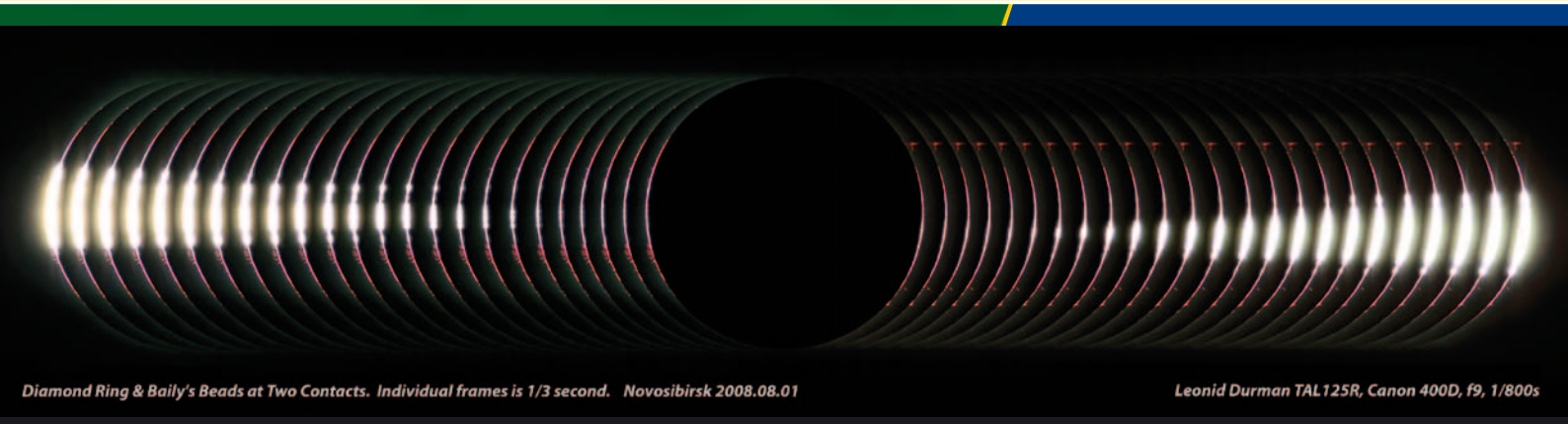
Journal for Occultation Astronomy

2013–02 FORMERLY OCCULTATION NEWSLETTER

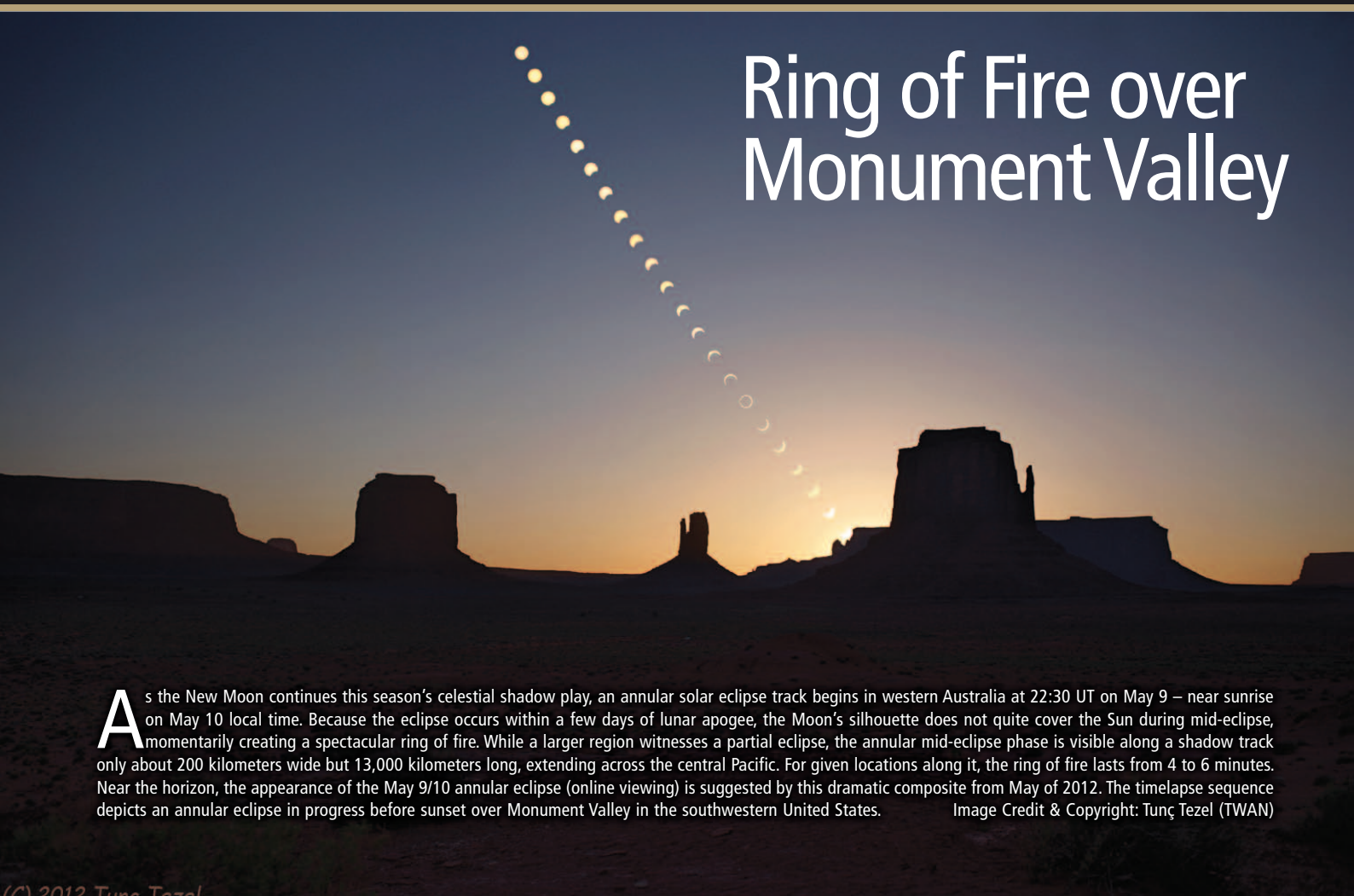


Diamond Ring & Baily's Beads at Two Contacts. Individual frames is 1/3 second. Novosibirsk 2008.08.01 Leonid Durman TAL125R, Canon 400D, f9, 1/800s

Baily's Beads near Solar Eclipse Totality

Image Credit & Copyright: Leonid Durman

A series of images recorded Baily's beads at times surrounding the 2008 total solar eclipse visible from Novosibirsk, Russia.
At the end of totality, as the Sun again emerges from behind the moon, Baily's beads may again be visible -- but now on the other side of the Moon.



Ring of Fire over Monument Valley

As the New Moon continues this season's celestial shadow play, an annular solar eclipse track begins in western Australia at 22:30 UT on May 9 – near sunrise on May 10 local time. Because the eclipse occurs within a few days of lunar apogee, the Moon's silhouette does not quite cover the Sun during mid-eclipse, momentarily creating a spectacular ring of fire. While a larger region witnesses a partial eclipse, the annular mid-eclipse phase is visible along a shadow track only about 200 kilometers wide but 13,000 kilometers long, extending across the central Pacific. For given locations along it, the ring of fire lasts from 4 to 6 minutes. Near the horizon, the appearance of the May 9/10 annular eclipse (online viewing) is suggested by this dramatic composite from May of 2012. The timelapse sequence depicts an annular eclipse in progress before sunset over Monument Valley in the southwestern United States. Image Credit & Copyright: Tunç Tezel (TWAN)

Journal for
Occultation Astronomy

Dear reader,

the production of any new issue of the Journal of Occultation Astronomy is not easy since for each volume articles to cover 24 pages have to be collected or written. The JOA is your journal and thus its articles should also be written by you allowing everyone to share your efforts and successes regarding occultation measurements, new technical equipment and your general advice, regardless whether your contribution resulted from good or bad experience. In case you have your own webpage you should still think about the possibility to publish your reports within the latest JOA first and only thereafter on your page. Not everybody may know you but worldwide everybody interested in occultations reads the JOA.

Last year at ESOP XXXI in Pescara a presentation of a professional astronomer reported measurements at ESO of hundreds of total lunar occultations within hours aiming at the discovery of double stars. For you it should also be possible to record double-star distances with an accuracy down to 10 milli-arc-seconds!

Lunar Occultations are still a target of interest and importance!

Hans-Joachim Bode

■ **JOA 2013-2** · $ 5.00 · $ 6.25 OTHER · (ISSN 0737-6766)

In this issue:

Writing articles for JOA:

The rules below should be regarded while writing an article; using them will greatly facilitate the production and layout of ON!

If your article does not conform to these rules, please correct it.

There are 3 different possibilities for submitting articles:

- pdf-articles (must be editable – these can be converted)
- unformatted Word *.doc-files containing pictures/graphs or their names (marked red: <figure_01>) at the desired position(s)
- *.txt-files must contain at the desired position the name of each graph/picture

The simplest way to write an article is just use Word as usual and after you have finished writing it, delete all your format-commands by selecting within the push-down-list "STYLE" (in general it's to the left of FONT & FONTSIZE) the command "CLEAR FORMATTING". After having done this you can insert your pictures/graphs or mark the positions of them (marked red: <figure_01>) within the text.

txt-files: Details, that should be regarded

- Format-commands are forbidden
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Name of the author should be written in the 2nd line of the article, right after the title of the article; a contact e-mail address (even if just of the national coordinator) should be given after the author's name.

IMPORTANT:Use only the end-of-line command (press ENTER) if it's really necessary (new paragraph, etc.) and not when you see it's the end of the line!

Sending articles to JOA:

Each country / state has a coordinator who will translate your article to English – if necessary.

In case there is no one (new country) please send a mail to the editorial staff at: **info@occultations.info**

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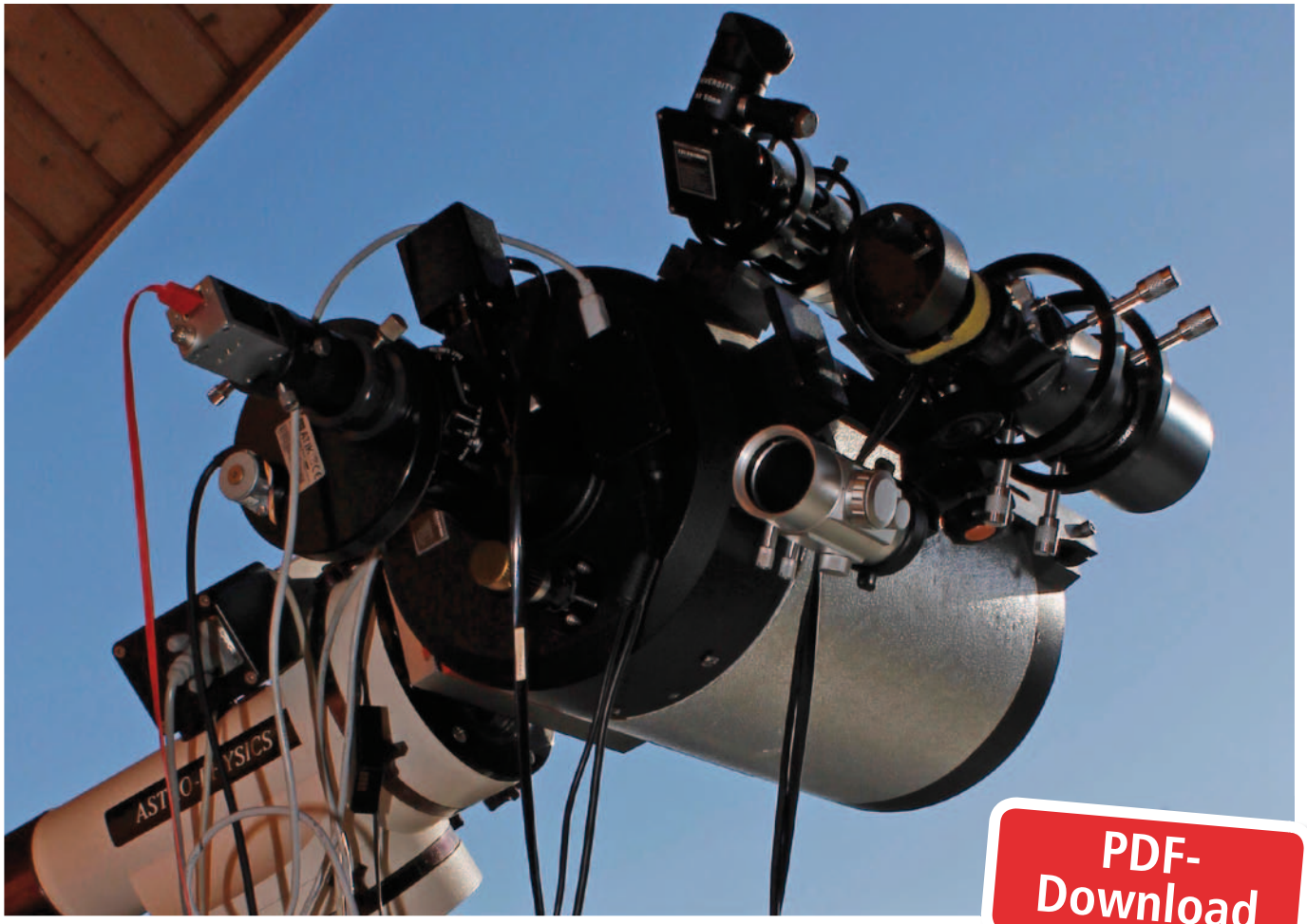
Journal for Occultation Astronomy



PDF-Download

Video Occultation Manual

Jacquie Milner & Graham Blow · Occultation Section, Royal Astronomical Society of New Zealand

Over the past two years Jacquie Milner, on behalf of the RASNZ Occultation Section, has been putting together a "Video Occultation Manual". This comprehensively describes how to capture occultations using video.

The project's aim has been to bring together in one place as much information as possible about current video equipment and options, observing practices, occultation techniques and other relevant material. It is intended to be a "how to" guide for observers new to the field, as well as for more experienced observers who need information about specialised aspects of the use of video in occultation work. Topics covered include: generating, interpreting and using occultation predictions, choosing good observing locations, the use of video versus CCD detectors, low-light video systems (including integrating cameras), suitable telescope systems, timing options, recording devices, techniques for monitoring events, reducing data using Limovie, Tangra and Scanalyzer software, and reporting results.

It is because of the many requests for information we have received over the years that this manual has been written. It's aim is to gather as much material as possible into one document. Although intended specifically for observers in New Zealand and Australia (i.e. those using the PAL video system), it still contains material which will be of interest to observers elsewhere.

The Manual has received input from participants at the last two Trans-Tasman Symposia on Occultations, as well as from a number of senior observers in Australasia. However it is by no means complete and we know that there still remain questions to be answered. At the forthcoming Seventh Trans-Tasman Symposium on Occultations (to be held in Invercargill, New Zealand, over May 27-28) time will be set aside for participants to make any comments they wish and to suggest further material which could be included.

In the meantime Version 1.0 of the Manual is now available for download as a PDF file from the RASNZ Occultation Section's website: http://www.occultations.org.nz/. We invite you to download a copy and send comments and questions to the editor, Jacquie Milner, at milnerjacquie@gmail.com.

Journal for Occultation Astronomy

UCAC2 42913552 a double star discovered during an asteroid occultation

Carles Schnabel · cschnabel@foradorbita.com

Abstract

The occultation of the star UCAC2 42913552 by the asteroid 388 Charybdis on December 3rd, 2012 has shown the duplicity of the star. Six observations carried out from Catalonia (Spain) allow determine the parameters of this double star. A distance of 27.1 ± 1.0 milliarcseconds (mas) and a position angle (PA) of 112.6 ± 1.3 degrees has been calculated. From the steps in the light curve the estimated magnitudes without filter are 11.7 and 12.2.

- Ricard Casas (a, b,c) Bellaterra (Catalonia, Spain)
- Jorge Juan, Hostalets de Pierola (Catalonia, Spain)
- Ramon Naves (d), Cabrils (Catalonia, Spain)
- Carles Perelló (b), Sabadell (Catalonia, Spain)
- Joan Rovira (b), Moià (Catalonia, Spain)
- Antoni Selva (b), Sabadell (Catalonia, Spain)
- Carles Schnabel (b,c) Sant Esteve Sesrovires (Catalonia, Spain)

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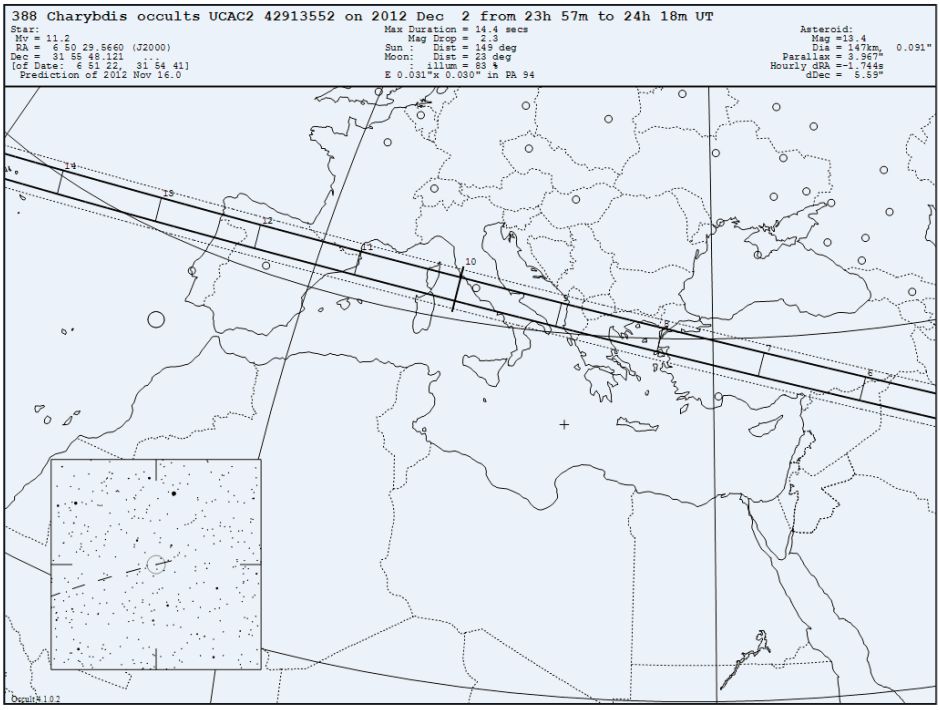
c International Occultation Timing Association, European Section
d Agrupació Astronòmica de Barcelona – ASTER



<Figure 1> Prediction of the occultation of the star UCAC2 42913552 by the asteroid 388 Charybdis on December 3rd, 2012 predicted by Steve Preston (http://www.asteroidoccultation.com/)

Introduction

During the year 2012 17 Spanish observers have participated in 85 possible events, 16 of which have been positive. But of them all, the most significant phenomenon has been played by the asteroid 388 Charybdis, on December 3. Six different observers, all located in Catalonia (northeastern Spain), obtained a positive result. Many of them perceived live in front of the screen a significant softness in contacts. Soon, preliminary photometric analysis of the records showed clearly the presence of two separate steps. No doubt, the occulted the star, UCAC2 42913552, magnitude 11.3, in RA 6h 50m 29.57s, DEC +31 ° 55 '48.76 "(J2000.0), had to be double.

This occultation, predicted by Steve Preston (figure 1), was observable from the North of Spain.

UCAC2 42913552 is an 11.3 magnitude star with coordinates RA 6h 50m 29.57s, Dec. +31º 55' 48.76" (J2000.0).

The magnitude of the asteroid 388 Charybdis at the moment of the occultation was 13.4. This value has been obtained from the ephemeris web page of the Minor Planet Center (http://www.minorplanetcenter.net).

Observations

Six stations observed this occultation with positive result. Table 1 gives the geographical coordinates and instrumentation used.

While the observation of station #1 had a poor SNR, the other five stations obtained good light curves of the event, showed in figures 2–6.

(http://www.hristopavlov.net/Tangra/Tangra.html).

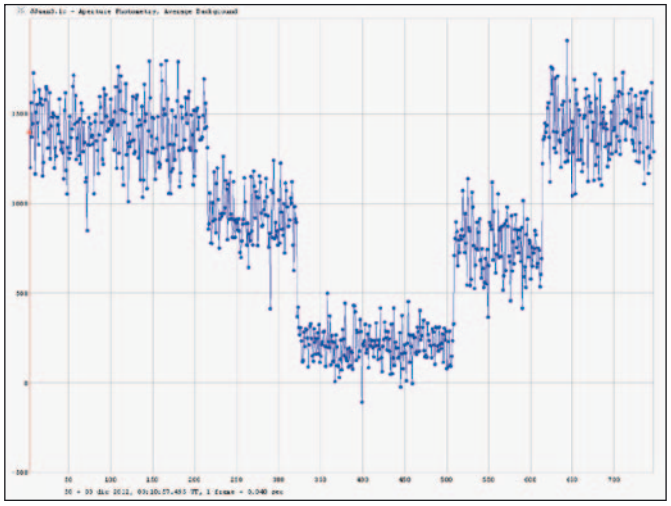
(http://www.driftscan.com/).

(http://www005.upp.so-net.ne.jp/k_miyash/occ02/limovie_en.html).

No.	Station Team	Longitude, Latitude & Altitude	Telescope	Equipment	Integration used
1	R. Casas	2º 07′ 14.7″ E, 41º 32′ 22.1″ N 165 m	Schmidt-Cassegrain 20 cm f/10	TV Camera, Mintron 12V1C-EX + KIWI inserter time	0.24 s
2	J. Juan	1º 45′ 55″ E, 41º 32′ 21″ N 423 m	Newton, 40.6 cm f/4	TV Camera Watec 120N+ + KIWI inserter time	0.04 s
3	R. Naves	2º 23′ 07.6″ E, 41º 31′ 11.3″ N 114 m	Schmidt-Cassegrain 30 cm f/10	CCD Camera ST8-MXE + NTP++	N/A
4	C. Perelló A. Selva	2º 05′ 24.8″ E, 41º 33′ 00.2″ N 224 m	Newton, 50 cm f/4	TV Camera, Mintron 12V1C-EX + KIWI inserter time	0.04 s
5	J. Rovira	2º 05′ 45.1″ E, 41º 49′ 05.4″ N 827 m	Newton, 20 cm f/5	Mintron 12V6EX + KIWI inserter time	0.16 s
6	C. Schnabel	1º 52′ 25.7″ E, 41º 29′ 41.5″ N 180 m	Newton. 40 cm f/4	TV Camera, Mintron 12V1C-EX + KIWI inserter time	0.08 s

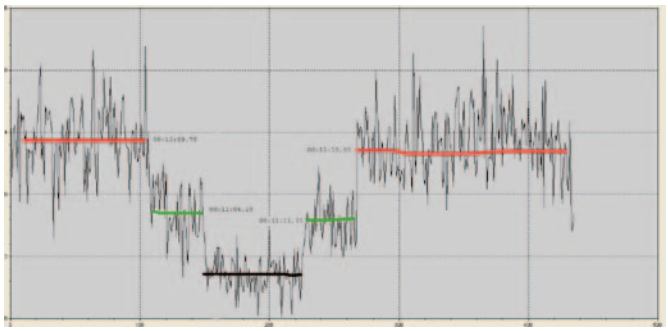
Table 1. Geographical coordinates and equipment of each station

While the observation of station#1 had a poor SNR, the other five stations obtained good light curves of the event, showed in figures 2–6.



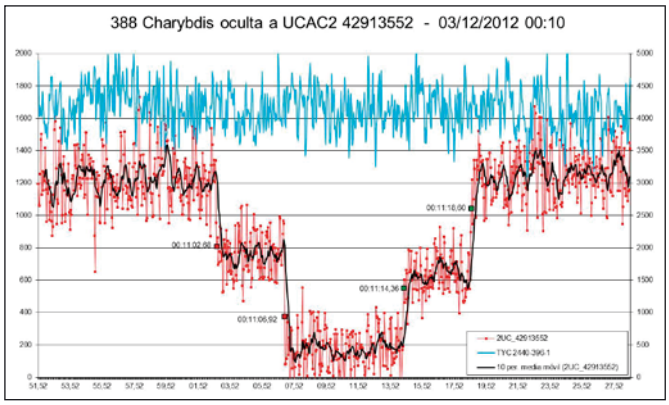
Light curve obtained by J. Juan, station #2, using Tangra software written by H. Pavlov.

(http://www.hristopavlov.net/Tangra/Tangra.html).



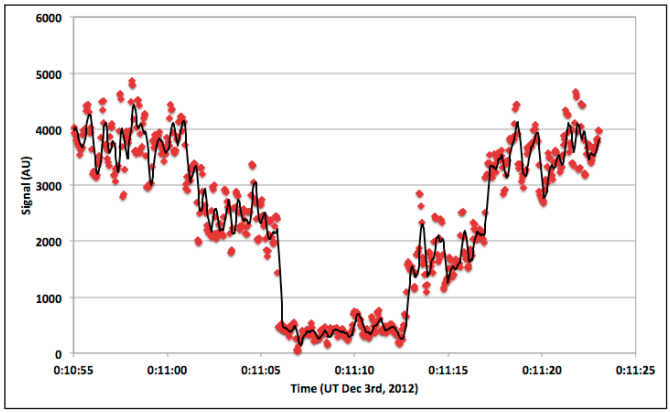
Light curve obtained by R. Naves, station #3, using Winscan software written by C. Flohr.

(http://www.driftscan.com/).

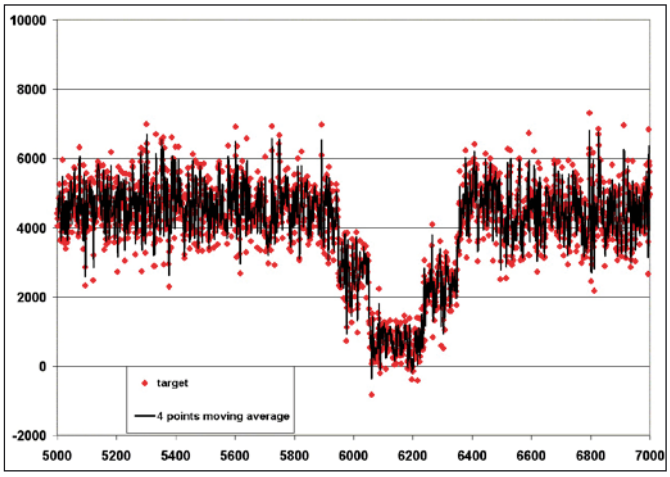


Light curve obtained by Perelló-Selva, station #4, using the software Limovie written by K. Miyashita

(http://www005.upp.so-net.ne.jp/k_miyash/occ02/limovie_en.html).



Light curve obtained by J. Rovira, station #5, using Tangra software.



Light curve obtained by C. Schnabel, station #6, using Limovie software for the analysis.

Data analysis

These figures are clearly showing the presence of two stages in the ingress and in the egress. The two stages are a clear signal of a double star system. Based on the nominal magnitude of the system (double star plus asteroid), 11.2, and the signal measured in these observations, we estimate the magnitude for each station, obtaining a magnitude for the first occulted star of 12.0 ± 0. 1 and 11.7 ± 0.1 for the second one. These magnitudes are an approximation, since there were no photometric filters placed in front of the detectors.

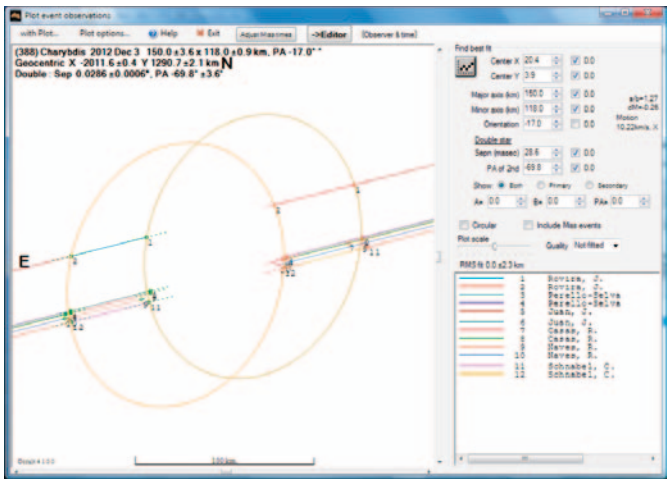
Four timings have been registered for each station. As the secondary star (fainter) was the first one to be occulted we label it as D2 (Disappearance of 2) the first timing, D1 (Disappearance of 1) the second one, R2 (Reappearance of 2) the third one, and R1 (Reappearance of 1) the last one. These timing are listed in table 2.

All timings acquired with TV-cameras (except station #3) have been corrected following the values obtained by Gerhard Dangl (http://www.dangl.at/ausruest/vid_tim/vid_tim1.htm).

Using the software Occult 4.1.0.0 of Dave Herald (http://www.lunar-occultations.com/iota/occult4.htm) we fitted the shape of the asteroid to an ellipse, obtaining a result of 150.0 ± 3.6 km x 118.0 ± 0.9 km, and a distance and a position angle of the occulted double star, which values are listed in table 3.

Distance (mas)	27.1 ± 1.0
PA (degrees)	112.6 ± 1.3

Table 3. Parameters of the double star UCAC2 42913552



Plot and fit obtained with Occult 4.1.0 (D. Herald)

No references for duplicity of UCAC2 42913552 had been found either in the Washington Double Star Catalog (http://ad.USNO.navy.mil/wds/), or the Interferometric Catalog (http://ad.USNO.navy.mil/wds/int4.html), or the entire database at the Centre de Données Astronomiques de Strasbourg (http://cdsweb.u-strasbg.fr/).

Conclusions

The casual occultation caused by an asteroid of the star UCAC2 42913552 revealed its duplicity. The fact that a relative large number of observers registered it allowed to determine the parameters of this binary system

#	D2	D1	R2	R1
1	00:11:02.14 ± 0.82	00:11:05.91 ± 0.51	00:11:13.10 ± 0.83	00:11:17.79 ± 0.55
2	00:11:04.20 ± 0.53	00:11:08.35 ± 0.28	00:11:15.77 ± 0.40	00:11:20.12 ± 0.38
3	00:10:59.75 ± 0.10	00:11:04.25 ± 0.10	00:11:11.75 ± 0.10	00:11:11.75 ± 0.10
4	00:11:01.74 ± 0.45	00:11:05.87 ± 0.28	00:11:13.34 ± 0.49	00:11:17.70 ± 0.39
5	00:11:01.35 ± 0.43	00:11:05.71 ± 0.26	00:11:12.69 ± 0.54	00:11:16.81 ± 0.55
6	00:11:03.21 ± 0.59	00:11:07.82 ± 0.55	00:11:15.19 ± 0.66	00:11:19.42 ± 0.52

Table 2. Timings of the occultation. D1 and R1 are the disappearance and the reappearance of the brightest component of the double star, while D2 and R1 are, respectively, the disappearance and the reappearance of the secondary component.

Journal for Occultation Astronomy

Paweł Max Maksym

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ICRANet, Pescara and Observatorio Nacional, Rio de Janeiro

(1983-2013) Polish Astronomer and Filmmaker

Journal for
Occultation Astronomy

Paweł Maksym and his son Karol, receiving a Papal Blessing during their audience with Pope Benedict XVI in Castelgandolfo on August 22, 2012.

Abstract:

The sudden and untimely death of Paweł Max Maksym will not diminish his contributions to the field of occultation astronomy, and to Polish society in general. Founder of the Pope Silvester II Observatory in Bukowiec, he was also writing a book to introduce children to astronomy. Graduating in Geography with an experimental thesis in Lunar Occultations at Lodz University, Paweł earned a diploma from the prestigious National Film School in Lodz. An expert observer, he mastered the technique of stellar occultations, fostering the scientific activity of the Observatory. A review of his publications in Minor Planet Circulars and on YouTube is presented here.

Introduction

It is always sad to write an obituary, as well as very demanding, because a whole life has to be summarised in a few lines with the obvious risk of missing the more important points. It is sadder when the person was a young friend, and even more so because Paweł Maksym died at the age of 29, following a surgical operation, leaving his wife Katarzyna with their son Karol, only two years old. The life of an astronomer should be as long as possible, to allow the person to experience the movements of all the celestial spheres. The astronomical cycle with which he becomes familiar is the Saros which governs eclipses, connected with the 18.6 years which rule lunar occultations. The first Saros is necessary to be

Costantino and Paweł at ESOP XXXI (Pescara 2012)

acquainted with what happens with it, the second one for starting to observe, the third one to analyse the data and coordinate other observations and so on… and Paweł did not have the opportunity even to complete his second Saros. For Paweł Maksym, the seventh sphere, the one of Saturn, just completed its first orbit when he passed away at the University Hospital of Prof. Barlicki in Lodz. His dates are: born in Lodz on 27th May 1983 and passed away on 13th February 2013. Because of legal procedures his funeral had been delayed until the 22nd February in the Church of Saints Peter and Paul in Lodz, and he was buried in Saint Ann Cemetery. The measure of a life, after all, is not its duration, but its donation.

Astronomical work: the world of occultations

Amateur and professional astronomers engaged in occultation studies are coordinated at European level by IOTA/ES (International Occultation Timing Association/European Section). In Poland there is the Department of Position and Occultations of PAAA, the Polish Amateur Astronomers Association, with which Paweł was also closely associated.

The main objectives of his occultation studies can basically be summarised in a few points:-

- Lunar grazing occultations: definition of the Cassini zones in the Watts profile
- Lunar total occultations: calibration of the Kaguya profile
- Asteroidal occultations: determination of the size and position of asteroids
- Trans-Neptunian Objects occultations: determination of their position, size and atmospheric pressure.

The first two points were already developed in his Master's degree thesis on Lunar Occultations, already written before the year 2009, and finally presented to the University of Lodz in the month of September 2012.

'In the field' observational campaigns are required in order to go to the exact locations where the star's path relative to Moon intercepts the mountains and valleys of the lunar limb. The stars appear to blink during these passages, giving a precise measurement of the angular amplitude of these valleys. An accuracy comparable with Kaguya laser-altimeter measurements can be locally achieved with these timing data.

The second point was in the observational projects included in the research programme of the Observatory "Pope Silvester II" of Bukowiec, which was inaugurated on the 21st of May 2010, five months after the Kaguya data were made public.

For the third point, the probability of a fixed observatory lying on the path of an asteroidal occultation increases as the limiting magnitude increases. Otherwise it is more common to organize trips with movable instruments to be located on the predicted path, as in the case of lunar grazes.

Paweł equipped the telescopes with increasingly better instruments, starting with a Sony HC96E, a PC170 and a VX2100 camera, progressing to a Watec 902H camera. These upgrades corresponded to an improvement in the limiting magnitude for video observations at 25 frames per second up to Mv≈12, using a 20 cm Newtonian telescope.

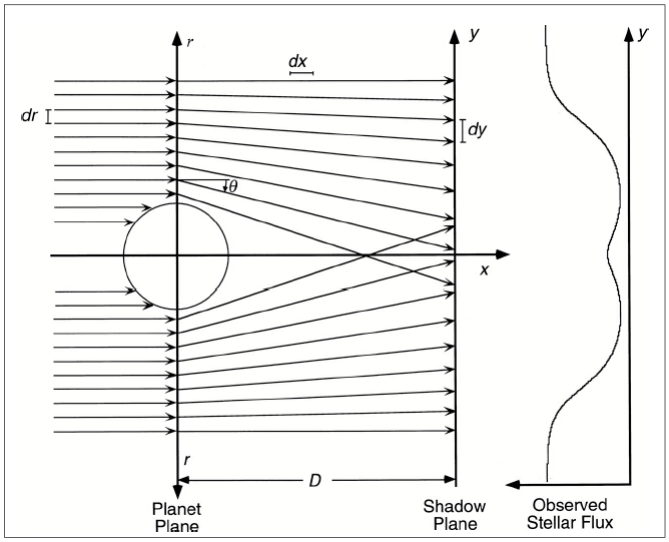
The timing resolution is important for lunar occultations since the angular velocity of the Moon is about 0.5 arcsec/s, then a resolution of 1/25 s in the occultation timing corresponds to 0.02 arcsec.

In the case of asteroidal occultations the relative angular velocities of the objects are lower, but also the angular diameters of them are much smaller, so the timing resolution required is always the higher the better. The largest trans-Neptunian objects - at distances ten times larger than the asteroids - offer longer occultations, where the video capability in timing resolution can be reduced in order to reach higher limiting magnitudes.

At the moment the Observatory, equipped with a 25 cm f/6.3 Schmidt Cassegrain telescope was capable of Mv≈12.5 with 25 fps (0.04 s of maximum integration time), which corresponds to Mv≈17.5 with a frame rate of one image every 4 seconds.

About the fourth point, the TNO occultations, it is interesting to note also that the light curve of a TNO occultation can give information on the presence and the density of an atmosphere around the TNO. A pressure of a few nano-bar is sufficient to bend the stellar rays by refraction, and some light arrives even during the totality at the shadow plane located tens of Astronomical Units away on the Earth.

The following figure summarises this point:-



Refraction of starlight by a planetary atmosphere. Starlight incident from the left encounters a planetary atmosphere and is refracted toward the density gradient as illustrated. The exponential gradient causes the rays to spread, which is seen as a dimming of the star by a distant observer located in the shadow plane. In general, light from both the near and far limb contribute to the light curve (depicted at the far right), although the near-limb contribution is dominant.

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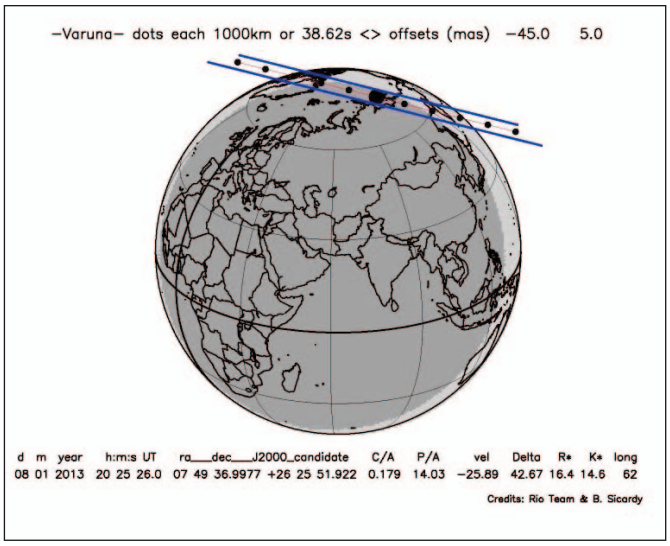
Varuna occultation of January 8, 2013: Focus on dwarf planets of our solar system

As is well known, the technique of stellar occultations is related to the possibility to make observations with portable instrumentation or to wait until the occasion when the fixed observatory is under the eclipse path. The ten biggest Trans Neptunian Objects (TNOs), known up to now, occult several stars brighter than magnitude R = 18.0 every year. The number of occultations ranges from 1-2 in the case of Eris to 100-400 for Ixion; this is a new opportunity especially for amateur astronomers to contribute to the knowledge of these dwarf planets.

Using the telescopes at the Pope Silvester II Observatory, Paweł Maksym attempted to observe the Varuna occultation, which was predicted for January 8, 2013. His technical and theoretical preparation, his observational skills, and the equipment that he provided to the Observatory he founded and previously tested with many other occultations, were capable of this very demanding task.

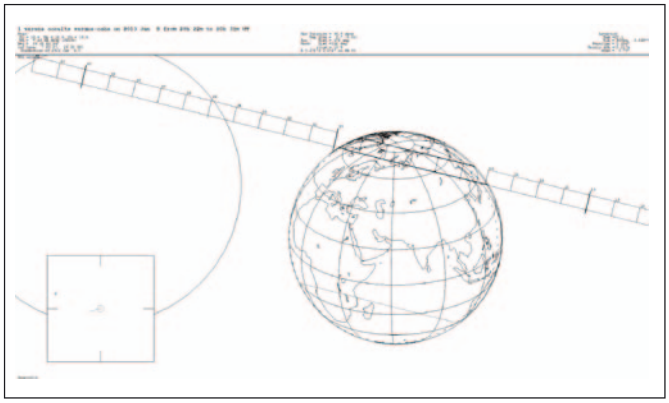
This occultation was first predicted for 8th Jan 2013 by the Rio Team and Bruno Sicardy as a polar region event. In the figure the dots identify each 1000 km along the path of the occultation, or 38.62 s. <> offsets (mas) -45.0 5.0

At 20:25:26.0 RA 07h49m36.9977s DEC+26°25'51".922.
C/A =0.179 P/A=14.03 velocity=-25.89 km/s Delta=42.67
the magnitudes R*=16.4 K*=14.6.

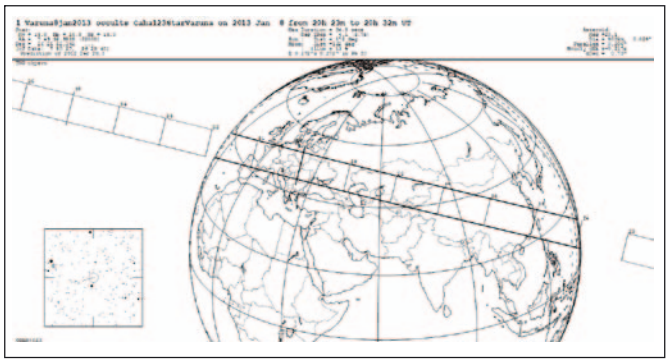


First prediction of the Varuna occultation of Jan. 8 2013

Later, with improved astrometry, a new prediction favourable for central Europe was announced, and this prediction was finally corrected to a zone covering only Japan among the populated countries, just 3 days before.



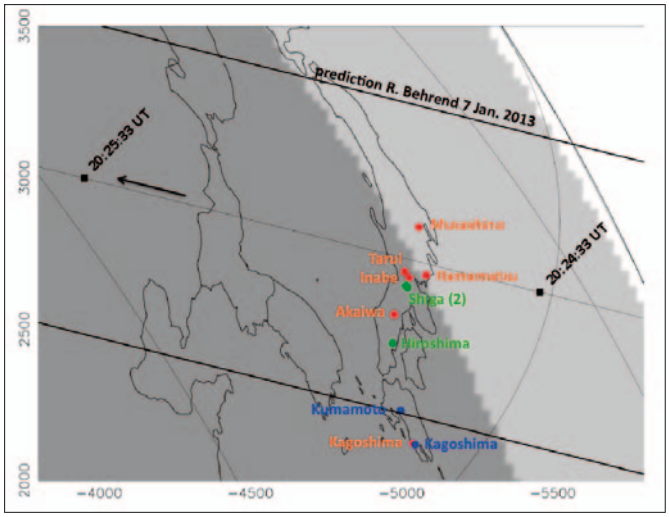
Second prediction of the Varuna occultation of Jan. 8 2013



Last prediction of the Varuna occultation of Jan. 8 2013

Wolfgang Beisker of IOTA/ES was following the development of the predictions to update the European observers. It is also interesting to note that the timing predictions made by Julio Camargo of the Rio Team - as the new astrometric data from the Pic du Midi were made available - showed a shift of 1 m 35s.

The news of two positive (successful) observations of the Varuna occultation from Hiroshima in Japan confirmed the latest predictions to within a few seconds.



Observations from Japan of the Varuna occultation of Jan. 8 2013.

OBS	OCC	Date	Star	Asteroid/Planet	SUC	Meth.	Instr.	CC	Observer	UT1	UT4	Dur. [s]
8214	2714	2011-06-07	HIP 48340	(173) Ino	O+	VID	M250	PL	P. Maksym et al	21:00:00	21:10:00	4.96
8385	2796	2011-03-08	TYC 1879-00114-1	(554) Peraga	O-	VID	M250	PL	P. Maksym et al	20:57:00	21:08:00	
8406	2800	2011-03-02	3UC225-098375	(4234) Evtushenko	O-	VID	M250	PL	Pawel Maksym	22:00:00	22:15:00	
7471	2401	2010-07-08	HIP 79593	(472) Roma	O-	VID	L100	DE	Pawel Maksym	21:50:00	22:06:00	
6610	2084	2009-09-08	HIP 25965	(10247) Amphiaraos	O-	VID	M250	PL	Pawel Maksym	00:50:00	01:05:00	
6627	2089	2009-08-24	TYC 2934-00106-1	(71) Niobe	O+	VID	M250	PL	P. Maksym et al	23:50:00	01:10:00	0.48
5947	1837	2008-09-04	TYC 0727-01424-1	(1144) Oda	O-	VID	M200	PL	Pawel Maksym	01:23:00	01:31:00	
5165	1541	2007-09-21	2UCAC 38215341	(663) Gerlinde	O+	VID	M200	PL	Pawel Maksym	01:42:00	01:47:00	4.28
5708	1726	2007-01-14	HIP 29196	(840) Zenobia	O-	VIS	M200	PL	Pawel Maksym	16:20:00	16:33:00	
4853	1377	2006-04-21	TYC 0406-02150-1	(15457) 1998 YN6	O-	VIS	M200	PL	Pawel Maksym	00:50:00	01:03:00	
3999	1012	2005-07-28	2UCAC 26766082	(2397) Lappajarvi	O-	VIS	M200	PL	Pawel Maksym	00:23:00	00:27:00	
4206	1081	2005-03-19	HIP 43206	(-) 1999 CO153	O-	VIS	L70	PL	Pawel Maksym	22:00:00	23:10:00	
4279	1110	2005-02-08	TYC 0207-00824-1	(1936) Lugano	O-	VIS	M200	PL	Pawel Maksym	23:12:00	23:18:30	
4300	1118	2005-02-06	TYC 1344-02003-1	(1306) Scythia	O-	VIS	M200	PL	Pawel Maksym	02:48:00	02:52:30	
3358	791	2004-09-06	HIP 84012	(287) Nephthys	O-	VIS	M200	PL	Pawel Maksym	15:21:00	15:27:00	
3394	805	2004-07-31	TYC 1688-01854-1	(849) Ara	O-	VIS	M200	PL	Pawel Maksym	00:40:00	00:50:00	
2879	652	2003-08-26	TYC 5757-00353-1	(420) Bertholda	O-	VIS	M110	PL	Pawel Maksym	21:30:00	22:00:00	
2969	676	2003-04-17	TYC 1368-01752-1	(407) Arachne	O-	VIS	M120	PL	Pawel Maksym	21:14:00	21:25:00	
2234	544	2002-09-17	HIP 19388	(345) Tercidina	O-	VIS	M90	IT	Pawel Maksym	00:41:00	01:01:00	
2294	547	2002-08-29	HIP 26351	(1567) Alikoski	O-	VIS	M150	PL	Pawel Maksym	23:45:00	00:08:00	
2342	565	2002-05-12	TYC 6747-01271-1	(280) Philia	O-	VIS	M150	PL	Pawel Maksym	22:27:00	22:48:00	
2436	585	2002-02-15	TYC 2847-00852-1	(36) Atalante	O-	VIS	M150	PL	Pawel Maksym	17:50:00	18:15:00	
2477	590	2002-02-02	TYC 4742-00609-1	(1051) Merope	O-	VIS	M170	PL	Pawel Maksym	20:24:00	20:49:00	

Based on data from: Frappa, E. - European Asteroidal Occultation Results - www.euraster.net

The green points are where the occultation was positive, blue points where it was negative and red where it was not possible to obtain data.

Asteroidal occultations

As in the case of TNOs, the asteroidal occultations are observed either from fixed observatories, offering larger aperture telescopes with fixed and stable mounts and accurate pointing, or in the field with portable instrumentation.

Paweł Maksym observed several asteroidal occultations, four of them in the first years of activity of the Pope Silvester II Observatory, and one of them resulted in a positive observation.

The umbral path of the naked-eye occultation of delta Ophiuchi by the asteroid (472) Roma was several hundreds of kilometres from the Observatory, but for the importance of the event, like the majority of IOTA/ES observers, he participated in the observational campaign, siting his instruments in the field.

This particular occultation had been followed by many observers along its umbral path, but the ephemerides published in the last few days contained an error of several kilometres and many observers located near the predicted centreline did not see the occultation.

Paweł Maksym's observations of these asteroidal occultations were included in five Minor Planet Circulars under the MPC Observatory code 244 "Geocentric Occultation Observation". The positive and negative occultations were calculated, reduced to the geocentre and published by D. Herald, G. Blow, D. Dunham, R. Dusser, E. Frappa, T. Hayamizu, J. Manek, M. Soma, J. Talbot, G. Taylor, B. Timerson.

The total number of occultations observed by Paweł Maksym and recorded on the Euraster website is 23, of which 3 were positive and 2 were observed outside Poland: the occultation of delta Ophiuchi by (472) Roma in Germany and the one of (345) Tercidina (in Italy, near Sanremo). The following table summarises all the observervations.

It is to be noted that despite 15 negative observations in a row, Paweł Maksym continued improving his skills and contributing his observations. This shows his awareness of the importance of these observations even if they were negative. After he started to video record occultations he obtained his first positive observation.

A video of the asteroid (71) Niobe occulting a 9.4 magnitude star was the first positive asteroidal occultation uploaded by Paweł Maksym onto YouTube. It was obtained in Bukowiec, 1.79 km from the site of the Pope Silvester II Observatory, at that time in construction. This brief occulta-

tion lasted 0.48s. The other positive occultation available on Paweł's videos on YouTube is that of HIP 48340 of magnitude 8.2, occulted by (173) Ino. It was observed from the Pope Silvester II Observatory and its duration of 4.96s was the longest occultation observed by him.

The asteroid (315166) 2007 GA4 discovered on April 6, 2007 by the team of Barbara Dłu ewska and the students at the Tadeusz Czacki High School in Warsaw, Poland within the IASC project, has been proposed through the official channels to be renamed (315166) Paweł Maksym.

Classical lunar grazes

The observation of lunar grazes is the classical activity for all occultation observers. The reference for this kind of observation is the book by H. Povenmire, where several fun experiences are included. Paweł published two grazing occultations on YouTube.

The first graze he put on YouTube was that of SAO77818 of April 21, 2007 mv=6.7, the second was the graze of the star ZC1298 of Mv=6.4 on April 13, 2008. In both observations the participants of the in the field mission are presented. Interviews were conducted before and after each observation, making the event an internet performance, with real scientific value.

After the publication of the Kaguya lunar profile in November 2009 the interest in the study of the lunar Cassini regions has reduced, but lunar grazes remain a very good tool for calibrating the Kaguya profile and for discovering very close double stars, and eventually measuring stellar diameters.

Total lunar occultations

This is the starting activity of occultation astronomy, already mentioned in the Almagest of Ptolemy and used to discover the secular acceleration of the Moon.

These observations are nowadays very important to help in the calibration of the Kaguya profile of the limb of the Moon, in order to be used in the Baily's beads method of the measurement of the solar diameter.

Paweł Maksym published the occultation of the Pleiades, M45, of July 18, 2009 observed from Andrespol, the birth city of his wife Katarzyna.

This kind of occultation allows a rapid test of the Kaguya profile, as implemented, for example, in the Occult 4 software, because the stars disappear and reappear at different position angles.

The final type of lunar occultation studied by Paweł Maksym is the occultation of a planet, namely Saturn, on March 2 and May 22, 2007.

The analysis of the light curve of gaseous planets and their satellites gives interesting information, which can be fruitfully exploited especially in educational contexts as at the Planetarium of Lodz, in which Paweł worked up to 2010, and the Pope Silvester II Observatory of Bukowiec.

Meteor videos

The observation of the Orionids meteor shower was made with the camera of the observing station n. 29 at Lodz Planetarium (PAV29) of the Polish Fireball Network.

The first fireball presented in the video was recorded on October 22, 2007 at 4:00:52 UT and it lasted about one second, showing two consecutive luminosity peaks.

Probably inspired by these observations, Paweł Maksym made two videos of the movement of clouds over the city of Lodz, using a VX21000 Sony camcorder with a polarising filter and Raynox 0,5x wide angle lenses, with excellent artistic results and noteworthy scientific and didactic interest.

Solar eclipses

Paweł Maksym observed the eclipse of March 29, 2006 in Egypt and presented his results to the XXV ESOP meeting held in Leiden (NL), under the affiliation of the Ary Sternfeld Planetarium and Astronomical Observatory in Lodz and the Polish Association of Amateur Astronomers Department of Position and Occultations.

The Pope Silvester II Observatory of Bukowiec

This has been his major realisation, with the largest impact on society: an observatory founded and built with his great capability of creating interests, motivations and strengths.

Located in the surroundings of Lodz, it was erroneously considered a competitor of the planetarium of Lodz, but this article is written also for demonstrating the contrary, as I made indirectly in an interview with Paweł in November 2011 when he visited the Vatican and he was my guest.

The inauguration took place on May 21, 2010 with a large gathering of personalities and local people. Paweł wrote an enthusiastic paper in the first issue of the Journal for Occultation Astronomy, and put 252 photos of the event onto the web. He honoured me with an invitation onto the scientific committee and to take part in the inauguration. The city council carefully considered the proposal to name the Observatory (which is located in the grounds of the Nicolas Copernicus school) after Silvester II, the Pope-astronomer of the year 1000;[35] they accepted it with enthusiasm.

The ceremony was accompanied by a pièce de théatre that he wrote for the occasion. The text of this theatrical work in the Polish language, with an English abstract, has been published in the first issue of Gerbertus, the electronic academic journal dedicated to Silvester II studies and to medieval science and astronomy. Gerbert of Aurillac-Silvester II, Galileo, Copernicus and Boghdan Paczy ski are the subjects of this play, and the historical portrayal helped the public to be acquainted with this forgotten scientist, Silvester II, and with his astronomical skills.

The Pope Silvester II Observatory is active mainly in lunar, asteroidal and TNO occultations, and observations made there were already included in some Minor Planet Circulars.

Editorial activity

Another important activity that Paweł Maksym assisted in was the editorial board of the Journal for Occultation Astronomy. Since the resurrection of the dormant Occultation Newsletter was discussed and agreed at the XXIX ESOP meeting in York, Paweł took a key role in

Pope Silvester II's Astronomical Observatory in Bukowi ec	
Name:	Pope Silvester II's Astronomical Observatory in Bukowi ec
Nearest city:	Lodz, Poland
Latitude:	N 51° 41' 28.23"
Longitude:	E 19° 40' 32.80" Altitude: 214.1 m
Remarks: (GPS, map)	WGS 84, GPS, Altitude (MSL) obtained with geodesic map
Website:	http://www.oabukowiec.pl/
In Minor Planet Center format:	
Longitude:	19.675778
Cos:	0.619899
Sin:	0.784681
Polish Name:	Obserwatorium Astronomiczne im. Papieza Sylwestra II w Bukowcu

collating and publishing the European contributions to this journal. The international scientific community acknowledged his leading role in this way, and his cultural and scientific level. In the short time he had at his disposal he made an excellent job of work, contributing to the very high level of the new journal of IOTA members. His death leaves a big hole that will be very difficult to fill, especially in the years to come, when the majority of current IOTA members will reach retirement age.

The material in the Polish language that Paweł Maksym has left on the web is much more detailed than these guidelines about his research activity, and many other works are recommended in order to gather all his contributions and present them to a wider public.

As an example I have found the conference Obserwacje zjawisk zakryciowych, The observation of occultation phenomena, where the main occultations of the last decade are discussed, namely the grazing occultation of HIP 9369 and Jupiter's atmosphere of October 10, 1999, the occultation of the star HIP 19388 by (345) Tercidina and the solar eclipse observed by Paweł et al in Egypt.

Indeed, the colleagues of Paweł Maksym, who were acquainted with him and the Polish language, can find more material either from private sources or on the web. They could, hopefully, publish his thesis on lunar occultations and the introductory book on astronomy for children that he was writing in the last weeks of his life, whilst he was preparing for the surgery of February 4th 2013.

It is recommended to do it also in the Polish language, because he cared so much about spreading this culture in his country. It is possible to repeat also the title and an abstract in English, so this text can be indexed to be reached by the international search engines and the international science community. The material could be published in the Journal for Occultation Astronomy but also on the arxiv.org website, where only the structure with title, abstract, text and references are required, and with an opportune second abstract and title in English that can be easily accessed worldwide.

On the occasion of the International Year of Astronomy Paweł Maksym wrote a tutorial in Polish on the use of the "Galileoscope". Such an instrument was intended to celebrate the 400 years of the first observations with the telescope and Paweł presented its potential in the observation of the sky.

Perspectives

The great work of Paweł Maksym in the field of occultation astronomy is seminal for his country and has been acknowledged in the international contexts of ESOP meetings where Paweł participated since the XIX Symposium held in Lodz in August 2000 at the age of 17. He was present at all ESOP meetings, and he was the organiser of the 2009 Symposium in Niepolomice, near Krakow. In the last ESOP meeting XXXI in Pescara he presented a talk about the new GPS time inserter from Poland, showing the progress of the basic task of an IOTA observer, the accurate timing of observations.

Both amateur and professional astronomers need this kind of applied research, because the issue of time keeping is of paramount importance in occultation astronomy, and the issue of the association of a time interval to a video frame requires the maximum attention and reliability.

It would be nice if sessions at the next ESOP meetings would welcome the papers of IOTA historians with contributions to outline and remember the great work of Paweł.

The publication of his miscellanea and his profiles as seen from his former collaborators are also suggested. This volume would be one of the grounds on which the newborn Silvester II Observatory and the newborn Karol Josef Maksym, who arrived the day before the partial solar eclipse of January 4th 2011, can continue their path to the future, with a more clear identity of their scientific and genetic father.

Acknowledgements: To Alexander Pratt for his kind help in the correction of the text and its upgrade and to Felipe Braga-Ribas for the useful discussions on TNOs, and in particular on the last Varuna's occultation.

References of Paweł Maksym's works on the web

http://www.youtube.com/watch?v=JEs4LRH7tAo
TV news about his death February 13, 2013

http://www.youtube.com/watch?v=M3KQdbqgpRw&list=UUAhmVcvUFXjQoGgliyo2G9g&index=18
Saturn occultation of March 2, 2007

http://www.youtube.com/watch?v=v3nk6wvnrCA&list=UUAhmVcvUFXjQoGgliyo2G9g&index=17
Saturn occultation of May 22, 2007

http://www.youtube.com/watch?v=ol_3aWglyK4&list=UUAhmVcvUFXjQoGgliyo2G9g
Orionid meteor shower

http://www.youtube.com/watch?v=m1Al4bZUrHw&list=UUAhmVcvUFXjQoGgliyo2G9g&index=10
Zakrycie brzegowe/Graze of ZC 1298 - 6.4 mag - 13.04.2008

http://www.youtube.com/watch?v=Gutyrl6GDN4&list=UUAhmVcvUFXjQoGgliyo2G9g&index=9

Zakrycie brzegowe/Graze of SAO77818 - 21.04.2007 mv=6.7 SONY HC 96E

http://www.youtube.com/watch?v=A-Mf7V1KdLQ&list=UUAhmVcvUFXjQoGgliyo2G9g&index=7
M45 total lunar occultation xz76103 xz76128 merope xz76135 xz76145 175 198 (in neg. view)

http://www.youtube.com/watch?v=yCxDoEj9Ktw&list=UUAhmVcvUFXjQoGgliyo2G9g
Watec Camera 902H specifications and test TYC 0727-01424-1 mag 11.4 by 1144 Oda 8" newton EQ5 on 4 set 2008 (a negative asteroidal occultation)

http://www.youtube.com/watch?v=wh7lerr0pMM&list=UUAhmVcvUFXjQoGgliyo2G9g&index=6
Occultation of star TYC 2934-00106-1, 9.4 mag by asteroid (71) Niobe on Monday, 24 August 2009 in Bukowiec

http://www.youtube.com/watch?v=ZrsAGEw6ukc&list=UUAhmVcvUFXjQoGgliyo2G9g&index=5
Occultation of HIP 48340 (8.2 Mag) by asteroid 173 Ino on June 7, 2011 at the Silvester II Observatory in Bukowiec

http://www.youtube.com/watch?v=iCw5vupXe7g&list=UUAhmVcvUFXjQoGgliyo2G9g
Clouds over Lodz, with sunset and "eclipse" by clouds

http://www.youtube.com/watch?v=_kfz57773-o&list=UUAhmVcvUFXjQoGgliyo2G9g&index=4
Interview made by Paweł Maksym with C. Sigismondi

Contributions on Minor Planet Circulars:

http://www.minorplanetcenter.net/iau/ECS/MPCArchive/2007/MPC_20070926.pdf

http://www.minorplanetcenter.net/iau/ECS/MPCArchive/2008/MPC_20080122.pdf

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http://urania.pta.edu.pl/pliki/kruszwica/zakrycia_ogolna.pdf The observation of occultation phenomena

Journal for Occultation Astronomy

The Beginning of Astrometry:

A QUADRANT

THE ASTRONOMICAL OBSERVATORY OF ULUGH BEG

Hans-Joachim Bode · IOTA/ES

I was asked whether I wanted to travel to Uzbekistan – I had been there before in 1981 (at USSR-times) but agreed readily having the promising opportunity to visit Samarkand (which I missed in 1981) and the observatory of Ulugh Beg.

In this short presentation I summarize some of the detailed knowledge I gained about this observatory. Probably the internet provides further facts and details. In Uzbekistan I also had a few talks concerning astronomical activities that may result in an astronomical cooperation. We will see …

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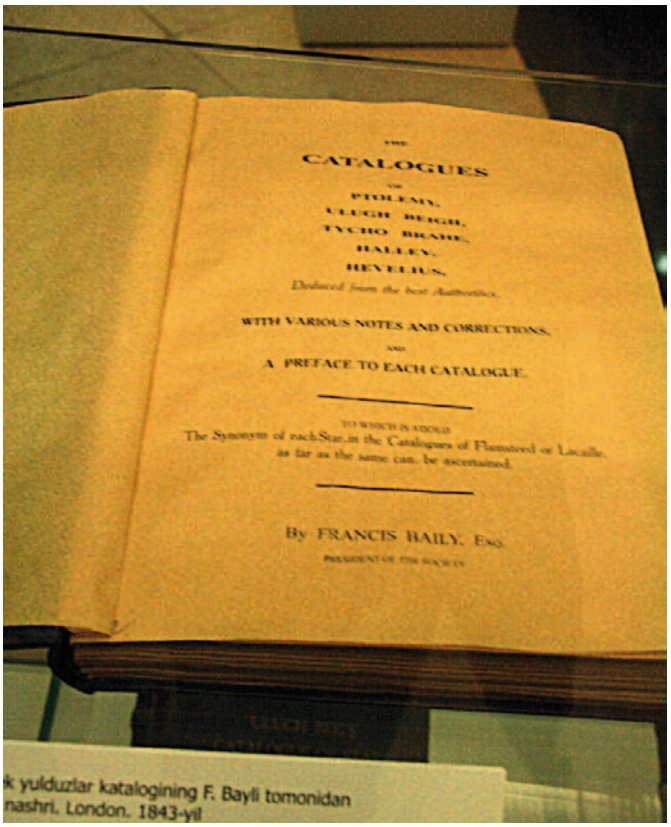
Portrait of Ulug Beg



Francis Baily: Historical Catalogues

Hipparchus of Nicaea, or more correctly Hipparchos (Greek: Hipparkhos; c. 190 BC - c. 120 BC), was a Greek astronomer, geographer, and mathematician of the Hellenistic period. He is considered the founder of trigonometry but is most famous for his incidental discovery of the precession of the equinoxes and for the compilation of the first comprehensive star catalogue of the western world, where he managed to determine the stellar positions to an angular accuracy of about 1 degree.

Mīrzā Muhammad Tāraghay bin Shāhrukh, better known as Ulugh Beg (born March 22, 1394 in Sultaniyeh, Persia – died October 27, 1449 in Samarkand) was a Timurid ruler as well as an astronomer, mathematician and sultan. His real name was Mīrzā Muhammad Tāraghay bin Shāhrukh. Ulugh Beg was also respected for his work in astronomy-related mathematics, such as trigonometry and spherical geometry. He built the great Ulugh Beg Observatory in Samarkand between 1424 and 1429. It was considered by scholars to have been one of the finest observatories in the Islamic world at that time and the largest in Central Asia. He also built the Ulugh Beg Madrasah (1417-1420) in Samarkand and Bukhara, transforming the cities into cultural centers of learning in Central Asia. He was also a mathematics genius of the 15th century – even though his mental capability was the power of endurance rather than any unusual gift of intellect. He ruled Uzbekistan, Tajikistan, Turkmenistan, Kyrgyzstan, and southern Kazakhstan for almost half a century from 1411 to 1449. His own particular interests concentrated on astronomy, and in 1428 he built an enormous observatory, called the Gurkhani Zij. He increased the accuracy of his measurements by increasing the length of his quadrant. It had a radius of about 40 meters where a quarter of this circle (10 meters of it were constructed below the surface) now had a height of 30 meters. This observatory was surrounded by a wall with a height of (around) 30 meters having a diameter of 46.40 meters. In the middle of this circle a tower with a height of about 30 meters was erected including a sight-feature on top of it for measuring the position of the sun, the moon and the stars. Only the lower part of that quadrant still exists. The north-south alignment of the quadrant was extremely precise to only 10.4'. Fortunately it was preserved starting about 1908 when W. L. Wjwatkin rediscovered the antique observatory (his grave is situated in the observatory area). The part of the quadrant at a depth of 10 meters had been used to measure stars close to the zenith. A corridor on the ground floor shows marks every 70.1 centimeters being equivalent to an angle of 1 degree as projected via the 30 meter tower to the sky. Channels at both sides of the ground floor had 2 holes at each degree to fix a possible little carriage. This carriage may have been used to move it degree by degree, and some unknown device may have allowed to determine the position of an object to about 1 minute of arc. Using this method he compiled the 1437 Zij-i-Sultani of 994 stars, generally considered to be the greatest star catalogue between those of Ptolemy and Brahe, a work of comparable quality regarding Abd al-Rahman al-Sufi's Book of Fixed Stars. The serious errors which he found in previous Arabian star catalogues (many of which had simply updated Ptolemy's work, adding the effect of

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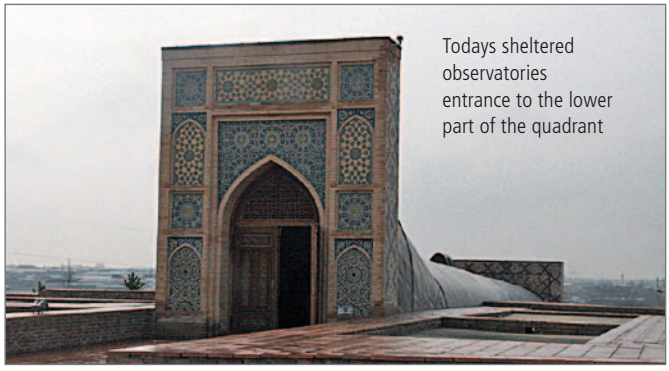
Only the lower part of the quadrant still exists below surface.

Ulug Beg museum



Todays sheltered observatories entrance to the lower part of the quadrant

Ulug Beg medrese (Islamic university)

precession to the longitudes) led him to remeasure the positions of 992 fixed stars, to which he added 27 stars from Abd al-Rahman al-Sufi's catalogue Book of Fixed Stars from the year 964, which were too far south for an observation from Samarkand. This catalogue, one of the most ingenious of the Middle Ages, was first edited by Thomas Hyde at Oxford in 1665 under the title "Tabulae longitudinis et latitudinis stellarum fixarum ex observatione Ulugbeighi" and reprinted in 1767 by G. Sharpe. More recent editions are those by Francis Baily in 1843 in Vol. xiii of the Memoirs of the Royal Astronomical Society and by Edward Ball Knobel in Ulugh Beg's Catalogue of Stars, Revised from all Persian Manuscripts in 1437. Ulugh Beg determined the length of the sidereal year as 365.2570370...d = 365d 6h 10m 8s (an error of +58 seconds).

For his measurements throughout many years he used a 50 m high gnomon. The value was improved by 28 seconds in 1525 by Nicolaus Copernicus, who referred to the estimation of Thabit ibn Qurra (826–901), which had an error of +2 seconds. However, Beg later measured another more precise value as 365d 5h 49m 15s, which has an error of +25 seconds, making it more accurate than Copernicus' estimation with an error of +30 seconds. Beg also determined the obliquity of the Earth's axis as 23° 30′ 17″ (true value 23° 30′ 48″), which remained the most accurate measurement for hundreds of years. It was more accurate than later measurements by Copernicus and Tycho Brahe.

Journal for Occultation Astronomy

The May 20, 2012 Annuar Eclipse

Richard Nugent

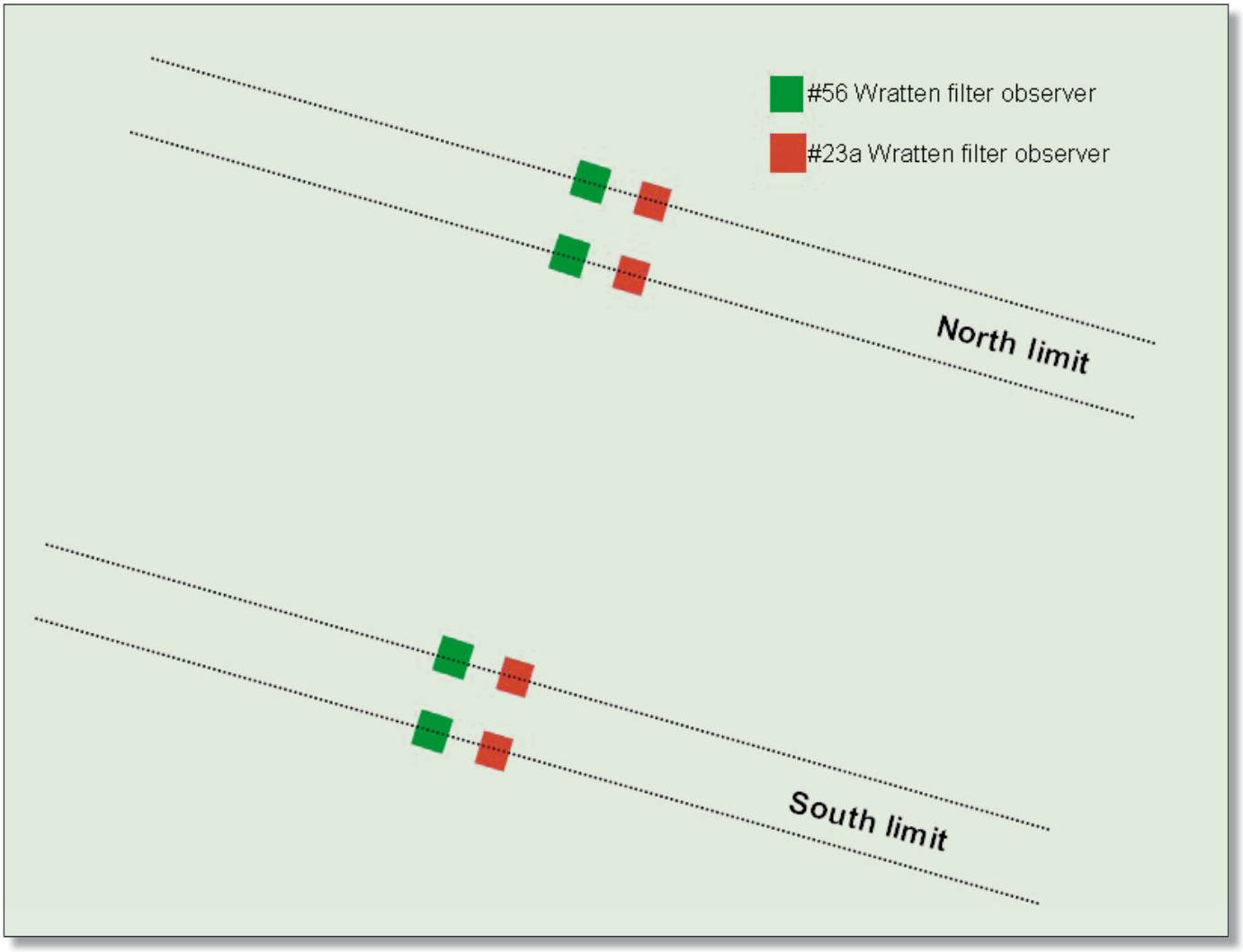
Path of May 20th eclipse over the Western USA

ON May 20, 2012 the path of the annular eclipse moved over several western states over the USA. This was IOTA's (USA) first attempt to standardize the equipment and filters used to capture the Baily's beads effect for deriving the solar radius. In the past, IOTA has been criticized for using different telescopes and different solar filters to derive the solar diameter from eclipse edge expeditions.

Richard Nugent took the lead in this effort over the USA created a web site 3 months before the eclipse to specify the standardized equipment required. Based on previous experience, telescope aperture was desired to be in the (3"-5") range. Nugent specified the use of Baader solar filters and narrow band filters: Kodak Wratten #23a or #56 filter. The web site had a host of observing and set up tips from his 9 previous Baily's beads expeditions.

The choice of the Baader solar filter was chosen due to it's availability in sheets for easy adaptation to telescopes and excellent transmission at desired wavelengths. These were ordered in sheets and distributed by Walt Morgan. Five-inch (5") square sheets were sold to observers for $10. The use of a 5" square sheet Baader solar filter required a telescope with an aperture of 3"-5" which was idea for recording Baily's beads.

For narrow band filters, it was decided that each observer would use either a Kodak Wratten #23a or #56 filter placed in front of the video chip to match to 535nm or 607nm Picard satellite wavelengths for future calibration of all previous existing ground based beads observations. The plan was to have observers at two stations (path lines) at both north and south limits with a 0.5km separation as shown in the diagram.



Narrow Band filters used at North and South eclipse limits.

Each of the path lines would host an observer with each of the #23a and #56 narrow band filter, thus a minimum of 8 observers would be needed.

Observers for the North limit were Tony George, Steve Preston, Dr. David Dunham, Dr. Terry Redding, Lawrence Flemming and Ernie Iverson. Due to cloud and some equipment problems, the north limit teams were largely clouded out. Dr. Terry Redding obtained a video with passing clouds that did show Baily's beads briefly, however it was not useful for analysis.

Southern limit observers were: Derek Breit, Sandy Bumgarner, Chuck Herold, Dr. Chris Kitting, Walt Morgan, Dr. Richard Nolthenius, Richard Nugent, Andreas Tegtmeier from Germany, Dr. Ted Swift and Dr. Roger Venable. At IOTA's 30th annual meeting in Las Vegas Nugent showed video frames from Chris Kitting's and Dr. Ted Swift's video from the southern limit. Although several good videos were obtained at the southern limit, no reliable solar diameter could be derived without north limit data.

The next good opportunity to measure the solar radius during the total eclipse that crossed the continental USA in August 2017. This 2017 eclipse will be the next good chance to coordinate Baily's beads observations on a large scale. At that time, it can be decided if IOTA's ground based method of measuring the solar radius should continue.

Journal for
Occultation Astronomy

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-ES Business-Meeting/Elections

Dr. Eberhard Riedel and Dr. Eberhard Bredner left the managing committee whereas Michael Busse (Secretary) and Konrad Guhl (PR) were voted on the board of directors.
Minutes of the meeting will be presented within the next issue.

Press date JOA 2013-3: July-Sept.: June 15 | Oct.-Dec.: 15. Sept. | Jan.-March: Dec. 15 | April-June: 15 March

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

http://www.occultations.org
http://www.iota-es.de

This site contains information about the organization known as IOTA and provides information about joining

IOTA and IOTA/ES, including topics related to the Journal of Occulation Astronomy (JOA), and also has an on-line archive of all issues of Occultation Newsletter, IOTA's predecessor to JOA. On the right side of the main page of this site are included links to IOTA's major technical sites, as well as to the major IOTA sections, including those in Europe, Asia, Australia/New Zealand, and South America. The technical sites include definitions and information about observing and reporting, and results of, lunar, planetary, and asteroidal occultations, and of eclipses and other timely phenomena, including outer planet satellite mutual events and lunar meteor impact flashes.

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