

TYPE OF MEDIA REQUIRED:

OVERHEAD PROJECTOR:___ SLIDE PROJECTOR:___ VCR/TV:___ MARKER BOARD:___

MULTIMEDIA COMPUTER (NAME TYPE OS REQUIRED): ____________________

OTHER:

OTHER TYPE OF PRESENTATION:

Grazing Occultation Observations

Mitsuru Sôma
SomaMT@cc.nao.ac.jp

The table lists successful, or partly successful, expeditions for lunar grazing occultations made in 1998 which have been reported to me by June 14. I also received some observations made in 1997, but I did not know which observations of them would be reported by the former grazing occultation coordinator Richard P. Wilds at the time of this writing, so they were not included here. They will be reported in the next issue of *ON*.

The first two columns of the table give the Universal Time month and day numbers. A "V" is given under the column headed by V if a video record of some graze contacts was obtained from at least one of the stations, and a "P" is given if a photoelectric record was obtained. The ZC and SAO star numbers are usually given, but for non-ZC stars, XZ star number prefixed by letter X is given in the ZC column. The next column gives the magnitude, which was taken from XZ94F. Under the column headed by %Snl the percent of the moon's apparent disk sunlit is given, where "+" signifies waxing phases and "-" waning phases. Next is CA, the cusp angle in degrees from the north or south cusp. %Snl and CA are the values calculated by OCCRED. 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 count ½ for "possibly spurious" events and nothing for "most likely spurious" ones. Only contact timings are counted, and only if they are timed to, at worst, two seconds accuracy. Totals involving halves are rounded up. SS is the best (lowest) sky steadiness code reported by any observer in the expedition. Ap gives the aperture, in centimeters, of the smallest telescope in the expedition which achieved the sky steadiness listed under SS (in case more than one observer achieved it). Shift gives the estimated shift from the ACLPPP prediction, in seconds of arc on the predicted profile. It was estimated by me using the 85J version of OCCRED and the 1997 December 22 version of observed profile data, which were used for 1998 ACLPPP prediction profiles. N and S indicate whether the observed shadow passed north or south of the predicted one. WA is the approximate average of the Watts angles of all observed contacts, which is usually close to the Watts angle of central graze, and b is the latitude libration in degrees. The reduction results of these grazes will be used in the future graze predictions.

The Aldebaran (ZC 692) graze on February 5 were observed at 51 stations in all in Slovakia and Hungary and 167 contacts were obtained. Its reduction profile is given in the figure. It is slightly different from those derived from the Aldebaran grazes on 1997 July 29 in the USA and on Oct. 19 in Canada mainly due to the differences in the longitude librations.

Please send reports of all lunar grazing occultations to

Lunar Grazing Occultation Observations

Date Mo	Dy	V	Star Numbers XZ/ZC	SAO	Star Mag	% Snl	CA o	Location	# Sta	# Tm	S S	Ap cm	Organizer	Shift "	WA o	b o
1998																
01	09		ZC 671	93957	3.4	88+	+1S	Aikawa, Kanagawa, Japan	2	5	2	10	Satoshi Suzuki	0.0	173	+7.1
01	09		ZC 671	93957	3.4	88+	+1S	Inagi, Tokyo, Japan	3	10	2	12	Mikiya Sato	0.1S	173	+7.1
01	09		ZC 671	93957	3.4	88+	+1S	Hosoe, Shizuoka, Japan	3	12	1	20	Miyoshi Ida	0.1S	173	+7.1
01	09		ZC 671	93957	3.4	88+	+1S	Shounan, Chiba, Japan	4	15	2	7	Shigeo Uchiyama	0.1S	171	+7.1
01	09	V	ZC 671	93957	3.4	88+	+1S	Toride, Chiba, Japan	2	4	2	10	Hideo Takahashi	0.1S	169	+7.1
01	16		ZC 1589	53449	5.9	84-	+5S	Iga, Mie, Japan	6	16	2	15	Miyoshi Ida	0.0	185	+0.3
02	05		ZC 692	94027	0.9	69+	0N	Velky Kamenec, Slovakia	3	14	1	6	Petr Zeleny	0.1N	358	+7.3
02	05	V	ZC 692	94027	0.9	69+	-1N	Hurbanovo, Slovakia	15	37	1	5	Peter Kusnirak	0.2N	358	+7.3
02	05	V	ZC 692	94027	0.9	69+	0N	Tachty, Slovakia	21	75	1	6	Pavol Rapavy	0.2N	358	+7.3
02	05		ZC 692	94027	0.9	69+	0N	Salgotarjan, Hungary	5	14	1	6	Pavol Rapavy	0.2N	358	+7.3
02	05	V	ZC 692	94027	0.9	69+	-1N	Sopron, Hungary	7	27	1	6	Sandor Szabo	0.2N	357	+7.3
02	20		ZC 2399	160046	4.9	42-	+8S	Ardmore, OK, USA	3	16	1	10	Robert Sandy	0.0	190	-6.2
02	23		X 45784	-	8.7	15-	+5S	Ramalhal, T.V., Protugal	1	4	1	20	Rui Goncalves	0.2N	192	-4.6
03	05	V	ZC 692	94027	0.9	46+	+2N	Atlan.Coast, NS, Canada	1	8	1	13	Roy Bishop	0.1N	3	+7.3
03	05	V	ZC 692	94027	0.9	46+	-5S	Port of Spain, Trinidad	1	6	1	20	Maura Imbert	0.2S	177	+6.8
03	09		ZC 1258	97773	6.7	86+	+8N	Blessing, TX, USA	1	6	1	21	Wayne Hutchinson	0.0	4	+4.3
03	22		ZC 2826	162512	3.9	35-	+8S	Canberra, Australia	7	28	1	5	David Herald	0.0	191	-5.7
04	03		X 8714	95484	8.1	42+	+4N	Saluda, VA, USA	1	5	1	20	Robert Stewart	0.2S	4	+6.7
04	04		X 11157	96932	8.4	56+	+2N	Koriyama, Fukushima, Japan	1	1	2	16	Masayuki Yamamoto	0.2S	1	+5.4
05	04		ZC 1405	98624	6.9	57+	+4N	Cameron, MO, USA	3	13	1	9	Robert Sandy	0.0	3	+2.4
05	04	V	ZC 1405	98624	6.9	57+	+5N	Woodbury, TN, USA	1	8	1	15	Scott Degenhardt	0.1N	4	+2.4
05	04		ZC 1486	98964	4.4	64+	-5S	MonteRedondo, Leiria, Port.	4	15	1	15	Rui Goncalves	0.2S	183	+1.3

me, preferably in ILOC's 80-column format (as attached files when sent by email) or in IOTA's email76 format by email or on 3.5 inch floppy disk. I can also accept other reasonably well organized formats giving complete information about the station coordinates (longitude, latitude, and height above sea-level, as well as the reference geodetic datum) and timings. Shifts from the predicted profile or other values such as %Snl and CA no longer need to be given in the reports since I can calculate them. Be sure to indicate to whom copies of your report have been sent. Please note that I am not a staff of ILOC, so if you have not sent your report to ILOC other than me, do not include ILOC in the list. In that case I will copy your report and send it to ILOC. ι

Reports of Asteroidal Occultations in 1995

Jim Stamm
nemo@flash.net

(Do me a favor and mention in editor's notes that this was ready over a year ago but fell through the cracks, and that 1996 will be published in the next ON. *[Okay, Jim, consider it done.])*

If you do not have a regional coordinator who forwards your reports, they should be sent to me at: 11781 N. Joi Dr. Tucson, AZ 85737 USA., or preferably by email. My email address is nemo@flash.net. Names and addresses of regional coordinators are given under "IOTA Publications" on Occultation Newsletter's first (non-cover) page. All times in this report are UTC.

I have collected reports on eight events that included definite positive observations for 1995:

Jan 19 (654) Zelinda and PPM 122496. The table (on the next page) lists the observers who sent in reports for this well publicized event.

Notes:

1) The chord at Sonoita (Track 2N) was a video recording by Jim McGaha, Derald Nye, and Mark Trueblood. They used the 24 inch telescope, with a GBC camera and time inserter. There were some high thin cirrus clouds, but a 12 magnitude star was also recorded during the occultation. The reappearance was slow, 3-4 video frames. The R time given was that of the first frame that started to brighten.

2) No times received.

3) The positive chord at 214S was timed visually by Warren and Betty Offutt, observing with separate telescopes (a C-8 and 7-in. refractor); the D was about 15 seconds after the closest approach of the object that occulted the star at track 2N). When asked if he was certain that it was not a cloud event, Warren replied, "no, I am not certain that it was not a cloud event, although the other stars in the field were unaffected. It would have had to be a small cloud, and moderately dense, but such is not impossible." He further said that there was cirrus and the seeing had deteriorated appreciably; the star disappeared completely, with no sign of the asteroid.

Feb 13 (654) Zelinda and PPM 122197. A 25 sec. occultation was recorded at 23:34:27.1 by Z. Lantos of Budapest, Hungary.

Apr 05 (105) Artemis and CLRS 708954. Roger Venable at Augusta, Georgia believes a 9.2 sec. event, which began at 05:24:51.7 to be real, ". . . as certain as one can be about a crisp fading of one-half magnitude."

Apr 22 (106) Dione and PPM 157858. At Limoux, France an 18 second occultation was recorded at 22:19:04 by O. Gadal, and confirmed by I. Guyot with a CCD camera. 51 other European observers monitored this event.

May 15 (30) Urania and PPM 227166. Of nineteen European observers, six recorded occultations from Poland (listed on the next page).

May 26 (7) Iris and DM +08 0089. Hidehiko Akazawa at Funaho, Okayama caught the occultation photoelectrically in the dawn. The S/N was only 1.6. A detailed analysis with median filters shows a 6.3 second event from 19h 17m 30.8s (report form shows 19:18:30.8), which corresponds to a 252 km occultation chord.

Dec 06 (704)Interamnia and GSC 518700396. Nobuo Ohkura at Okayama, Japan timed a 10.7 sec. occultation beginning at 09:10:31.1.

Dec 10 (85) Io and PPM 146634. David Dunham is working on a full report for this event. Larry Wasserman has published a circular diameter of 178 km for this asteroid. See *ON* (vol. 6, no. 13, p. 300). A summary of the observations is listed on the next page. ι

Treasurers's Report

Terri A. McManus
IOTA@inlandnet.net

The balance as of 1998 May 31 is $6,734.73. It has come to my attention in a round-about-way that some members are upset that I do not acknowledge renewal payments. I can understand with the sporadic ON publication schedule how it is difficult to know if your payment has been received. Please do this: If your check does not clear the bank or if payment does not show on your credit card within two months please contact me. I may be slow at this or may not have received your renewal. My neighborhood has a lot of misdelivered mail. Also please keep in mind that I,. as well as all other IOTA officers, do this on a volunteer basis. A paying job and family obligations come first! Thank you for your patience.

Jan 19 (654) Zelinda and PPM 122496

Track	Observer	Location	Disappearance	Reappearance	Note
286N		Casa Grande, AZ			
146N	Jim Stamm	Tucson, AZ			
138N	David Harvey	Tucson, AZ			
134N	Bill Hubbard	Mt. Lemmon, AZ			
002N	Grasslands Obs.	Sonoita, AZ	07:32:08.84	07:32:19.02	1
062S	Bob Millis	Lordsburg, NM	??	??	2
155S	Larry Wasserman	Deming, NM			
160S	Richard Nugent	Amarillo, TX			
195S	Paul Maley	Amarillo, TX			
208S	Paul Carnes	Alamogordo, NM			
213S	Walter Farrar	Mountain Park, NM			
214S	Warren Offutt	Cloudcroft, NM	07:31:41.32	07:31:52.25	3
214S	Betty Offutt	Cloudcroft, NM	??	??	3

May 15 (30) Urania and PPM 227166

Observer	Location	Beginning	Lasting
Leszek Benedyktowicz	Krakow,	21:21:31.7	5.3 sec.
Andrzej Janus	Krakow,	21:21:34.5	4.8
Andrzej Pigulski	Wroclaw,	21:21:54.0	6.0
Witold Piskorz	Kracow,	21:21:34.3	5.7
Mariusz Swietnicki	Zrecin	21:21:15?	?(1-2 sec)
Aleksander Trebacz	Niepolomice	21:21:28.8	4.5

Dec 10 (85) Io and PPM 146634

#	Observer	Location	Long./Lat./Elevation/Track #
1		Anderson Mesa, AZ	/ / /37S
2	Dunham, David	St. Joseph, MO	/ / /23N
3	Martinez, Tom	Cleveland, MO	W 94 35 53.6/N 38 40 01.8/298/
4	Sandy, Bob	Lewisburg, KS	W 94 41 59.0/N 38 38 46.0/325/54S
5	Nason, Guy	N. York, Ont.	W 79 36 51.7/N 44 01 27.0/225/58S
6	Dempsey, Frank	Greenwood, Ont.	W 79 04 35.3/N 43 56 13.8/160/
7	Wilson, Timothy	Jefferson City, MO	W 92 08/N38 31/ /
	Kniffen, Doug	Warrenton, MO	W 91 13 14/N 38 43 30/ /
8	Hubl, Erik	Marysville, KS	W 96 38/N 39 41 (approx)/~350/
9	Scherping, Dave	Blue Rapids, KS	W 96 38/N 39 41/ /
10	Stamm, Jim	Tucson, AZ	W 110.9645/N 32.4204/842/127S
11	Harvey, Dave	Tucson, AZ	W 111.0000/N 32.3427/750/131S
12	Schlyter, Paul	Stockholm, Sweden	E 17 21 16.8/N 58 55 55.2/12/
13	McCausland, Phil	St. John's, NF	W 52 43 22/N 47 33 40/85
14	Roberts, Benny	Jackson, MS	W 90 17 52.4/N 32 15 17.8/110/
15	Gaskell, Martin	Lincoln, NE?	

#	Observer	Disappear.	Reappear.	Notes
1	Anderson Mesa			No event
2	Dunham, David			No event
3	Martinez, Tom	00:42:55.9	00:43:14.6	19.2 sec.
4	Sandy, Bob	00:42:57.2	00:43:15.6	18.5 sec.
5	Nason, Guy	00:40:50.8	00:41:09.7	18.9 sec.
6	Dempsey, Frank	00:40:47.1	00:41:07.6	20.5 sec.
7	Wilson, Timothy			16.07 sec. w/stopwatch
	Kniffen, Doug	00:42:42.5	00:42:55.2	Flickers at beginning
8	Hubl, Erik	00:45:50	00:46:13	Star dimmed by half
9	Scherping, Dave			No event
10	Stamm, Jim	00:44:53	00:45:01.7	
11	Harvey, Dave	>00:44:52.9	<00:45:03.4	
12	Schlyter, Paul	00:31:17	00:31:17	0.25 sec. blink
13	McCausland, Phil			Secondary??
14	Roberts, Benny			No event
15	Gaskell, Martin			

Sad News: Joaquim Soares Garcia Dies

Rui Goncalves
rui.goncalves@igm.pt
Thu, 07 May 1998 11:25:30 -0500

Unfortunately for all us and Portuguese Astronomy, Mr Joaquim Soares Garcia passed away last Tuesday. It was unexpected, and all his friends and family are in shock.

Monday night he and Mrs. Alite Garcia were at Monte Redondo (120 km north of Lisbon, Portugal) with me and my wife, and two more local amateurs. Altogether (4 stations) we made 20 timings. The weather was perfect, and he was very happy with this graze (31 Leo). After the graze we talk about the 4 stations results and went home. This was Garcia's last graze, and we all feel happy that he was doing what he likes most until his last day - Astronomy.

I start working with Garcia in the Summer of 1984, doing my 15 cm f/9.5 Newton telescope (the same one used in this last graze) and observing total occultations together. Since that Summer until 1996 the collaboration between us was intense. From that year to Monday it was sporadic. We where planning to start collaboration again, with the new equipment in his observatory, performing astrometric observations.

We will all miss his presence and work.

Nuno Gracias
(On behalf of his family)
GPOA
ngracias@isr.ist.utl.pt

I am afraid I bring you the saddest news. It is with the greatest grief that I inform you that Mr Joaquim Soares Garcia has passed away, last evening, from an acute heart failure. The stroke that killed him was unexpected, considering his good health condition in the last months. In spite of quick help, he was unable to be revived, and died in the hospital shortly after arrival. Joaquim was submitted to a surgical intervention to his heart three years ago, from which he recovered with a renewed will to work and to do the activities he enjoyed. The night before he died was spent on a successful observation of a grazing occultation, a few kilometers north of Lisbon. He's last day was a normal, active day.

He will be dearly missed. ι

Corrections and Updates

Concerning the Aldebaran Feb 5 graze publication in *ON* (vol. 7, no. 1), I (Henk Bulder) made one mistake. I used PA instead of WA in the figure. The WA of central graze line in the figure is 158.2. Rex Easton got all the observations as I got them from Pavol Rapavy. Nevertheless, he published only the observer names of the first Slovakian expedition. Pavol sent me results of three expeditions, two of them having a place name of Rimavska Sobota (as I understand from Marek one of these should be Hurbanovo) and one having place name of Tomasovska. The second expedition at Rimavska Sobota has observers: M. Maturkanic, J. Ondrus and V. Doliak. The third expedition at Tomasovska has observers: J. Ambroz, R. Kardoz, N. Werner, J. Masiar, M. Znasik, M. Kavecky, K. Kerekesova, V. Cillik, P. Hrmady, D. Ocenas, P. Zimnikoval, J. Kasperova, J. Sliz, I. Benyo, P. Sedlak, D. Rpavy, P. Rapavy, J. Gerbos, J. Slusarczyk, L. Benedyktowicz, M. Borkowski, A. Mikiel, J. Wiland and A. Papista.

The address for Dr. Mitsuru Sôma has been updated in What to Send to Whom.

The address for ILOC has been updated in What to Send to Whom. ι

IOTA Occultation Camera Production Schedule

Dr. Wolfgang Beisker

The status of the IOC cameras is at follows: After long delays based on the nonreliability of companies and people as well as some quality problems, the final assembly of the IOC is now under way.

A new printed circuit board (PCB) has been developed and is currently in testing. The board contains besides the electronics necessary for the CCD Chip a 12 Bit A/D converter which can be attached to the parallel printer port of any standard PC (no bidirectional port is required, the standard printer configuration is fine).

In the past the IOC has been used in many cases, up to three systems have been in use simultaneously. This evening, one more try to record an asteroidal occultation will be done from Munich.

The time schedule up to delivery is as follows:

Testing the new board including signal to noise checks:
up to May 20
Producing 30 PCBs
May 20
Assembly of the boards and producing the housing for it:
June
Occultation of a 14m7 star by Pluto including many IOC's
June 9
Continuing production
July

Final testing and quality control
up to ESOP Meeting
DELIVERY (I believe up to 20 could be ready)
ESOP Meeting

A workshop should be held in Belgium (about a ½ day long) for all of you to learn how to work with CCD's. ι

MUNIDOS Review

Warren Offutt
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The very nice article, Bulder and Gestel, "Preliminary Results of PHEMU97: A Joint Effort" (*ON*, vol. 7, no. 1, pg. 12) discussed use of short interval CCD images for light curve construction.

I [would like to] call attention to a piece of software (shareware), MUNIDOS, written by Rudolf Novak and Filip Hroch at the Nicholas Copernicus Observatory--Masaryk University in Brno, Czech Republic. It accepts an unlimited number of images, will automatically convert SBIG images to FITS format if necessary, performs both dark and flat field correction if desired, and then accepts three field stars as photometric comparison standards in addition to the program object and constructs both an ASCII tabulation of the photometry as well as presenting a graphical display of the results.

The DOS based software has been tested under Win 95 and Win 3.1 and writes a very nice results file in ASCII showing the target star time series photometry, and also how the comparison stars behaved. The results file easily can be used as an input file for subsequent special purpose processing. I have occasionally imported the results file into a spreadsheet program for detailed inspection of some special part.

MUNIDOS is actually a suite of interlocking programs which run automatically under an executive batch control program, although the user need not know any of the details. One of the internal programs is the well known and proven DAOPHOT II. The user may, if desired, customize the parameters such as photometry window size, etc.

I recently processed about 2,500 images of an eclipsing flare star this way. Individual runs of approximately 900 images were completed, essentially hands off, in approximately one hour on a 200 MHz PC.

My eclipsing flare star images were taken with an old ST6 camera, downloading 5 frames per minute, each with 6.5 second exposures. With images taken with a 60 cm telescope on these runs, MUNIDOS had no difficulty with stars to approximately magnitude 16, although, out of the 2,500 images, I had to process about 25 images manually where the eclipsing star was fainter than about magnitude 16.5 . . . in fact, it was even difficult to process those images by hand because the target star was so faint. No wonder MUNIDOS had difficulty!

I downloaded MUNIDOS in a zipped file of about 550 kilobytes from a Brno web site. I obtained mine by contacting Rudolf Novak at **rudolfn@physics.muni.cz** or Filip Hroch at **hroch@physics.muni.cz** and I downloaded the zipped file from **http://physics.muni.cz/~rudolfn** and related pages may be found at **http://www.sci.muni.cz/~hroch**. Web addresses have a way of changing from time to time; out of this assortment, interested persons should be able to make contact. ι

Video Basics 101: Part One

Scott Degenhardt
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With the latest video revolution going on in amateur astronomy I thought it might be good to provide some basics on video. I will even list the basic camera specifications and explain them in laymen's terms.

Some history on video

The first camera tubes were invented in the 1920's and were called the Iconoscope, a later version was called the vidicon tube. Until the CCD chip became popular, the vidicon tube was the standard way to convert an image to an electronic signal. The vidicon tube was a vacuum tube that had a photosensitive screen inside of it that your image was focused onto. An electron beam scanned this screen (usually made of a phosphorus coating) and converted any part of the screen that was illuminated to an electrical signal one point (called a pixel) at a time. This point by point image was then reassembled by your TV tube (cathode ray tube, CRT) that performed the reverse operation by scanning the front of the CRT with an electron beam and excited one pixel at a time to match the transmitted picture.

After World War II the United States set up a committee called the National Television System Committee (NTSC). Their job was to set a standard that all video signals must be generated in so that tv sets, cameras and tv transmissions could be mass produced and still be compatible with each other. They picked the specifications already developed by Radio Corporation of America (RCA). I will discuss the NTSC standard later.

The original cameras were only black and white. Color cameras were developed by Columbia Broadcasting System (CBS). So the committee (NTSC) reconvened again in 1953 to establish the NTSC standard for color video. Color video was accomplished by using three vidicon tubes with red, green, and blue filters in front of them. The color CRT likewise has a red, green, and blue electron gun that then recreates the image sent electronically by the vidicon tube.

Video technology today

Today's video cameras use an imaging device called a CCD, short for Charge-Coupled Device. These imaging devices efficiently convert up to 60% of the photons that strike it to a signal. I was fortunate enough to be involved in video as part of my career (I was working for Country Music Television) and attended an International Television Conference when RCA demonstrated serial #1 of their first camera that replaced the vidicon tube with a new fangled CCD chip. They played a tape they made wandering around downtown Nashville, Tennessee at night time to show the high sensitivity these chips had under low light conditions. There were LOTS of "Oohs" and "Aahs" (several were emitted from me) as they showed reflections of images of buildings in water puddles AT NIGHT! The other thing that was immediately obvious was the ability of these cameras to "stare" at bright lights without leaving the streaks and trails as this bright light moved around on the screen. They possessed absolutely NO ability to burn in which was a real problem with vidicons, even under normal lighting conditions.

Today, it is next to impossible to find anyone who sells the vidicon tube cameras anymore. Over 50% of all households [in USA] own a camcorder. These lightweight, low power draw [cameras] were only made possible by the advent of the CCD chip.

What exactly is a CCD chip?

Think of the CCD, Charge-Coupled Device, as an array of wells or buckets (called pixels). It is an integrated circuit silicon chip in an array of squares on average with 600 square pixels by 800 square pixels to a side. Figure one shows an array of 8 horizontal pixels and 3 vertical pixels. In a camera an image will be brought to focus on the array. The photons from the light source (the image) will strike the array and cause a charge to build up in individual pixels that is directly proportional to the number of photons that strike it. In other words, the brighter the object the more photons that will strike a pixel and the higher the charge will build up in the pixel.

```
                     ######## Row 3
                     ######## Row 2
Electronics <---     ######## Row 1
```

Fig. 1

There are different types of CCD chips and thus different methods of extracting the image from the array, but here is a typical method of retrieving the image. After the time for the exposure is up, the pixels will start passing their charges down one row at a time. For instance, Row 1 will pass its charge out its side to the electronics. Row 2 will pass its charge down to Row 1 which will then pass the charge out of its side. While this is going on Row 3 will pass its charge to Row 2 which will then pass it to Row 1 which will then pass it to the electronics.

Each one of the pixels has an X, Y position and an intensity. The electronics in the video camera takes all of that and inserts it in the NTSC standard video signal which comes out of the camera and can either be displayed directly on a monitor or recorded by a VCR. The TV tube reconstructs the image by putting a bright spot in the same X, Y position with the same intensity as the CCD array saw. In an integrating CCD camera these pixels are sent digitally down a connection to a computer.

What is the NTSC standard?

Among the important things for us is the frame rate is 30 frames per second. This is the number of pictures per second the video camera takes. I will talk more about this in a bit.

The video signal is 1 volt in amplitude peak to peak. It also has a 75 ohm (Ω) impedance. What this means is the load (the monitor or VCR) on the camera should be 75 ohms so that the electronic signal is evenly balanced on the output of the video camera and the input of the tv or VCR. All VCR's will have the 75 ohms built into it, but monitors sometimes have a switch for 75 ohms or no impedance. If you are daisy chaining several monitors together only the last on should be the 75 ohm load.

The rest describes things like the horizontal and vertical sync signals, color burst frequencies and other terms you probably don't need to be to concerned about knowing.

Astrovideography

Astrovideography is a new term that has been created to name video imaging of astronomical objects. Now that we understand a little about how the video camera works lets answer the big question. What good is a video camera for astronomy?

Here are some video camera basics:

As mentioned earlier, video cameras generate 30 pictures or frames each second (usually abbreviated as fps). This means that one frame represents 1/30 or 0.033 seconds in time resolution.

However, the time the camera spends actually taking each picture (what photographers usually call the integration time) is anywhere from 1/60 of a second to 1/10,000 of a second. It uses the rest of that 0.033 seconds per frame to convert its picture into a NTSC standard video signal.

The CCD chip used in video cameras is more desirable than film in some ways. The CCD has a higher dynamic range, meaning it can distinguish between more subtler changes in color than film. The typical CCD can see the difference between up to 1 million different shades of gray! It is also more sensitive than film is in a wider range of the visible and invisible spectrum of light.

The typical CCD can still be sensitive into the near infrared up to 10,000 angstroms.

CCD's also have no memory like the phosphorus vidicon tubes had. This is because after one image is integrated the wells of each pixels are completely emptied before the next image begins integrating. This prevents streaking and burn in like the old vidicons were susceptible to.

For prime focus videography the camera is inserted into the focuser in place of the eyepiece. In order to figure out how much "magnification" the camera will provide I use the following rules of thumb:

A CCD video camera with a ½ inch array acts as a 6 mm eyepiece.

A CCD camera with a 1/3 inch array will provide a slightly larger image on the monitor, so I consider it a 5 mm eyepiece.

As you can see by the above values, the video camera will provide a very hefty magnification not usually used by graze or occultation visual work. Likewise this usually means a VERY narrow field of view on the monitor.

My 6" f/8 Newtonian has a 1200 mm focal length. This means my camera yields about a 200 X image. The field of view is about 20' vertical and 26' horizontal.

My 12.5" f/10 Newtonian has a 3.2 meter focal length. My 1/3" array camera then yields about 600 X and the field of view is ONLY 5.6' V by 7.5' H!

One of these cameras in a typical finder scope will provide about a 1 degree field of view. They make standard C mount lenses for these video cameras. My 75 mm lens yields a 4 degree field of view, while my 16 mm gives a 10 degree field. They make these lenses down to about 6 mm in focal length which will probably give one quite a bit more in field size. I haven't had a chance to try one this small yet.

I have found one of the better ways to get more magnification (if you really think you need it and seeing will allow) is to put a barlow lens in the focuser first and then the camera in the barlow lens. This will yield typically 3 times more focal length. Keep in mind that this will also triple your f/ratio. So if an object is faint to start with it will be hard to find when dimmed more. However, if you are looking near the Moon's bright edge or a bright planet like Jupiter this is a good method for dimming the glare down.

Video cameras usually have some type of electronics built in to either adjust the gain (or sensitivity) of the camera (we call this autogain) or the length of the integration time of each frame (we call this autoshutter) in accordance to how bright the object you are viewing is.

There are several things to be concerned about with autogain or autoshutter.

First, one needs to know if there is a switch that will allow you to disable this feature. I had one graze station loose ALL of his data due to the fact he forgot to switch the autogain OFF and every time he adjusted the telescope in Right Ascension the star faded out as the bright limb moved into the center of view. Every time this happened he thought he was getting D's and R's. I was trying to reduce his tape when I realized that not only was he getting way too many events but they were occurring when the star was no where near the lunar limb according to the profile predictions!

Second, one needs to also remember that you can have a bright image that is over saturated in the field of view and still not have the autogain or autoshutter kick in. This is because the electronics is looking for a much larger area of the array to be affected by an overly bright object before it can sense that it needs to adjust its gain or shutter speed.

Video cameras have a rating system designed to tell you how sensitive it is to light. You will find this rating in the camera specifications usually called the minimum scene illumination and it is usually rated in lux. The lower the lux rating the less light it needs to be able to display an image.

The typical home color camcorder has a low light rating of 2.0 lux.

The typical black & white CCD camera used for security systems are typically at least 200 times more sensitive than that, usually with low lux ratings at 0.05 lux to 0.01 lux.

These are some general basics in astrovideography. Stay tuned for part two which will gradually become more technical in its discussions.

For some video images that have been converted to graphic images check out our image gallery at the Degenhardt Amateur User Facility: **http://nashville.com/~dega/images.htm**.

Time Inserted Video Occultation Instructions

(Written by Don at the end of April, 1998, with some additions by David Dunham in mid May, and again in late May after receiving remarks from Tom Campbell and Don.)

Enclosed are your video occultation observations with a digital display of the time added. I have usually recorded the time inserted observations after your originals; if not, I'll specify otherwise. A clear-image single-framing VCR is needed to extract the timings. Please note the following:

1. The format of the seconds is **not** in tenths and hundredths, but in tenths and **sixtieths**. Thus a display of 59.93 would convert to 59 + 9/10 + 3/60 = 59.95 decimal. Single framing produces a jump in the display of 2/60 second = 1/30 = the frame rate, so the

count of the last digit would be a sequence of 0, 2, 4 or 1, 3, 5. Each frame is actually composed of two half-frames or "fields", each field being 1/60 of a second. Some VCR's will display each field, in which case, the sequence will be 0, 1, 2, 3, 4, 5.

2. Playback rates seldom match the original record rate exactly. Thus stop times are usually not exactly 00.00 for the seconds. To compensate for this, use the following scaling adjustment:

If

UTSTART = UT start time of the interval TIME INSERTED (integral minute)

UTSTOP = Corresponding stop time (integral minute)

DISPSTOP = Actual stop time of the digital display

EVENTTIME = Display time of an occultation event,

Then the corrected time (after converting from sixtieths notation to decimal is:

UTSTART + ((UTSTOP - UTSTART) / (DISPSTOP - UTSTART)) * (EVENTTIME - UTSTART)

For example (all times in minutes), if UTSTART = 10 (such as, UT time = 1h 10m, and just drop the hours), UTSTOP = 20, DISPSTOP = 19.990, and EVENTTIME = 15.000, then the corrected time is

10 + ((20-10)/(19.99-10))* (15-10)
= 10 + 10/9.99 * 5
= 10 + 5.005 = 15.005.

Then, the UT of the event would be 1h 15m 00.30s (calculations should be done to a precision of 0.01 second or 0.0001 minute).

The Mark IV Manly time inserter/VTACT combination that we are using does not trigger automatically (start the display running) until at least a few of the 1000 Hz cycles of WWV have been detected. So this introduces an instrumental delay, which is 4 milliseconds for tapes that have been time inserted by Don Stockbauer and is 28 milliseconds for those time inserted by Tom Campbell (that is, use 4 milliseconds for the delay if you received your time-inserted tape from Don, and use 28 milliseconds if you received it from Tom). Therefore, when the display is automatically triggered (usually the case), you must add this amount to the time for the report. Hence, the time for the report, for the above example, would be the same to the nearest 0.01 second if your tape came from Don or would be 1h 15m 00.33s if it came from Tom. This correction should **not** be applied when the display (start) is manually triggered (sometimes necessary when the audio is noisy so that the WWV minute tone is not clearly detected). The person sending you the time inserted copy will include a note saying that the display has been manually triggered (on starting) if that is the case; of course, then the accuracy is not as good, typically ±0.2 second if only the minute tone is audible and ±0.05 second if the seconds beats are also audible (fortunately, the necessity for manual triggering is rare, especially if the time signal is recorded reasonably well, even if a little noisy, and as long as there is no talking or other significant noise at the minute tone). For automatic triggering, the instrumental accuracy is ±0.002 second, but that should be added to the frame or field half-width for the reported accuracy on the form, in other words, ±(0.017 + 0.002) = ±0.019 second for single-frames and ±(0.008 + 0.002) = ±0.010 second if your VCR can display single fields. Since the ILOC report form (and email or Email76 version) only allows a specification of the accuracy to 0.01 second, you should enter 0.02 second for single-frames and 0.01 second for single-fields. If there is no remark about manual triggering, you can assume that the start of the display has been triggered automatically.

Other factors that the observer should take into account are:

1 The distance of the radio broadcasting the time signal from the microphone (speed of sound, about 1,100 feet per second, delay, add 0.001 second for each 1.1 feet, or negligible if the radio output is wired directly to the recorder with no audio transmission. If you strive for an accuracy of ±0.01 second, then this might be considered negligible if the distance is less than five feet. But then you would need to add this to the error (strictly speaking, it should be root-mean-squared) from other sources.

2. The distance of the WWV transmitter (Ft. Collins, Colorado) from the observing station (or WWVH, if it is used; Kaui, Hawaii); the speed of light is close to 300,000 km/sec, so add 0.001 second for each 300 km; great circle distance is all right for the precision needed. Sometime soon, we will post on the IOTA web page the computed delay for each IOTA station for each major time signal transmitter, and will later include this in some of the IOTA predictions. But for distant graze expeditions, it will need to be computed using the observation site coordinates.

Sometimes DISPSTOP really is incorrect due to poor WWV reception. In this case, I'll include its correct value in a separate note herein.

When Does an Event Occur?

If a star is visible on one frame and not on the next one, then, strictly speaking, the time should be taken as that between the two frames. Thus, if the displayed time on the last "star visible" frame is 01:15:00.00, and the next, the first "star gone" frame is 01:15:00.02 (that is, 1/30 second later), then 01:15:00.01 (1/60 second after 00.00s, or 00.01667s decimal) is the display time of the disappearance. If you can display individual fields, with the "star visible" field at 01:15:00.00 and the next, first "star gone" field at 01:15:00.01 (that is, 1/60 second later), then 01:15:00.008 is the time of the disappearance. Of course, this must be corrected for the playback rate and instrumental delay, as described above.

Often with video records, the star will take a few frames to disappear (or reappear). The report form has provision for reporting the start and end of a disappearance or reappearance, but it is best not to use this (doubles the reporting for each event) unless the fade or brightening occurs over five or more frames.

For events that occur over less than five frames, select the one where the star appears closest to 1/4 of its unocculted brightness; that is the equivalent geometrical occultation from application of the theory of Fresnel diffraction of the star's light at the Moon's edge caused by the wave nature of light. During grazes, especially of bright stars, the diffraction fading and brightening can be greatly enhanced, sometimes with complex structure, sometimes with partial blinks and faint flashes. For these, you can report the start and end of an event, and might also give one or more intermediate "0" code events with an estimate in a following comment line of the brightness as a fraction of the unocculted brightness, if the fade or brightening is not approximately linear. Peter Manly, who designed the time inserter, also has designed a "box digitizer" that makes it possible to generate a photometric record of a star's fluctuations from a videotape.

Reporting Observations

In general, all observers need to report their observations themselves using the information given in IOTA's web site: http://www.sky.net/~robinson/iotandx.htm

Look for the Email76 format description near the bottom of the menu. Producing this ASCII file format is a little cumbersome, with the design made most convenient for the computers at the International Lunar Occultation Center (ILOC), not for people. An easier way for first time reporting is to obtain the OCCULT program and use its menu driven reporting option. IOTA is working on a more user friendly format for reporting lunar occultation observations, along with a small program to convert that format to the one that ILOC really needs. As soon as it is ready, it will be distributed by email and given on the web site above.

Local IOTA coordinators should be asked for help where necessary. The web site also has information on obtaining accurate geodetic coordinates, and how suitable the GPS is for positions or as a time source (most GPS receivers are not accurate enough for these functions; care must be exercised). I can in general only help with questions concerning the time insertion process. For these, please respond to

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USA
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Regulus Graze 1 Degree from Sun 1998 August 22

Rex,

I think Friedhelm Dorst's plans for the Aug. 22 Regulus graze, and his work in general described below, would make for an interesting article for *ON*.

David Dunham

Dear David Herald,

The person attempting to observe the Regulus graze on August 22 is Mr. Friedhelm Dorst of Witten, Germany. He is well aware of the fact that the distance between the star and the sun's center is only a little more than 1 degree. But he has some experience in observations like that, although, because of different diameters of glare around the sun due to weather conditions he cannot be certain whether a spotting of Regulus will be possible.

Mr. Dorst already is in contact with Mr. Andrew Fitzgerald of the Alice Springs Astronomical Society who wants to help out with a 4-wheel car (among quite a few other things). He was in the area before, which was less than three years ago.

Mr. Dorst has asked me to forward the following letter to you. I am as curious as anyone else whether this expedition will be successful.

Eberhard Riedel.

(Written, May 29, 1998)

Dear Mr. Herald,

Thank you very much for your assistance concerning my expedition to the Regulus occultation by the New Moon of Eclipse Day August 22, 1998! Only very few people are as keen as me in looking for stars close to the solar disk. My experience began in the summer of 1968, when Venus nearly traveled behind the sun on solar superior conjunction, though my interest in daylight observations began in 1960. Since then I have observed Mercury some 62' from the solar limb and Venus some 35' apart from the sun, the latter at 13 deg. solar elevation! I shall bring with me a set of ND 2 filters for elimination of most of the heat and reducing the sky brightness near the solar edge to a convenient amount. My largest filter (hopefully delivered in time!) will measure 180 mm across, the smallest 90 mm and 100 mm, respectively. My *Traveler* (diam. 10.5 cm) will be equipped with a 120 mm ND 1.8 filter and a set of eyepieces from 6 mm to 16 mm fl, three of them being reticle eyepieces. I hope to record the event through the eyepiece with one of my camcorders (either TR 3300-E or the VX 1000-E digital recorder, both from Sony). A Garmin 12 GPS device should assist in finding an observation site for several observers a few hundred meters apart from each other and just inside the Northern Limit of the grazing occultation. If successful, this unique kind of observation of a grazing occultation would surely be the first one.

Last, but not least: Professor Max Waldmaier succeeded to photograph Regulus at solar conjunction as early as 1937!! I no longer remember, where I read this, but the Annals of the Zuerich Eidgenoessische Sternwarte should be a reliable source for this fact.

Very sincerely yours,
Friedhelm Dorst
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D - 58452 Witten
Germany
Fax: +49 2302 30232

Lunar Grazing Occultation Data Reduction Spreadsheet

Jim Stamm
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(Here is an article that I started on years ago, and never finished. It is complete in the sense that I can and do use it, but it has never been "Beta Tested." There may be conditions in which it gives false output. I was hoping to have someone check it for me, but never found the interested person. Perhaps some ON *readers will check it out, and revise it to a fully usable version.)*

Dynamic astronomical phenomena have always fascinated me. And none are more dynamic, with multiple and prolonged events, than lunar grazing occultations. The mountains and valleys of the polar regions of the Moon respectively hide and expose a relatively bright star as the orb sails past in its revolution around the Earth--if the observer happens to be in the right place at the right time.

There is a double dose of pleasure here, for I also enjoy determining where the right place is. The International Occultation Timing Association supplies predictions for grazes in my area (any member's area), and with a few lines on a topographic map, and several simple calculations, one can determine the best seat in the house. Even if I'm clouded out, I have captured the pleasure of refining the prediction.

If all goes well, and I also make the observation, I have some pretty indelible memories of a "rare" and exciting event. The events aren't rare, but the successful observations are, because few take the initiative of obtaining the predictions, and fewer locate and travel to the "best graze line," which in many cases is only a few miles away.

Not only will I have fine memories, but if I make simple timings of the event, I have valuable data that can lead to refining the Moon's orbit, discovery of double stars, improving the profile of the Moon, or providing information for determining the Sun's diameter during Solar eclipses.

Unfortunately, the third aspect of observing lunar grazes, namely data reduction, is tedious and anticlimactic for me. The most important datum obtained from the graze is the amount of observed shift of the Moon's "shadow" from that predicted by IOTA. It is obtained by plotting, measuring, and calculating lines drawn on a map from the observing station, and from the predicted graze limit line. There is nothing complicated about the task, but for me, the excitement is past, and I have never figured out how to fit a 22" x 27" map on my cluttered 40" x 72" desk. Sometimes a location may require two (or more) maps. Also a good graze expedition will have several (or many) observing stations, so the process may need to be repeated often.

Since my computer may be part of the above mentioned problem (cluttered desktop), I decided to let it do the work. I created the spreadsheet shown here, to instantly give me the information that I need, to draw a time line on the profile supplied by IOTA. After entering data from IOTA's prediction sheet (lines 3 and 4), I enter coordinates and elevation of the observing station into five cells of the spread sheet (B5 to E5 and B6). The guts of the spread sheet (C13-C17, G13-G18, and K13-K18) are a series of trigonometric formulae that do all of the measuring and calculating of the "map lines," producing the precise time of central graze (beginning in cell F5), the shift (D8), and the coordinates in the format used on the report form that is sent to IOTA and/or the International Lunar Occultation Center (ILOC) in Japan. The display shown as figure 1 may seem cramped and full of abbreviations, because I wanted to fit the whole scheme onto the screen of my Mac Plus. And I wanted to use the line data to check for errors. B18 and C18 are the average number of feet per arc minute that I measured from the maps I use for these events (easier than calculating geoid distances). These are different on different maps, so your measured values will increase the accuracy of your results. If you retype the formulae (figure 2) correctly into their respective cells, your screen should show the same numbers as shown in figure 1 then you can annotate and rearrange the spread sheet to fit your own needs.

(Figure 2.) Spreadsheet formulae:

The following is what I developed for when the Graze Limit Line had a bearing of less than 90 degrees. Although it has always worked for my grazes, I don't know if it works for other conditions:

```
F5=Int((K18+(F3*3600+G3*60+H3))/3600)
G5=Int(((K18+(F3*3600+G3*60+H3))-(F5*3600))/60)
H5=(K18+(F3*3600+G3*60+H3))-(F5*3600)-(G5*60)
I5=(B3-(B5+C5/60))/(B3-B4)*(I4-I3)+I3
J5=(B3-(B5+C5/60))/(B3-B4)*(J4-J3)+J3
K5=(B3-(B5+C5/60))/(B3-B4)*(K4-K3)+K3
B8=-(G17+G18)
D8=B8/5280
F8=D8*1.61
B10=B5
C10=Int(C5)
D10=(C5-Int(C5))*60
F10=D5
G10=Int(E5)
H10=(E5-Int(E5))*60
K10=B6/3.280833
C13=((D4+E4/60)-(D3+E3/60))*60*C18
C14=Cos(Radians(((D3+E3/60)+(D4+E4/60))/2))*(B3-B4)*
60*B18
C15=Sqrt(C13*C13+C14*C14)
C16=90-Degrees(ATan(C13/C14))
C17=(F4*3600+G4*60+H4)-(F3*3600+G3*60+H3)
G13=Cos(Radians(((D3+E3/60)+(D5+E5/60))/2))*(B3-(B5+
C5/60))*60*B18
G14=((D5+E5/60)-(D3+E3/60))*60*C18
G15=Sqrt(G13*G13+G14*G14)
G16=Degrees(ACos(G14/G15))
G17=Sin(Radians(G16-C16))*G15
G18=Sin(Radians(C16-J5))*K5*B6
K13=Abs(G18)
K14=K13/Tan(Radians(K16))
K15=Sqrt(K13*K13+K14*K14)
K16=J5-C16
K17=K14*C17/C15
K18=G17/Tan(Radians(G16-C16))*C17/C15-K17
```

Occultation Data Reduction - Lunar Graze						Graze Limit Line Bearing < 90¡					1
	Long.(j)	Long.(')	Lat.(j)	Lat.(')	Hr.	Min.	Sec.	Mn. Alt.	Mn. Az.	TanZ	2
West Edge	110.75	xxxx	32	43.61	3	41	56.30	26.20	110.60	2.03	3
East Edge	110.625	xxxx	32	42.01	3	42	4.40	26.30	110.80	2.02	4
Station	110	38.279	32	43.23	**3**	**42**	**2.27**	26.29	110.78	2.02	5
Elev. (ft.)	2357										6
											7
Shift =	6747	feet =	**1.28**	miles =	2.06	km					8
											9
Longitude =	**110**	**38**	**16.74**	Lat. =	**32**	**43**	**13.86**		Height (m) =	**718.42**	10
											11
Graze Limit Line:				Station Bearing Line:				Moon Azimuth Line:			12
Opposite =		-9696		Opposite =		34446		Opposite =		549	13
Adjacent =		38443		Adjacent =		-2297		Adjacent =		4732	14
Bearing distance =		39647		Bearing dist. =		34522		Hypotenuse =		4764	15
G.L.L. Bearing =		90.00		Bearing =		93.81		Az/GLL Angle =		20.78	16
Bearing dist. (sec) =		8.10		Dist. from GLL =		-6197		Time shift =		0.97	17
Hor/Vert =	6092	6060		Elevation Shift =		-549		Time Diff. =		5.97	18
											19
											21
Event	Hr.	Min.	Sec.	Delta Sec.		**Event**	Hr.	Min.	Sec.	Delta Sec.	22
Blink	3	39	4.5	177.77						13322.27	23
Off	3	39	25	157.27						13322.27	24
On	3	39	31.5	150.77						13322.27	25
Off	3	39	51	131.27						13322.27	26
On	3	46	28.3	-266.03						13322.27	27
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	20

Lambda Aquarii 10 is a Binary Star!
Hal Povenmire

On Saturday night, December 6, 1997, we attempted a major grazing occultation of the bright star, Lambda Aquarii at the intersection of 1-95 and RT. 407. This graze was extremely favorable and over 150 persons were invited to participate. Invitations were sent to observers all over the eastern United States.

On Saturday afternoon, a major cold front swept through and provided clear skies and exceptionally steady seeing. It was also about 40 °F, therefore, no mosquitoes.

One goal was to obtain more timings than we had on our previous graze in that area. This was the World Record breaking, Iota Capricorni graze of December 4, 1970.

Lambda Aquarii is a +3.7 magnitude, MO spectral class star that is known to be slightly variable. It is an exceptionally large, red supergiant star with an angular diameter of 0.01 arc seconds. For this reason I warned everyone to expect diming events. I asked everyone to describe them as accurately as possible.

When the graze started, most of the observers including myself, noted that the events were slow and sluggish as would be expected with this Antares colored star.

After midgraze a remarkable change occurred. Instead of just sluggish events, all Reappearances were prolonged for durations over 1.0 seconds. They were also stair step events. Many of the observers saw a companion visible for up to 3 seconds alone before the primary Reappeared. Lambda Aquarii is a binary star!

I am now deep into the reduction of the timings and as a preliminary figure I can state that there appear to be at least 260 reducible timings. There were also two smaller teams in the center and western part of the state that observed this graze.

I immediately notified IOTA, the Smithsonian, the U.S. Naval Observatory, AAVSO, and CHARA. The Center for High Resolution Astronomy group (CHARA) said that they will make it a priority to attempt to confirm it by speckle interferometry this spring on their next observing run. Since several of the high quality VHS video tapes clearly show the stair step dimings and the companion alone, we have a preliminary confirmation.

My preliminary graphical reduction indicates the best solution to be that of a companion of about magnitude +6.5 with a separation of about 0.15 arcseconds at a position angle of approximately 200 degrees. The color of the companion seemed to be the same so the spectral class of the companion is probably MO.

In the 34 years and about 350 grazes observed, this is the brightest binary that we have found. Since this was a team effort, if you turned in usable timings, consider yourself a codiscoverer. if you desire a copy of the complete report, drop me a postcard. I expect to have the data completely reduced about mid-January. Thank you very much for your attendance and participation. ι

International Occultation Timing Association, Inc. (IOTA)

IOTA's Mission

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

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IOTA European Service (IOTA/ES)

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

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International Occultation Timing Association, Inc. (IOTA)

IOTA on the World Wide Web

(IOTA maintains the following web sites for your information and rapid notification of events.)

IOTA Administrative Site
http://www.inlandnet.net/~iota

This site contains information about the organization known as IOTA and provides information about joining IOTA and IOTA/ES, topics related to the *Occultation Newsletter*, and information about the membership--including the membership directory.

IOTA Asteroidal and Planetary Occultations Site
http://www.anomalies.com/iota/splash.htm

This site contains information on asteroidal and planetary occultations and the latest information on upcoming events and how to report them.

IOTA Lunar Occultations and Eclipses Site
http://www.sky.net/~robinson/iotandx.htm

This site contains information on lunar occultations and eclipses and the latest information on upcoming events. It also includes information explaining what occultations are and how to report them.

IOTA's Telephone Network

The Occultation Information Line at 301-474-4945 is maintained by David and Joan Dunham. Messages may also be left at that number. When updates become available for asteroidal occultations in the central USA, the information can also be obtained from either 708-259-2376 (Chicago, IL) or 713-480-9878 (Houston, TX).