Journal for Occultation Astronomy

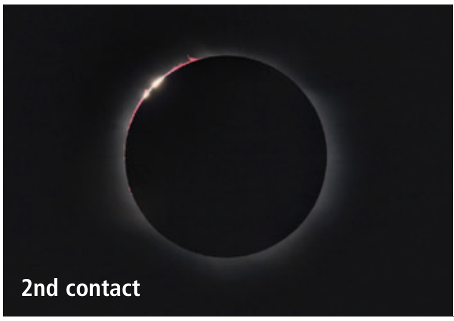
2012–02

FORMERLY OCCULTATION NEWSLETTER

Solar-Eclipse 2006 in Turkey

Observing Solar-Eclipses in 2012 and 2013

Loooking for better measuring-methods and recording-techniques.



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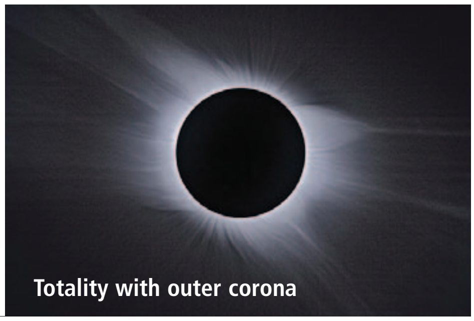
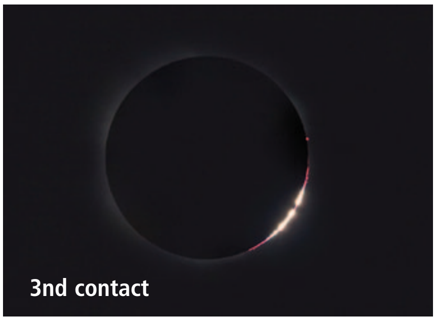


Totality with outer corona



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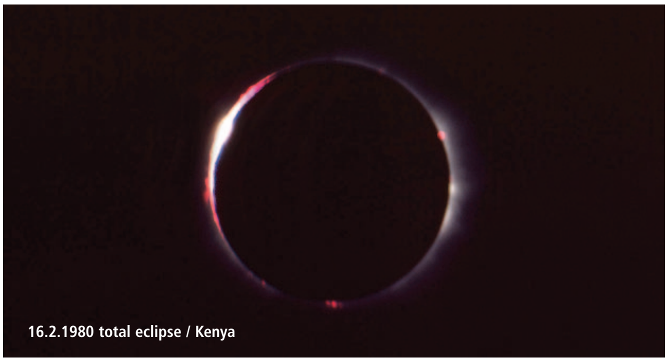
Journal for Occultation Astronomy

Dear reader,



16.2.1980 total eclipse / Kenya

not only occultations of stellar objects by minor and major planets or the moon are the goal of the work of IOTA but the sun as our nearest stellar object is still a source of our interest.

In the past there were always a lot of interested observers who liked to travel to distant places in the world – unfortunately this changed so only a few observers are still willing to leave for far distant locations to the edges of the path of a solar eclipse.

Within the next two years there will be 4 solar eclipses which could be used to measure the variations of the diameter of the sun. That is a good opportunity to combine our efforts to determine the actual diameter of our nearest star using observations at the edges of the eclipse path.

I hope in 2012 and 2013 much more observers will pick up the chance to record these eclipses together with "eclipse-chasers" of the origin country living close to the eclipse-path.

In case that all these observers are using the same kind of equipment all the possible result could be reduced at a comparable scale.

Let us hope that will happen.

Hans-J. Bode

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In this issue:

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Journal for Occultation Astronomy

The Occultation by (22) Kalliope and its Satellite Linus at 2011 November 22

Oliver Klös, IOTA-ES · oliverkloes@nexgo.de

Abstract: The positive video observation of the occultation by (22) Kalliope was my first digital recording with a notebook after 9 years of using analog video tape. The new setup worked perfectly. Four positive chords were measured for this occultation across Europe.

Previous Observations

Occultations by (22) Kalliope were observed before. The first chord of an occultation was recorded by Francois Meyer (France) in June 2004. 16 positive chords were obtained by Japanese observers in November 2006 including Kalliope's satellite Linus. This was the first successful observation of an occultation by an asteroidal satellite known previously by other means [1]. Another single chord of the main body was recorded in January 2007 in Japan again.

The Prediction

The shadow of was supposed to cross in Europe Italy, Switzerland, France, Austria, the Netherlands, Belgium and Great Britain [2]. This prediction gave a fine opportunity to measure an occultation by (22) Kalliope's satellite Linus too. The path of the satellite was supposed to cross western France [3].

My station was inside the predicted path of the main body at chord +44 according to Steve Preston's last prediction for this event dating 2011 November 17th . The path width was calculated to 220 km with a very good probability of 85 % to record a "positive" observation at my station.

For my setup (video camera with an ICX255AL, 10" LX200 Classic at ~ f5 with a telecompressor, video timing by video time inserter STVAstro with GPS 35 with 1PPS) the bright asteroid (10.6 mag) would be detectable during an expected drop of 0.7 mag from combined magnitude in case of an positive observation.

Preparing the Recording - Goodbye, Analog

I had recorded occultations with a portable Phillips VHS recorder ever since my first observations in 2002. The evaluations were made with a 6-head-video-recorder by Panasonic which had the ability to step from field to field backward and forward. Direct digital video recording to a computer was a risk, dropped frames and/or double frames were common because computers couldn't handle this amount of data. This made it necessary to later digitize the analog video tape with capture hardware, watching out for any errors while capturing. Another problem was the additional noise from the analog video tape added to an already noisy image. Years ago I even digitized videos field by field to bitmaps to create an AVI from these images. This was an annoying process but only that way I was sure to have the correct field sequence captured. Software tools like LIMOVIE, TANGRA and OCCULAR improved the evaluation of recordings in the last years and a digital video file is a must for getting the maximum information out of noisy recordings of faint occultations or events with very small drops of magnitude.

Today processors are faster and can handle a video stream from a capture device without loosing frames. The capture software VirtualDub is capable of recognizing any dropped frames and will indicate these errors.

VHS-recorders are getting older; some of mine are "eating" tapes. The small built-in 3" LCD display of my Phillips recorder doesn't work anymore. So it's time to say goodbye.

I made some tests with the external USB capture card "TerraTec Cameo Grabster 200", a hardware capable of capturing a video stream only – no sound. Tests showed a stable recording on my notebook with this outdated capture hardware. So my setup was ready to go to capture my first direct recording to the harddisk.

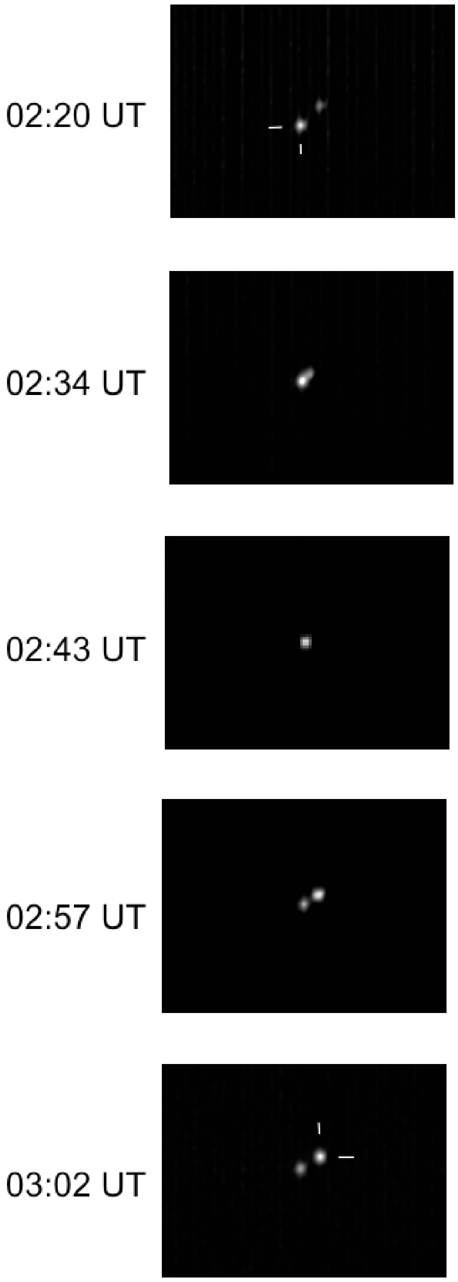
The Recording of the Occultation

The GPS-time inserted video signal was connected to the capture device with the VHS-recorder as a backup connected to the video out of the Cameo. Another backup were my calls and the beeps coming from the DOS-software KIWI recorded on a digital voice recorder.

The altitude of the target star of 69 degrees was very high so I had to be sure not hitting the base of the fork of the altaz-mounted LX200 with the camera. So I attached the camera after I slewed to the target area. Star and asteroid could be observed as two separate objects. I made short video clips to document the motion of the asteroid.

Because Steve Preston's predictions are very accurate I decided to run the video tape 4 min before the occultation, but the digital recording +- 1 min around predicted time of occultation only to be sure that my notebook can handle this file.

At 02:42:54 UT the star disappeared at the screen of the notebook. Only the asteroid was visible now. The occultation ended at 02:43:05 UT. Before shutting down VirtualDub I made a screen capture of its data

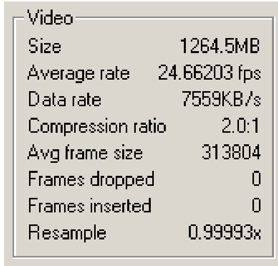


(22) Kalliope oocults the star 2UCAC 42217550.

Several frames were stacked for each image to get a better S/N ratio. Asteroid is marked.

field. There was no indication of any dropped frames during recording. The video file was saved without any problem.

Later I checked the video tape visually on a big TV screen. No occultation besides the main event was visible. My calls on the digital voice recorder were late about ~ 1 sec at disappearance and ~ 2 sec at reappearance.



Data field of VirtualDub
No dropped or inserted frames.

The Evaluation

The evaluation of the video stream was made with LIMOVIE 0.9.96.4 and OCCULAR V4. I didn't average any fields because I wanted the full time resolution of 50 fields per second.

The alignment of the telescope was not perfect. There was some drifting of the field of view during recording. This gave me some trouble to anchor at the objects at LIMOVIE, even with „Drift" checked. I located the part of occultation at the file and made a copy of this part only. At this short sequence I was able to anchor at the objects with „Drift" checked. Star 2UCAC 42217542 was used as reference stars.

The times calculated by OCCULAR were cross checked with the real time inserts at the video fields (to avoid misleading by any double or dropped frames at capturing). The calculated times were confirmed by the time inserts at the video stream. The data field at VirtualDub was correct. There were no "bad" frames in the video file.

The calculations by OCCULAR V4 figured the following data:

D: 02:42:53.966	+- 0.015
R: 02:43:04.670	+- 0.015
Duration: 10.704 sec	+- 0.029
Mid-event: 02:42:59.318	+- 0.015

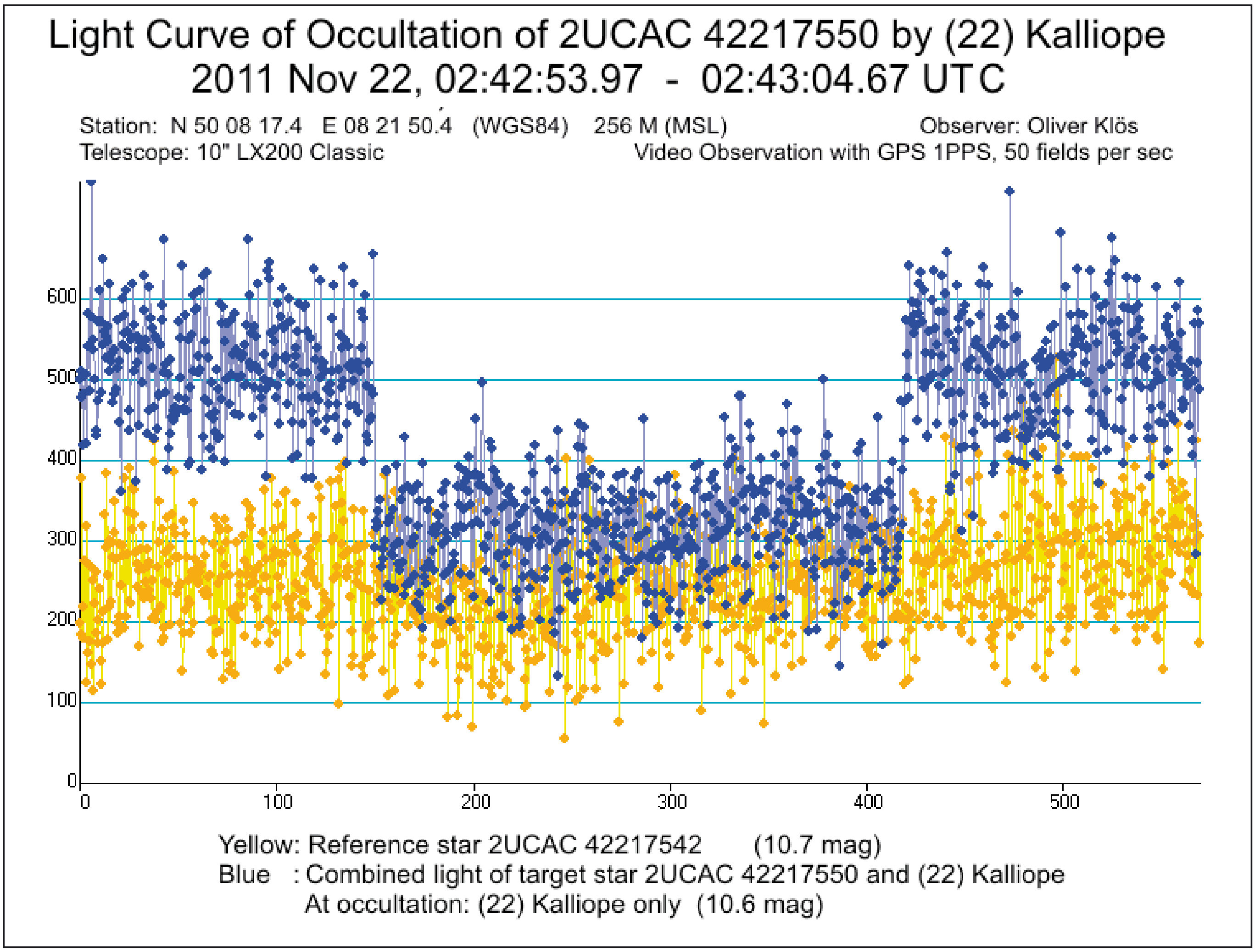
Other Observing Stations

Eric Frappa (euraster.net) published a profile just a few days after the observation [4].

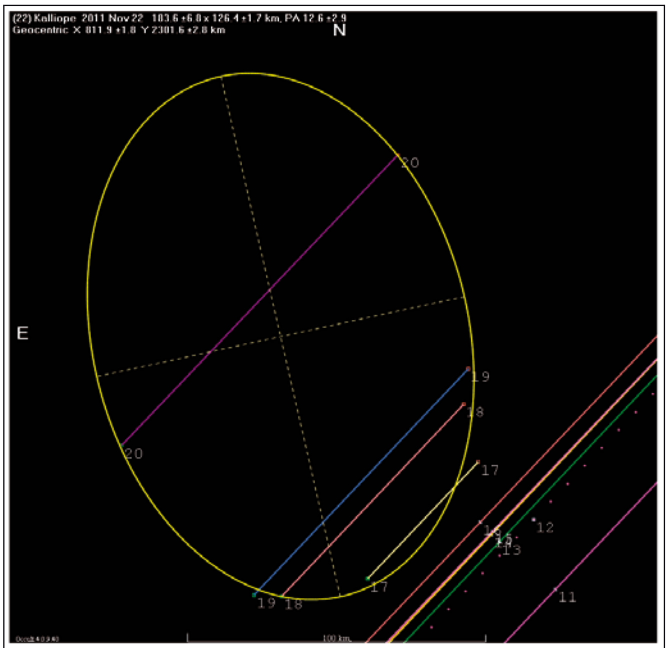
Unfortunately many observers were clouded out at the eastern part of the path. 14 observers reported a miss, two of them near the predicted center line for Linus. Bernd Brinkmann and Josef Müller (both from Germany) added two more positive chords near to my own chord, Michael Parl (Munich, Germany) contributed a very important single chord at the eastern side of the profile. The real path was shifted to the East compared to the predicted path.

Four Days Later

There was another occultation by (22) Kalliope and Linus crossing Europe at November 26th [5]. Unfortunately this event was during dawn.



Wolfgang Rothe (Berlin, Germany) tried this very difficult observation. He had bad luck and reported: "The „Pro-Planet 742 IR pass filter" was inserted in order to suppress the increasing brightness of background. It was possible to detect Kalliope with acceptable quality, Watec exposure time 1.28 s and reduced gain at the BW tube monitor. So I hoped to observe the 0.5 mag event. But a last minute cloud covered the target area around the predicted time 06:10 UT, again "just in time". I could watch Kalliope until 06:07 UT and recognize it again at 06:11 to 06:13 UT (Sun depression 5 degree) fading in the brighter noisy background, may be thin clouds or fog ... " [6].



Positive chords plotted with OCCULT
20 Michael Parl 19 Josef Müller 18 Oliver Klös 17 Bernd Brinkmann

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[3] http://asteroidoccultation.com/2011_11/1122_Linus_29104.htm

[4] http://www.euraster.net/results/2011/index.html#1122-22

[5] http://asteroidoccultation.com/2011_11/1126_22_24284.htm

[6] E-Mail to PLANOCCULT by Wolfgang Rothe, 2011 November 27th

Journal for
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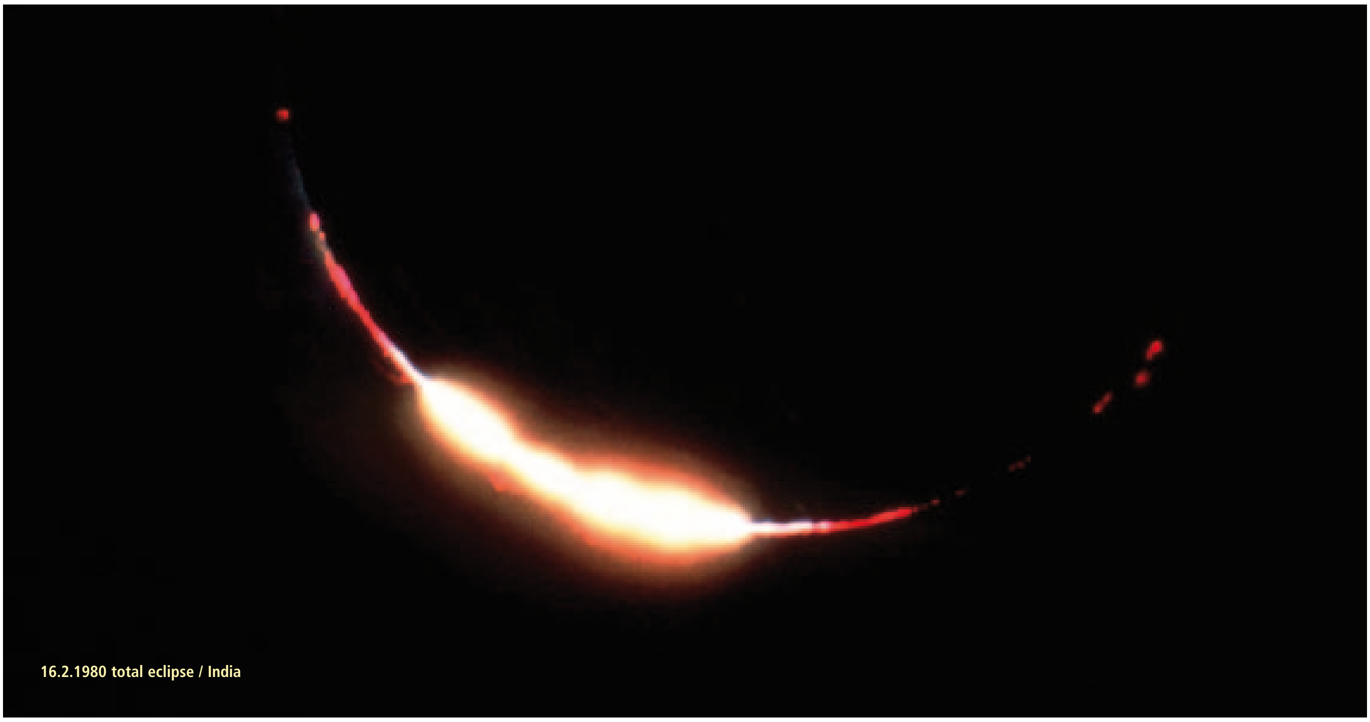
Measuring the solar diameter toward Baily beads observations: An improvement of the method.

By A. Raponi



16.2.1980 total eclipse / India

1. Why improving the method

Measuring the solar diameter with the eclipse observation permits to bypass the atmospheric and instrumental effects that distort the shape of the limb. They are overcome by the fact that the scattering of the Sun's light is greatly reduced by the occultation of the Moon.

The observation of the solar limb through the observation of eclipses has already had several contributions.

The early works took into account the nature of the rugged lunar profile, but like a nuisance to be overcome.

A decisive breakthrough was made thanks to David Dunham (IOTA) that proposed to observe the beads of light that appear or disappear from the bottom of a lunar valley when the solar limb is almost tangent to the lunar limb (Baily's Beads).

The technique consists to look at the time of appearance of the beads and to compare it with the calculated positions by the ephemeris using the software Occult 4 by David Herald [1]. The simulated Sun by Occult 4 has the standard radius: 959.63 arcsec at 1 AU.

The difference between the simulations and the observations is a measure of the radius correction with respect to the standard radius (R).

However this approach has a defect: it conceives the bead as an on-off signal. In this way one assumes the luminosity profile of the solar limb, called Limb Darkening Function (LDF), as a step profile, but it is actually not.

Different compositions of optical instruments (telescope + filter + detector) could have different sensitivities and different signal/noise ratios, recording the first signal of the bead in correspondence of different points along the LDF. This leads to different values of the R. As an example, the same bead (AA=177°) observed during solar eclipse in 15 January 2010 by Andreas Tegtmeier in India, and by Richard Nugent in Uganda, gave R = - 0.43 arcsec for the former and R = + 0.72 arcsec for the latter. A gap like this (more than one arcsecond) is not acceptable for this method which would give results with accuracy of some cents of arcsecond.

So in this paper a further improvement of the method is proposed.

It takes into account the whole shape of the LDF and thus the actual position of the inflection point, that is the conventionally accepted definition of the solar edge.

2. The theory about the method

Every Baily's bead has its own light curve (the amount of light in function of the time). In an ideal case where instrumental and atmospheric effects are completely overcome, the light curve is forged by only two elements: the shape of the lunar valley that generate the bead and the LDF of the solar limb. Our assumption is that the other effects are negligible for our purpose. Even if it seems reasonable, proving this assumption is an important future task.

So, these three function (light curve, shape of the lunar valley, LDF) are linked each other. Indeed the light curve is the convolution between the LDF and the shape of the lunar valley. Having two of these functions one can get the third.

Our goal is the detection of the LDF and its inflection point position, that gives the measure of the solar radius. The problem is determined because we can obtain the other two function: the light curve is obtainable through observation, and the shape of the lunar valley through analysis of the kaguya profile.

The procedure, as explained in Raponi et al. 2011 [2], is involved and require a careful analysis of the light curve and the shape of the valley, in order to proceed with the deconvolution and to obtain an accurate evaluation of the errors.

However this method could be greatly simplified by assuming for the lunar valley a linear shape, namely the width of the lunar valley increases linearly from the bottom outwards. One could show that this assumption does not introduce a significant error on the results. In this way one can obtain the shape of the LDF by the first derivative of the light curve of the bead. This operation is straightforward with any software for calculation.

Obviously with this simplified procedure what one gets is just a shape of the LDF, losing any information about photometry. But it is a sufficient information if the target is the position of the inflection point to obtain the solar radius.

3. The method step by step

What follows is the explanation of the simplified method to detect the LDF. It differs with respect to the one exposed in Raponi et al.[2] because the analysis of the lunar valley is bypassed, and the analysis of the errors is also simplified.

3.1 Recording the beads

An appearing (or disappearing) bead is usable for this procedure if its light is recordable from the first (or last) signal to the saturation of the CCD (or when the bead is no longer distinguishable because of the background of sunlight). Moreover, the amount of light has not to depend by instrumental effect, like variable shutter or automatic gain, and the noise has to be as little as possible.

To record the light curve of the bead we can use Limovie free software [3]. One can select the right radius of the recording circle in order to capture all the light of the bead. The form of the background area has to be setted in "Meteor/Lunar Limb" mode, to avoid recording the sunlight.

Then one has to export the data taken by Limovie software into a software for calculation. Origin software is recommended (see Figure 1).

The Limovie data to be taken into account concern the signal recorded by the circle without any further elaboration, namely the column "Detect", and not the column "Result".

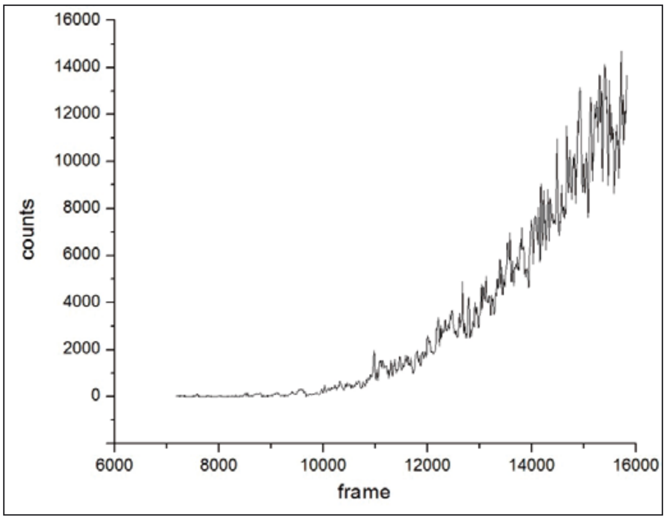


Figure 1. Light curve of the bead at AA = 177°, during annular eclipse on 15 January 2010, recorded in Uganda by Richard Nugent. The plot represents raw data taken by the Limovie software.

3.2 Subtracting the background noise

In some video of eclipses the background noise is significant and the instant of the first signal of an appearing bead could not be clear. The data concerning the background noise are obtainable toward the subtraction: Detect-Result columns. The resulting column represents the counts taken by the two background areas, normalized for the detection area. A simple procedure to evaluate the background noise is to perform the standard deviation ( ) of the data in the resulting column. Then 5 have to be subtracted from the light curve. After the subtraction, the first positive value of the light curve could be considered the first signal. The values before the first signal have to be throwed out (see Figure 2).

The procedure is the same for a disappearing bead, but one have first to plot the light curve back in time.

3.3 Excluding the saturated light curve

In some video the light could saturate the CCD. The saturation of the CCD has to be evaluated thanks to the visualization of the light curve of the bead in 3D (option of Limovie software). When the 3D bell shape of the bead reaches the top, the CCD is saturated. All the saturated light curve has to be throwed out (see Figure 2).

3.4 Eliminating the electronic noise

To eliminate the electronic noise is sufficient to perform a polynomial fit of the light curve of the bead. The shape of the fit could be considered the shape of the light curve (see Figure 2).

Different grades of the polynomial fit could give different shapes. The difference between the polynomial fits could give an estimation on the error induced by the electronic noise, as we will see. 7 polynomial fits, from third to ninth grade, are sufficient to do the evaluation.

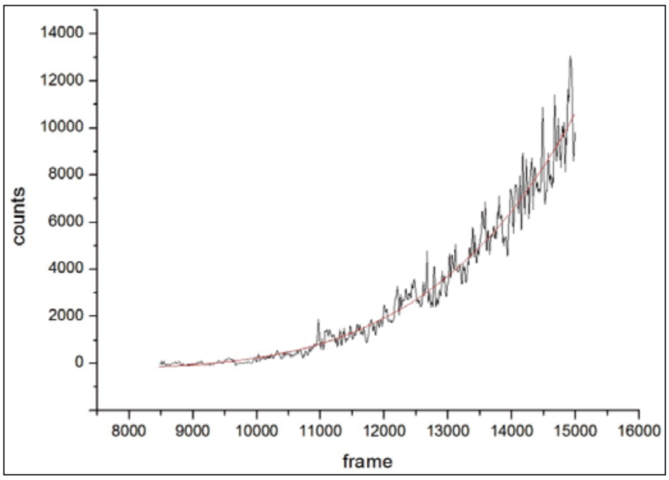


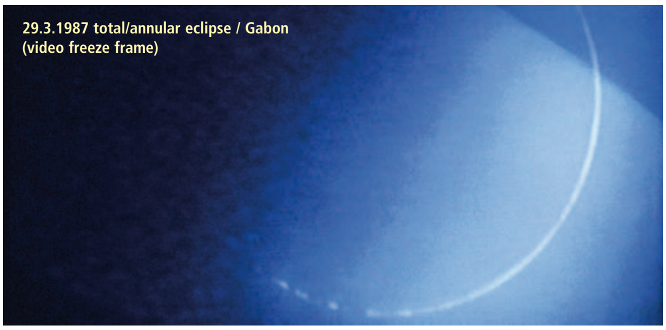
Figure 2. The data before the first signal and after the saturation point are throwed out. An example of polynomial fit is showed (red solid line).

3.5 Obtaining the LDF

The first derivatives of the 7 polynomial fits have to be performed. They give the shape of the LDF. They could be different each other because they come from different functions (see Figure 3). Those with too much oscillating behavior are not good and have to be throwed out. A plot of the profiles and an estimate by eye is sufficient to do the evaluation. In general the higher is the grade of the polynomial fit, the more is the oscillating behavior of its first derivative.

Often the two extremes of the profiles, present a great scatter between them. This is a ineliminable defect, and one can just throw out the points that present this huge scatter.

Now one can perform the average and the standard deviation of the profiles for each point. These are the values and the errors of the piece of LDF concerning the path covered by the lunar valley during the light curve, usually less than one arcsecond.



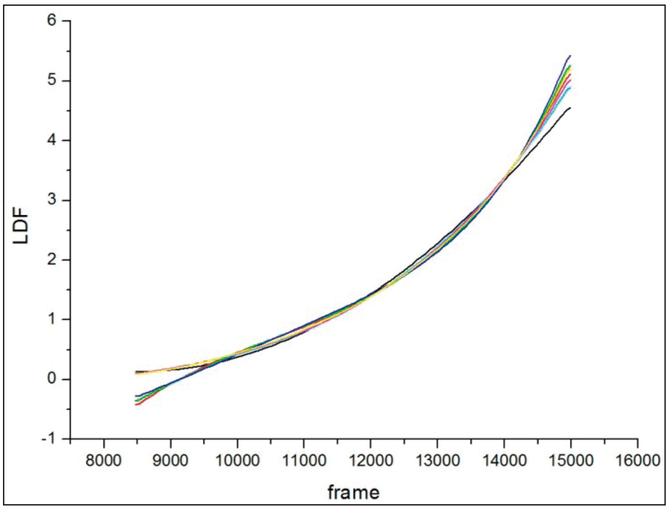


Figure 3. The first derivative of the 7 polynomial fits are plotted together. They give an estimate of the shape of the LDF.

3.6 The LDF along the solar radius

What we got in the previous point is a piece of the LDF in function of the frames of the video. However this independent variable does not make any sense. Any frame should be linked with time, thanks to the Limovie software, and time should be linked with the position of the solar limb (bottom of the lunar valley) with respect to the standard solar limb, thanks to Occult 4 software. Finding the correspondence between frame and position, one can plot the LDF in function of the solar limb position, being the standard solar limb in the zero point. This is necessary to locate the piece of LDF in a certain position along the solar radius.

3.7 Adding pieces of LDF

The piece of LDF obtained are often too short to identify the inflection point position. Thus one can add several pieces of LDF obtained by different observers in order to identify a unique profile along some arcseconds (if they are not overlapping). For this purpose little differences in the equipment of different observers became really useful because they detect the beads in different positions along the whole LDF.

Keep in mind that the value on the ordinate between different pieces of the LDF may not be mutually compatible. One can fit all the pieces with a certain linear transformation ($y' = Ay + B$, being A and B arbitrary constants) for each one of them (see Figure 4). This operation maintains the shape of the profiles. In any case, this normalization is arbitrary and it can be evaluated by eye on the plot. Any normalization should produce the same composed profile.

4. Results

As explained in Raponi et al.[2], we studied the videos of the annular eclipse on 15 January 2010 obtained by Richard Nugent in Uganda and Andreas Tegtmeier in India. The equipment of Nugent was: CCD camera (Watec 902H Ultimate); Matsukov telescope (90 mm aperture, 1300 mm focal length); panchromatic ND5 filter (Thousand Oaks). The equipment of Tegtmeier was: CCD camera (Watec 120N); Matsukov telescope (100 mm aperture, 1000 mm focal length); IOTA/ES green glass-based neutral ND4 filter. From a bead located at AA=177° we obtained two LDF pieces by each of the two observers.

The resulting points (see Figure 4) show that the inflection point is clearly between the two profiles obtained for each of the two beads. So it is possible to deduce an upper and lower limit corresponding to the points that better constrain it.

The same analysis explained till here was performed for the bead at AA=171° for both the video. It permits to add other two pieces of LDF even if they are almost totally overlapping to the previous as expected, because coming from the same equipment.

The final result is: -0.190 arcsec < ΔR < +0.050 arcsec.

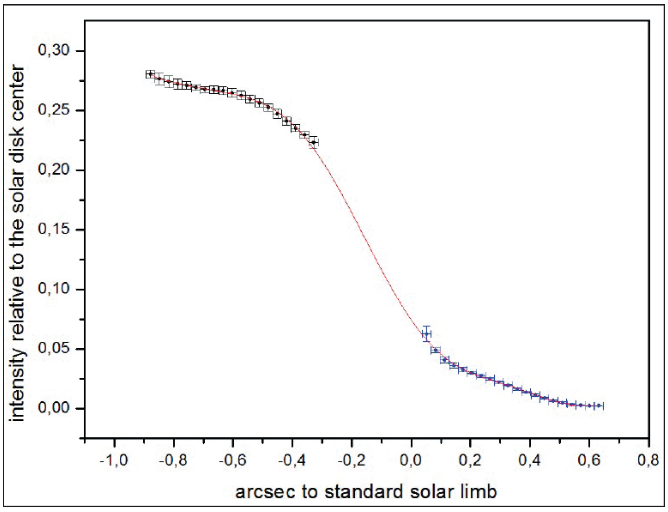


Figure 4. The luminosity profiles obtained for the bead at AA = 177° are plotted and put together. The inner and brighter part is obtained from Tegtmeier's video; the outer and weaker part is obtained from Nugent's video. The luminosity profile is normalized to the center of the solar disk according to Rogerson [4], but any other arbitrary normalization is suitable for our purpose.

The zero of the abscissa is the position of the standard solar limb. The error bars on y axis are the standard deviation of the profiles found in section 3.5. The bins on x axis are arbitrary. The solid line is an interpolation between the profiles and gives a possible scenario on the position of the inflection point.

5. Recommendations for future observations

5.1 Dynamic range

An immediate improvement of the method could be reached increasing the dynamic range of the detector from 8 to 12 bits, that is from 256 to 4096 levels of intensity. In this way the light curve could be observed over a longer path of the LDF before being saturated, revealing a longer piece of LDF with respect to those showed in figure 4.

As stated in section 3.7, it is necessary to add different pieces of LDF coming from different observers, with different equipments, to obtain a composite profile longer enough to detect the inflection point. However, in theory, with a 12 bit CCD it is possible to bypass this step obtaining a single profile useful for our purpose.

5.2 Filters

The LDF, and its inflection point position, change in function of the wavelength because both the continuum and lines behavior of the solar spectrum (Raponi et al.). This fact makes evident that comparisons between different profiles taken by different filters have to made with care. The standardization of the filters between different observers is thus required. The choice of the filter have to be made with respect to other measurement method, permitting a further validation of the method toward comparison of the results.

5.3 Calibration

As stated, this method permits to obtain the shape of the LDF, losing any information about photometry. These further information are not useful for the purpose of this paper, but they could be really useful for the study of the solar atmosphere. The potential of this method is evident on this direction. An observation in a certain bandpass and with calibrated equipment permits to obtain important spectrophotometric information, even if this goal seems challenging.

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Journal for
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TTSO5 – The Fifth Trans-Tasman Symposium on Occultations 26-27 May 2011 – Napier, New Zealand

by Steve Kerr, Rockhampton, Queensland, Australia · srkak@optusnet.com.au

Coordinated amateur occultation observing across New Zealand and Australia has enjoyed a long and productive history under the guidance of the Occultation Section of the RASNZ (Royal Astronomical Society of New Zealand) and its director Graham Blow. Over the past decade as occultation observing transitioned from a principally visual process to video and CCD techniques, the Section has been active in support through making video cameras available to observers where commercial options were not available locally. It also became clear that equipment alone was not sufficient and that information and practical hands-on advice was also required. And while on-line mechanisms are vital in this role, a face to face meeting is hard to beat for getting the subtleties across as well as motivating observers and making new contacts. The idea was hatched to hold the First Trans-Tasman Symposium on Occultations with these general aims which came together as a two day meeting in Auckland in May 2007 in conjunction with the annual RASNZ conference of that year.

The outstanding success of that meeting lead to the establishment of subsequent symposia with a pattern established with the event held in New Zealand or Australia on alternating years – the New Zealand meeting held in conjunction with that year's RASNZ conference and the Australian meeting in conjunction with NACAA (the National Australian Convention of Amateur Astronomy – a biannual meeting held over the Easter weekend at different locations around the country). The content of the meetings has evolved over that time to cover more than the original educational objectives. Discussions now extend to recent observation results through to emerging new techniques, equipment and software options.

TTSO5 – the fifth symposium – was held in Napier, New Zealand in late May 2011 with Murray Forbes from Lower Hutt putting in an admirable effort as meeting convenor. A healthy contingent of 30 attended including six from Australia. It was particularly pleasing to see so many faces that were new to occultation observing as well as a few that had been involved in the past and were looking for a refresher on the topic. Scheduled over one and a half days, the agenda covered the full range from basic to cutting edge. Here is a quick summary of the presentations.

■ After Murray and Graham taking care of the administrative details and welcoming everyone to the meeting, Steve Kerr presented a now well recycled talk introducing the astronomical concepts of occultations for beginner observers.

■ Well known South Island observer, Bill Allen, gave an overview on his CCD drift scan observing strategies and results particularly in pursuing occultations by Pluto. Bill offered some different perspectives on how to provide a time base for this observing technique.

■ Jacquie Milner from Western Australia introduced the Occultation Video Manual. This has been a project bubbling along in the background for some time to support beginner observers particularly with respect to the technology aspects of electronic observing. Plenty of discussion followed on what content should be included and how best to maintain and distribute the document. A broad based collaborative approach would appear to be the best so watch out for your opportunity to contribute.

■ On behalf of Dave Gault, Tony Barry, Walt Morgan and Sandy Bumgarner who could not attend the meeting, Steve Russell and Dave Herald rolled out the red carpet for the global launch of the new IOTA VTI – Video Time Inserter – the long awaited successor for the KIWI OSD system that has been the cornerstone of video occultation observing. The features and capability of the new device was outlined along with test results and a real live prototype present for everyone to touch and smell. Of course, the dominant question was where do people get them and Steve and Dave got plenty of practice at answering.

■ After an informal session on assembling video observing equipment on a telescope, North Island observer Peter Graham gave a review of his own experience at capturing his first lunar occultation by video - an excellent review of the challenges new observers face.

■ Dave Herald from Canberra, Australia, gave a quick overview of the best asteroidal occultation outlines determined over the past two years as reported to IOTA. There were as usual some great examples of what can be achieved with large numbers of well placed observers – something that is difficult to organise in our part of the world.

■ John Broughton of Queensland, Australia, has in recent times been catching many asteroidal occultations using portable telescopes. While he could not attend the meeting, he sent along a very informative video presentation on his design approach to ultra compact, quick setup large aperture telescopes designed for video occultation observing.

■ At the other end of the scale, South Islander Stu Parker gave a short summary of using small aperture optics based on Scotty Degenhardt's Might Mini concept for multiple site coverage of occultations.

■ In what is becoming a regular update for TTSO meetings, Brian Loader from Darfield gave an update on recent measures of double stars using lunar occultations as well as a background description of the technique as an introduction for new observers.


Dave Herald


Murray Forbes and Graham Blow


Bill Allen


Stu Parker and John Drummond


Steve Russell


Steve Kerr


Hristo Pavlov


Jacquie Milner


Brian Loader

■ John Talbot also usually gives an overview of planetary occultations across New Zealand and Australia but in his absence, Murray Forbes made the presentation. Observation numbers for 2010 were consistent with previous years with a number of good profiles achieved with multiple observers/locations. New Zealand and Australia continue to punch above their weight with the region contributing 22% of observations reported to IOTA from around the world.

■ Steve Kerr closed the first day's proceedings with a short discussion on the observational aspects of trying to detect shallow planetary occultations. An example including a difficult to interpret light curve was presented.

■ Day Two kicked off with a presentation by Hristo Pavlov via Skype outlining the features of his Tangra software. While primarily aimed at less experienced observers looking to learn the software, there is always something for the more experienced to gain from an insight into the software's author.

■ Dave Herald then gave an overview of a process underway to draw up a new star catalogue to cover stars down to 20th magnitude to support planetary occultation efforts. While there are many catalogues in play at the moment, it is proposed to take the best of the current data and develop a format compatible with future efforts to improve the quality of data.

■ Hristo returned with a second session delivered via Skype on his OccultWatcher software - the gold standard for coordinating planetary occultation observing. Once again, a first rate review of the capabilities for beginner and experienced observers alike.

■ Closing the session, Murray Forbes outlined a work in progress to develop a minimal cost mechanism for integrating the widely available "Beeper Box" devices into video observing using basic video insertion electronics.

In closing the meeting, Graham Blow noted the enthusiasm shown and the level of interest by new observers discovering occultations for the first time. Clearly the TTSO concept still fills a valued need for observers around the region and to that ends, planning is well at hand for TTSO6 to be held in conjunction with 2012 NACAA in Brisbane, Queensland, Australia over the Easter weekend. Interested observers are invited to attend and expressions of interest are currently being taken at http://www.nacaa.org.au/2012/interested.

Journal for Occultation Astronomy

Technology for the Observation of Trans Neptunian Objects I. Simulation of Occultation Observations – The OCCSIM software –

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Introduction

What have been occultations by asteroids in the 1970s and -80s are occultations by Trans Neptunian Objects (TNO) nowadays. Astrometry has still a long way to go, to predict such events with an error of 100km or less. With the GAIA mission in the future, such an accuracy will for sure be reached. The technology for observation however, will remain the same. Therefore it is evident, that the technological limits for detection with a given instrumentation have to be evaluated. This will give the observer more confidence, what he/she can expect to detect with the instrument already available. But it also will help to predict the improvement, if a decision about new instrumentation has to be made.

Very often observers do underestimate their equipment, they feel they can never detect these objects in a proper way to gain a scientific benefit. This under-estimation is caused by the feeling, that occultations have to be recorded with time resolution better than about 100 msec. As this is true for lunar occultations, it is not fully true for asteroids, but its is absolutely not true for TNO occultations. From these distant objects, only a little bit more than nothing is known, mostly their brightness. With a timing accuracy of around 1 second we get a spatial resolution in the range of 30 km. This is far better than any other technique can achieve. Using the diameters and/or shapes of the objects, a correct albedo can be estimated. Even with a timing accuracy of around 3 seconds, the shapes of larger TNOs can be determined with a precision of about 100km. 3 seconds extends the limit of detection one magnitude!

Because of the high sensitivity of CCD (or even CMOS) detectors in the range of 60% to 70% quantum efficiency and a readout noise of around 8 electrons, a possible improvement of detection will only be in the range of less than 2 magnitudes.

The observation of occultations of faint stars requires in many cases the optimization of equipment in order to get reliable results. Because of the growing number of TNO occultations being predicted, the user should get an impression beforehand, what he /she can expect if observing with the available equipment. A number of parameter influences the observation, some of which can be calculated easily with a proper software, other remain problematic, such as szintillation conditions and/or light scatter in the earth's atmosphere. These latter parameters can vary rapidly even in a few hours, a precise prognosis seems not to be practicably.

The following occultation simulator (OCCSIM) is a software for the simulation of an occultation observed by a specified telescope, camera and observing conditions as well. The physical parameters of the used devices can be selected as input parameters. OCCSIM generates a light curve, which is as comparable to reality as possible. The software has been written in FORTRAN 90 and will generate a datafile with results just comparable to a real occultation. The graphical user interface of OCCSIM provides an easy input of parameters and gives an overview of the simulated light curves. It also generates complete printouts and ready to publish graphics of the results in many data formats.

In the following report, the objectives, methods and some results concerning real observations are presented.

This publication is the first one of a series of papers about the technology of observation and data reduction. This is an urgent need not only for TNO occultation but also for occultation astronomy in general. The prediction process for generating the occultation track is well documented and software packages are available even for the amateur, such as WINOCCULT and others. But there is a lack of compact information and/or software, which cover other needs.

Objectives:

The program OCCSIM simulates an occultation of a star with a magnitude between 12 and 19 using the following parameters:

- Telescope diameter
- Telescope focal length
- CCD quantum efficiency in BVRI Bands
- CCD pixel size
- CCD Read out noise
- Atmospheric transparency
- Stellar magnitude in BVRI Bands
- Size of the stellar image (FWHM)
- Size of the measurement aperture for analysis
- Exposure time
- Sky background magnitudes
- Stellar intensity in photons

These parameters are input parameters of the software, and can be changed using the graphical user interface (GUI) of OCCSIM. OCCSIM creates during its run an output file with the simulated occultation light curve for a star with the nominal intensity as given as the input parameters. It also generates curves for fainter stars (up to 3 mag fainter) in order to get an idea, what the observer has to expect, if observing conditions are poor.

Methods

In order to simulate occultation curves as realistic as possible, proper statistics has to be used.

If we want to determine the signal to noise ratio as well as to understand the noise in CCD images, a few facts about the statistics of the counting process have to be understood. All electrons generated by photons, which originate from the observed object or from the sky background, obey Poisson statistic. The same is true for all electrons released by other processes such as dark current. This means, that for a large number of measurements, the variation of the electrons (the "root mean square" (RMS)) is equal to the square root of the mean number of electrons.

The simulation program uses Poisson statistics for generating the appropriate amount of electrons in an array. As an input parameter the number of photons in an appropriate band (or a sum of It) per square meters outside the atmosphere has to be given. Bessel gives the photon numbers per band in his paper (Bessel, 1979). Different atmospheric transparencies can be selected as a parameter. The program further simulates a gaussian distribution for the stellar image, where you can select the stellar image's full width half maximum (FWHM) value. This is useful in order to compensate for bad optics or for a smear out of the image due to poor air quality.

The program generates an ASCII data file with the following columns: Image# Im Im+1 Im+2 Im+3 Im+4

Im is the occultation simulation of a star with nominal magnitude as given by the input parameters from the GUI. Im+1 to Im+4 are lightcurves for stars fainter by 1 to 4 mags compared to the nominal intensity.

200 rows are generated, the time between two images is assumed to be equivalent to the exposure time. The program generates 200 data points for the occultation, where the light of the star decreases down to zero from image 85 to image 115. Therefore, if the exposure time is 0.5 second per image, the actual time span, covered by the data output is 100 seconds and the occultation takes place from 42.5 seconds to 57.5 seconds after start. Image# is the number of each image analyzed, it can be used as a timing parameter, if the data are processed with a data analysis software.

Im etc. is the measured intensity in electrons, if the generated image is analyzed with a standard photometric technique, having an inner ring (with previous given radius at data input) for stellar intensity determination and and an outer ring for determination of the background. There is no nomansland for photometry.

Using the input parameters for the quantum efficiency of the CCD in BVRI bands, the sensitivity of the CCD as well as of other filters in the optical pathway can be adjusted. Typcial values may be around 30 to 60 percent.

The input parameters

The following parameters can be varied:
Telescope diameter: The telescope diameter in meters.

Focal length: The effective focal length in meters.

CD pixel size
The pixels are assumed to be square, and the length of one side of the square has to be given in micrometers. If the pixels are elongated (or binned) the square root of the pixel area has to be used. The value, the program calculates from it, is the whole pixel area.

CCD readout noise
The readout noise of the chip in electrons.

CCD quantum efficiency in BVRI bands
The average quantum efficiency of the CCD chip (including a possible glass window of filter) of the used wavelength band can be chosen.

Atmospheric Transparency
The photon data from the star should be "out of atmosphere" values, the actual transmittance averaged over the full wavelength range can be given here. The value is a ratio less than 1.0, typcial values may be between 0.4 and 0.7 . The value has to be an average for BVRI bands, spectral selection is not possible in this version of the software.

FWHM
The full width half maximum (FWHM) value of the stellar image in arcseconds. Typical values may range from 0.5 to 4 arcsec.

Sky background intensity in magnitude per square arcsec
The sky background intensity has to be given in mag/arcsec^2 . Typical values may be around 17.5 near the center of a big city or 21 to 22 for locations in optimal conditions. The value should be given for the same wavelength range as used for recording.

Aperture of photometry (diameter in pixels of CCD array)
For determination of the intensity of a star versus the background, a real calculation is done with data in a real 2-dim array. Using a 2 ring photometry program the intensity in electrons is determined. From the outer ring the background per pixel is determined and subtracted from the inner ring. Typical values may 3 pixels or more. In order to simplify the calculation, a square aperture is assumed.

Stellar magnitudes in BVRI bands
The magnitudes of the star in the BVRI bands can be selected with the 4 input sliders. OCCSIM converts the magnitudes to the number of photons in each band according to the selected telescope area and atmospheric transparency. Band magnitude data are according to Bessel (1979,2005).

Integration time in seconds
The integration time for each frame in seconds should be typed in here. This is not necessarily the time between two images, because a lack time due to data transfer to the computer or other might be not zero.

Execution and Output of the program

During execution, the program generates true images, as a default value the generated sequence is of 200 images. The total time span of the dataset is therefore 200 multiplied with the exposure time in seconds. For each pixel we assume a Poisson statistics. At certain coordinates the stars are inserted in the images. This is necessary if true images have to be generated. Now, for each pixel in the image, the Poisson statistics is calculated. The true

This is followed by a subroutine, which calculates the intensity around the center of each star just like in a real program for intensity measurements of stars using a typical 2 ring aperture photometry with square windows. The "measured" intensities are written for each file together with the image number in an ASCII output file named. The file does not have any header, it can directly be read in by programs like DATAPLOT from the NIST or in any spreadsheet after proper format conversion.

For demonstrations a version of the program can be compiled, which generates true images on the disk (FITS format), which can be displayed as a movie for demonstrations.

The graphical user interface of OCCSIM has been created using the DISLIN package from the Max Planck Institute for Solar System Research, Lindau, Germany (Michels, 2012). The OCCSIM software has been compiled using the GNU Fortran90 compiler (GNU Fortran compiler, part of GCC). It has been tested in a LINUX environment (OPENSUSE 11.3). Because the DISLIN package can also be run under the Windows operating systems, it could be recompiled for use with Windows operating systems (Microsoft) as well.

Fig. 1

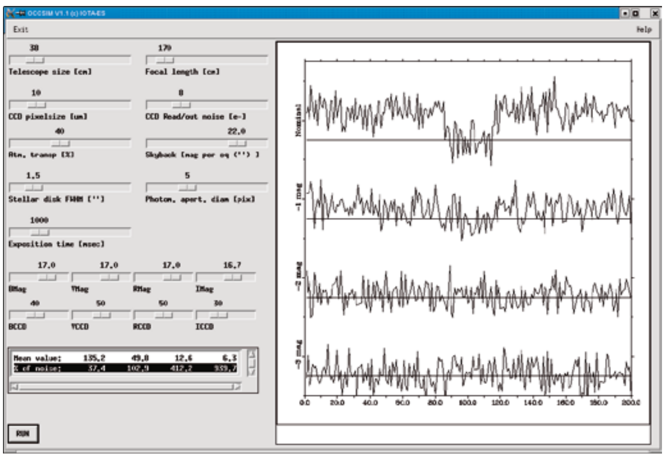


Figure (1) gives an overview of the graphic interface, where you can set all parameters by using the sliders on the left side of the OCCSIM window. In the lower part of the GUI you find 4 sliders for the BVRI intensities of the star as well as for the quantum efficiencies of the CCD chip in each band. It allows to show the influence of different stellar colors as well as of different CCD detectors on the simulated light curves. The most upperone light curve gives the simulated curve for a star with nominal magnitude as selected by the sliders. The three lower curves show simulations for stars 1, 2 or 3 magnitues fainter to give an overview.

If the "Run" button is pressed, the curves are generated and displayed on the right side of the OCCSIM window. In the text output window below the sliders for the CCD quantum efficiency, the mean value of the number of electrons for the nominal star as well as for the fainter star models is displayed as well as the noise per datapoint in percent.

Applications of the program

In the following for special cases light curves will be shown, which are valid for conditions the typical occultation observer will have. To simplify the graphic output, in all figures light curves for only 4 stars will be displayed, for a 16th, 17th, 18th and 19th magnitude star. Brighter stars are anyway easy to measure, they do not need special treatment. The occultation is simulated by setting the stellar intensity to zero for image 85 to 115.

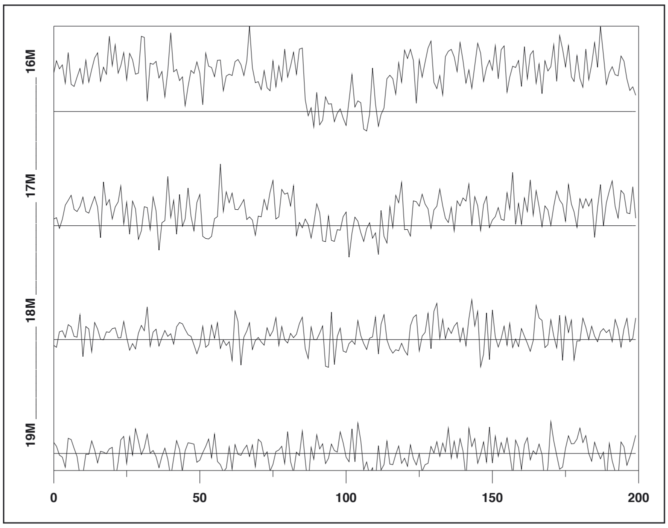


Fig. 2

For figure (2) a telescope with 0.3 m diameter is used for the first run, having a typical camera with about 10 electrons readout noise. No filter is used, the BVRI intensities have been chosen such as of a 16mag star (Bessel, 1979). The average quantum efficiency of the camera is assumed to be 30% in B, 50% in V and R and 30% in I Band. The stellar image is set to a diameter (FWHM) of 1.5 arc seconds.

The output is formatted in a way, that you see the four generated light curves of stars from top to down with magnitudes from 16th to 19th, In the center you see the occultation itself, which is assumed to be a total one. The light decreases from 100% to 0% and back. Integration time is set to 1 second, and the background intensity of the sky is assumed to be 21mag/arcsec^2 . This is a reasonable good site, inside a big city you can have 17.2mag/ arcsec^2, a value which has been determined for a place 5km east of the central square in Munich (the "Marienplatz") at typical conditions. The transparency of the atmosphere is assumed to be 50%.

For comparing the light curves of the four stars, the intensity scale for each star remains the same. You can see easily in the simulation the occultation of a 16th mag star, barely for a 17th mag star, but not for the 18th and 19th mag star.

To show the influence of the readout noise, a readout noise of 1 electron is used for figure (3). The 17mag occultation can be seen easily, whereas the 18th mag may be the limit. In general, the low-

Fig. 3

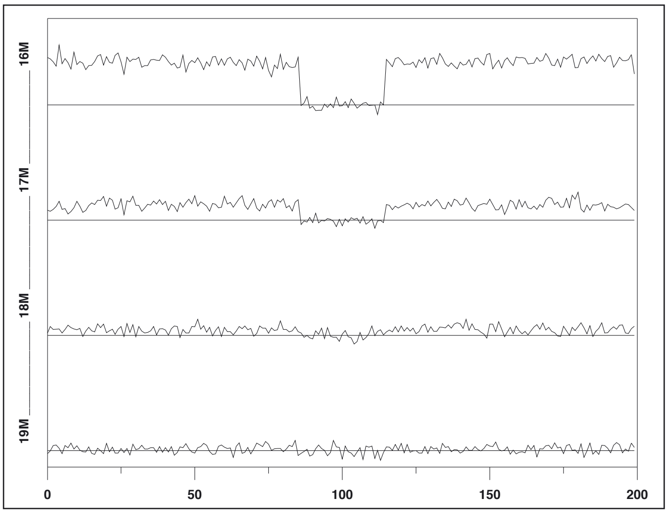
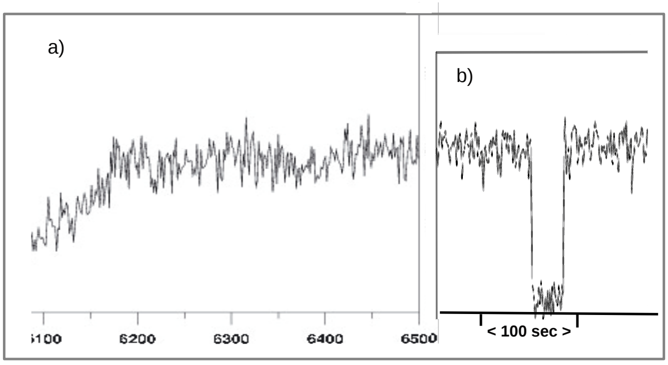


Fig. 5



ering of the readout noise to 1 (from 10) results in a gain of about one or two magnitudes.

The influence of the sky background is shown in figure (4). For 1 electron readout noise the simulation has been run with a sky background of 17.5 to 20.5 mag/arcsec². The high sky background wipes out nearly all of the advantage of the 1 e⁻ readout noise.

A comparison with real measured data is given in figure (5). An occultation by Triton observed from Namibia (Tivoli, Observer Hans-J. Bode) observed with a 35 cm instrument and the IOTA Occultation Camera (a) is compared with a simulation run for this equipment, which is shown in part (b) of figure (4). Both graphs have been adapted, to give a similar time resolution. The left part of (a) shows the slow decrease of the signal due to Triton's atmosphere, whereas in part (b) the abrupt decrease of the simulation program can be seen.

A figure for optimal conditions for a 80 cm instrument with a focal ratio of 1:5 is shown in figure (6). Such a telescope is available in relatively large numbers throughout Germany or other countries of central Europe, either owned by private persons or by public or university observatories. It shows, what can be done and that the observation even of faint occultations is now in reach for many stations. A camera with 8 electron readout noise was assumed here as well as a background of 21.5 mag/arcsec². Such a camera is available for less than 500 €, and it shows the possibility to observe an occultation by a star less than 18th magnitude.

Fig. 4

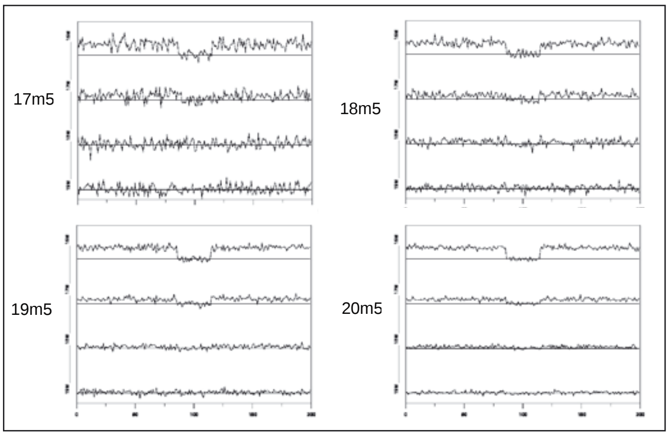
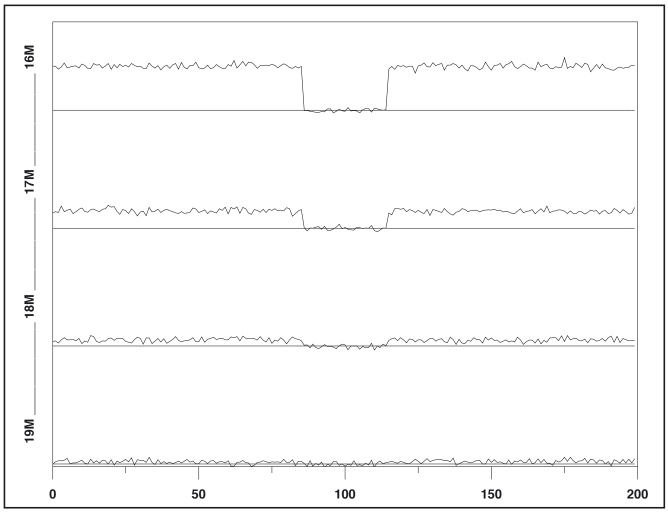


Fig. 6



Conclusion

A software package OCCSIM, has been developed to simulate occultation light curves for stars in the range of 15m to 19m. The parameters for the simulation can be varied to simulate different instrumental capabilities well ahead of a real occultation. This simplifies the selection of telescopes and cameras for a certain event and may stimulate observations of occultations by Trans Neptunian Objects (TNOs). A simple 30cm telescope can observe an occultation of a 17th mag star with a conventional camera, whereas using a 80cm instrument even occultations of 18m5 stars get into reach. It has been shown, that the results of the simulations are in agreement with real occultation data.

For anybody interested in the software, an email for request should be written to the author. He also offers to run simulations for certain parameters in discussion with the user.

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Journal for
Occultation Astronomy

Solar Eclipses in 2012 and 2013

By Hans-Joachim Bode

There are pretty good chances to record 4 eclipses (annular and total ones) within 2 years and it is possible to reach the different observation sites without any problems: California (and its surrounding states), twice the northeast of Australia (Queensland, Cairns-area) and central Africa (Gabon).

Those of you having plenty of time could stay in Australia in the same area for half a year and will have the chance to observe the total and annular eclipses (November 13, 2012 & May 10, 2013) at nearby locations related to both paths in Queensland!

IOTA-ES members already made plans for three of the eclipses: 2 Spanish and 3 German stations will be established in California / Nevada for this year's May-eclipse. There will be a German and a Spanish station in northern Australia and by now 2 German stations again in Australia for next year's May-eclipse.

For there will be a lot of American observers at both edges of the path of the annular eclipse the result to be expected should be great!. Let us hope that a comparable amount of edge-observers will come together for both eclipses in Australia …

The Gabon-eclipse still is not within our focus. We have been in that country in the late 80s and there is no problem to leave for Gabon, which once belonged to France and still the official language is French.

One important thing concerning the recording of Baileys Beads is the fact that all data should be comparable for the reduction-work. This was one of the topics at last year's ESOP in Berlin presented by Andrea Raponi.

He mentioned that a narrow-band filter (< 10nm) should be used centred at a wavelength of 535 nm (being one of the possible wavelength where satellites are collecting data of our sun) as well as a 12 bit-recording device.

This device could be a problem for we are using an „optical" time-inserter combined with an 8-bit video camera – what's about 12-bit video cameras or the delay of electronic time-insertion via a 16 bit-CCD-camera into the PC?

Let us hope the questions could be answered after being solved which one is the best solution …

Journal for Occultation Astronomy

The partial asteroidal occultation of Betelgeuse on Jan 2, 2012

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Abstract:

The asteroid (147857) 2005 UW381 will pass over the supergiant star Betelgeuse on January 2nd 2012. The event is visible on a limited geographical region, and the magnitude drop is only 0.01 magnitudes for a maximum duration of 3.6 seconds. The opportunity to measure this phenomenon can be interesting for dealing with extrasolar planetary transits.

The occultation:

The data on the partial asteroidal occultation are presented in the image available at the web link

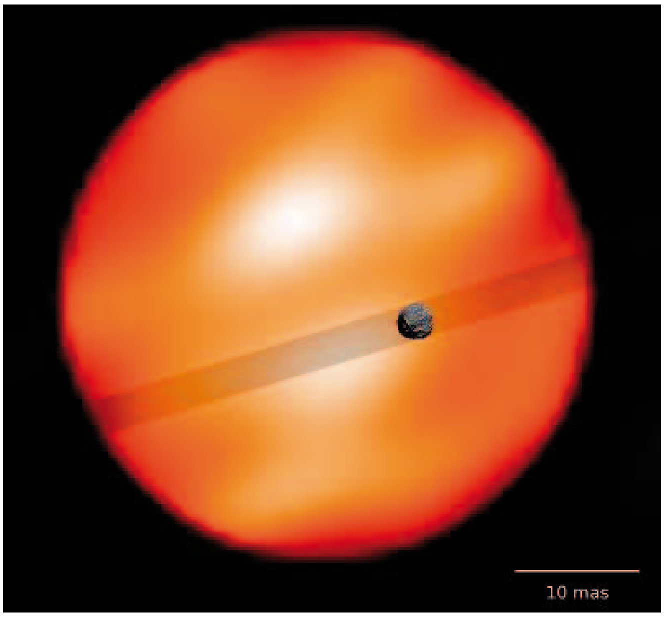
http://www.asteroidoccultation.com/2012_01/0102_147857_29098_Map.gif

We can to do the following considerations: assuming that Betelgeuse has a diameter of 31 mas (as indicated in that website) and the asteroid has a diameter of 3 mas.

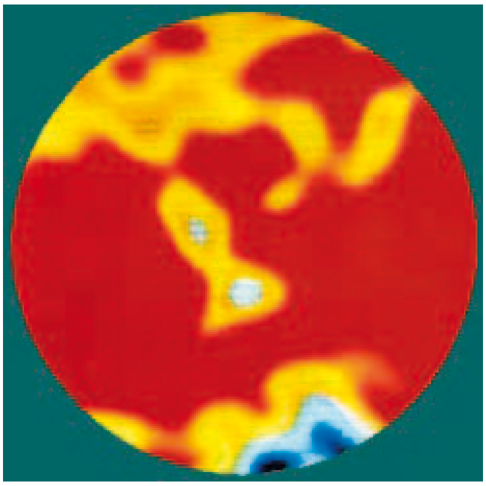
The ratio between the areas is $(3/31)^2$ and the luminosity of Betelgeuse will be: $[1-(3/31)^2]*100\%=99.06\%$ of its maximum

In terms of magnitude the difference according to the Pogson's law the decrease of the magnitude of the star will be:

$2.5 \cdot \log(0.9906) = -0.0102$ magnitudes



A sketch of the phenomenon made by Alfons Gabel (IOTA/ES).



With the speckle interferometry technique the surface of Betelgeuse has been inspected at the Kitt Peak Observatory.

The extension of the stellar atmosphere stellar could be measured by timing that passage from different locations along the predicted path of visibility of that transit.

Since the occulting asteroid has a parallax of 4.648" it means that this is the Earth's radius seen from its position. The following equivalence 1.37 km = 1 mas implies that the 31 mas diameter of Betelgeuse corresponds to 42.5 km on Earth, where the asteroid appears over the disk, plus 4.1 km North and 4.1 km South of the central path, where the asteroid is grazing the star's disk.

The locations of the central path, with Northern and Southern limits are plotted on the website of IOTA/ES http://www.asteroidoccultation.com/2012_01/0102_147857_29098_Summary.txt

The Star

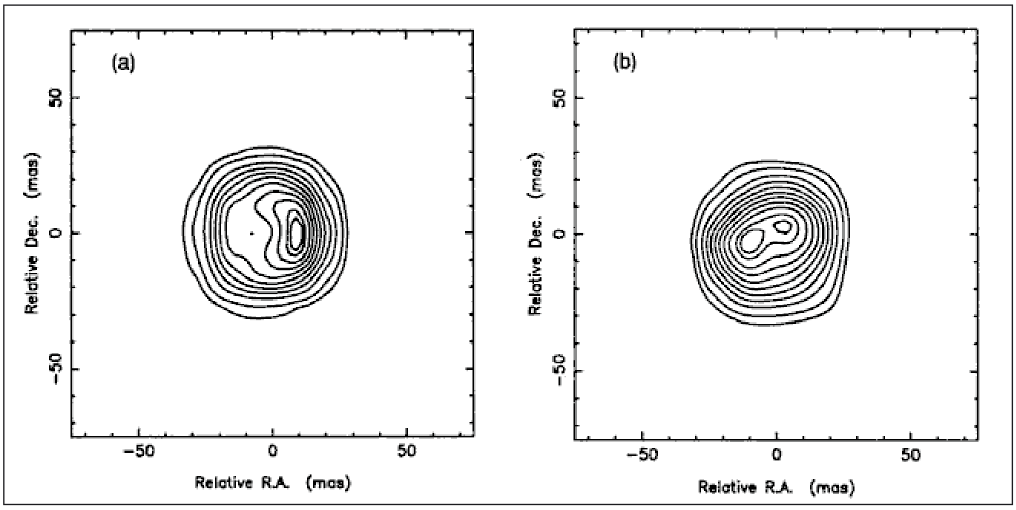
Betelgeuse is the alpha of Orion. The angular diameter is the largest observed for a star, and it is the first star of which some surface's details have been observed.

Contours are 5, 10, 20… 90, 95 of the peak intensity.

In the UV the stellar disk at 255 nm is 2.5 times larger than in visible light. The atmosphere of that supergiant star is as large as 125 mas. Already Michelson and Pease [4] considered the limb darkening reducing the measured diameter.

The variability

Betelgeuse is known as an irregular variable star. Stebbins [7] found in 1931 a 5.781 years period of luminosity fluctuation in the B band. This



Betelgeuse at the William Herschel 4.2 m Telescope – Ground-based High Resolution Imaging Laboratory (La Palma), from [1]. Left (a): reconstruction of Betelgeuse with Maximum Entropy Method at 710 nm in February 1989 and Right (b): in January 1991.

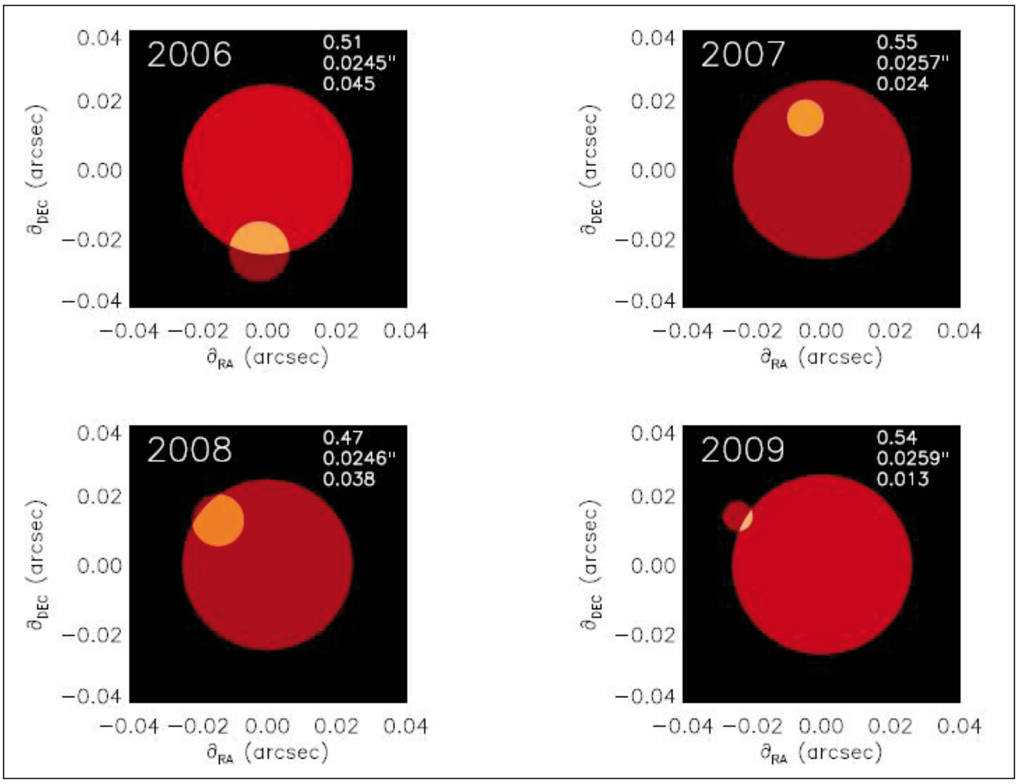


Image from the paper "The many faces of Betelgeuse".[2] A geometrical model for an hot spot, calculated from different measures made on Betelgeuse at the Berkeley Infrared Space Interferometer of 11.15 μm in 2006, 2007, 2008 and 2009. Each figure includes the fit parameters; the fraction of the total flux from the star, the stella radius in arcseconds, and the fraction of the total flux from the point. The point sources have been give the uniform disk sizes that they would have if they represented regions at a temperature of 7200 K. The upper limit on the point source diameter is 20 mas.

phenomenon has been reconsidered during the increment of luminosity occurred in December 1983 - February 1984.[8]

Changing of luminosity of 0.1 magnitudes occurred over a month are reported by several authors, and differential photometry has been carried on Betelgeuse compared with Gamma and Phi-2 Ori.[9]

Now the AAVSO website www.aavso.org gathers observations of Betelgeuse made worldwide by amateur astronomers.

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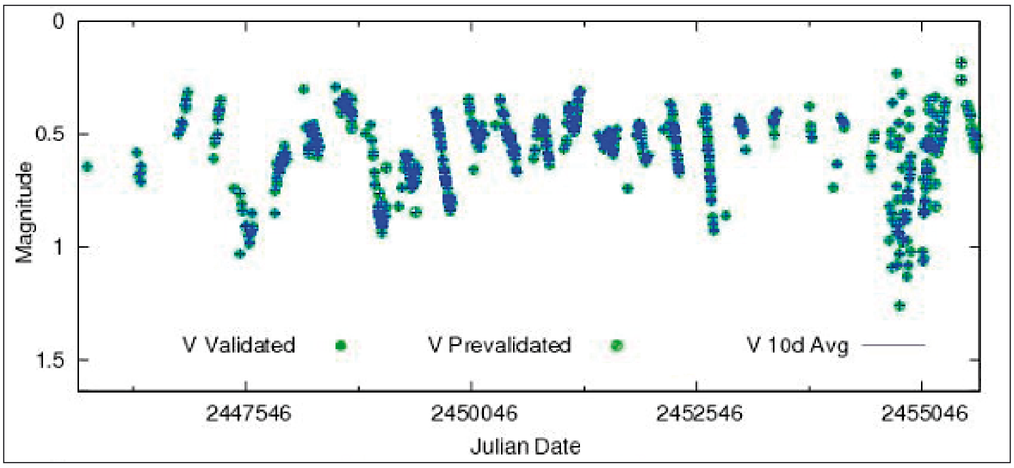
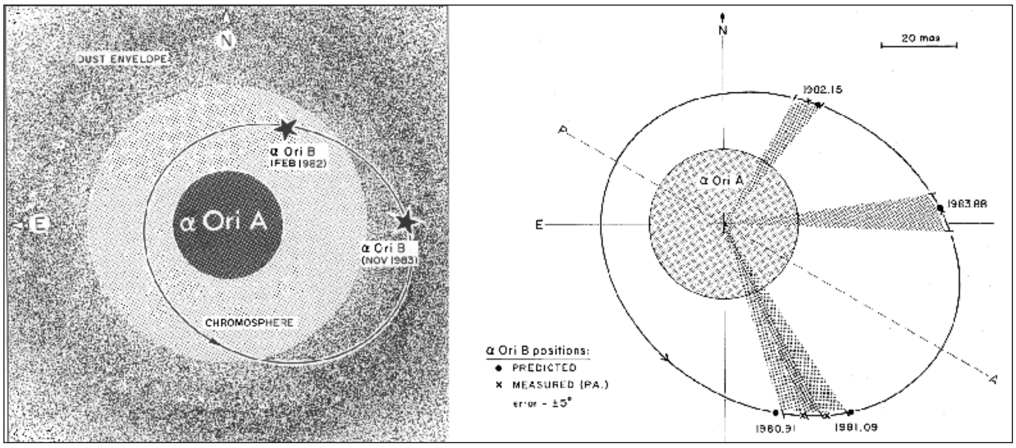
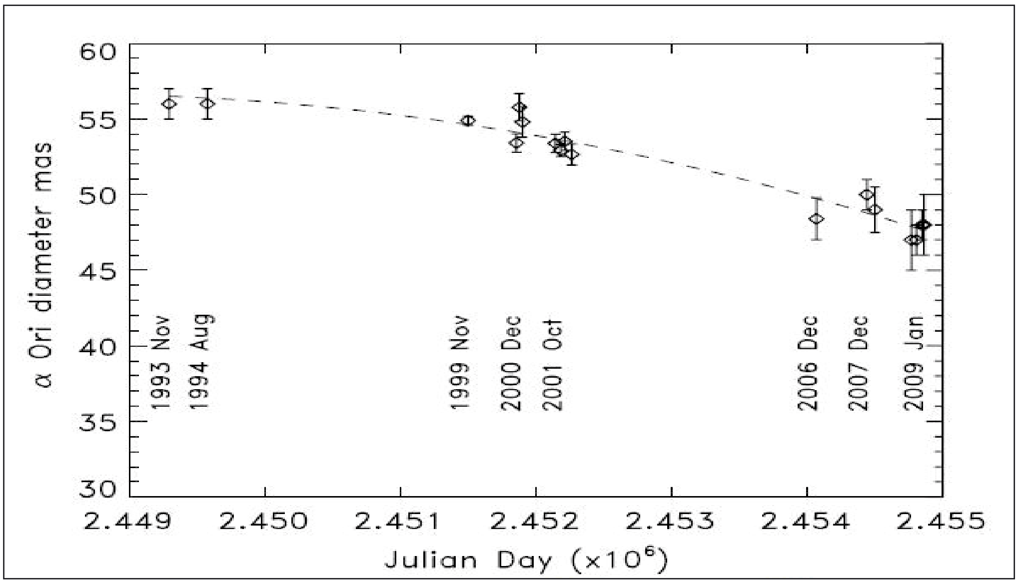


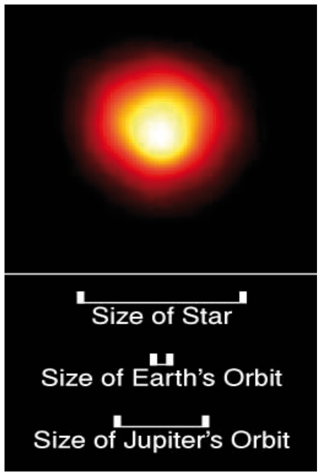
The luminosity of Betelgeuse in V-band, from AAVSO data.



The multiple system of Betelgeuse, with its extended chromospheres and the dust envelope around the star, from [8].



The diameter of Orionis measured at 11.15µm by the Betelgeuse at the Berkeley ISI Infrared Space Interferometer over 15 years. Values previously published are quoted in Townes et al., [5] were this figure has been taken. The dashed line is a quadratic fit to the data.



The angular diameter of Betelgeuse with the Hubble Space Telescope.[3]

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The CLAVIUS Four Centennial Meeting and XXXI ESOP

Costantino Sigismondi, ICRA International Center for Relativistic Astrophysics

The poster of the meeting, with the new sea bridge (2009) and the porto-canale, harbor on the river.

The XXXI European Symposium on Occultation Projects will be celebrated in ICRANet center of Pescara from 24 to 27 August 2012 (www.icranet.org/clavius2012). The occasion is the fourth centennial of the Jesuit astronomer Christopher Clavius (Bamberg 1538 - Napoli 1612). The hybrid eclipse witnessed by Clavius in Rome (1567) and published on his Commentarius on the Sphere (1581 edition) was the first account of an annular eclipse ever published in a scientific book. To account of this eclipse a larger solar diameter for 1567 has to be considered, and the scientific debate is still open. This is the trait-d'union between Clavius and ESOP annual meeting. The city of Pescara and the region of Abruzzo are presented with an historical, climatic, religious and gastronomical outline.

Clavius, the Euclid of XVI century

Christopher Clavius (Bamberg 1538 - Napoli 1612) was one of the greatest astronomers working at the dawn of telescopic age and contributing to the Copernican revolution. He taught mathematics and astronomy at the Collegio Romano for four decades, earning the title of "The second Euclid" and gave a contribution to the Gregorian reformation of the Calendar (1582) of paramount importance. The hybrid eclipse witnessed by Clavius in Rome (1567) and published on his Commentarius on the Sphere (1581 edition) was the first account of an annular eclipse ever published in a scientific book. According to Ptolemy's parameters such an eclipse was impossible because the angular solar diameter would never be larger than the lunar one. This eclipse was rediscussed by J. Eddy in 1978 in order to demonstrate a larger physical diameter of the Sun before the Maunder minimum (1645-1715).

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Clavius with the image of pope Gregory XIII, the reformer of the calendar.

The eclipse project has been carried out by several fellows of the European Section of International Occultation Timing Association (IOTA/ES), and by timing the Baily's beads the solar angular diameter is recovered up to a few hundredths of arcsecond of accuracy. This is the trait-d'union between Clavius, IOTA and solar diameter measurements: a project to monitor the solar diameter with drift-scan methods from ground is named Clavius.

A section dedicated to Clavius will have prominent scientists and historians, ready to present this figure of very high level at the dawn of telescopic era in astronomy.

Occultation astronomy and Relativity

Occultation astronomy, among all classical astronomy, provides the more accurate measurements of positional and physical parameters of asteroids, TNO and stars, paving the way to all relativistic measurements. That's why the International Center for Relativistic Astrophysics Network coordinating center of Pescara welcomes this meeting. Since more three decades ESOP gathered professional and amateur astronomers to share projects and observations based on the accurate timing of the occultations (asteroidal, lunar and Baily's beads).

Among the works relating Occultation Astronomy and General Relativity I can refer to the references of the following papers: Astrometry and Relativity [1]; Relativistic Implications of Solar Astrometry [2] where the topic of the solar obtaness, a possible issue of eclipse measurements,

is strictly related with the Dicke's experiments on quadrupole moment of the Sun in order to explain the anomalous precession of Mercury's perihelion. Also the paper dealing with the occultation of 161 Rhodope over Regulus of 19 october 2005 [3] showed the possibility to observe the relativistic light bending in the gravitational field of the Sun even 48° apart.

The hospitality of ICRANet, an international organism dedicated to General Relativity studies, for the ESOP meeting is therefore grounded also over solid scientific basis.

Pescara and Abruzzo

The yearly meetings, started before the fall of the Berlin's wall, were organized with the alternance of Eastern and Western Europe. Pescara, on the Adriatic Sea, is also a natural gate open to the Eastern Countries, and welcomes eagerly the XXXI ESOP in 2012.

Pescara is facing Albania, and the harbor of Split, in the former Jugoslavia. So the influence of Eastern Countries in this city is strong, and the presence of foreign people is normal.

Pescara is a young city, having celebrated its 85 years of foundation on January 2, 2012. But this city is the merge of two former villages, Castellamare and Pescara.

The geographical position allowed to this city to develop rapidly. With about 300000 people leaving in its surroundings Pescara become the most populated urban area of Abruzzo, the region immediately to the East of Lazio, were Rome is. In the years 70s an highway has been realized between Rome and Pescara, the A25 branch of the national highway network, and this allows in 1 hour and half to go from the capital to that pearl of the Adriatic sea.

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Abruzzo is called the Green Region of Europe, because agriculture is still the major source of its economy, and was under subventions from EU in the previous decade. It maintained its medieval traditions rather unchanged until the very last years, thanks to the geographical insulation due to the horography. Appennines mountains separate Abruzzo from Rome, and from the wealthier region of Marche at North, and from Puglia at South, where the shepherds from Abruzzo travelled to spend the wither with the flock. The climate in the mountain region is severe, reaching in some closed valleys the lowest temperatures of the whole peninsula (-32°C). Moreover thanks to the barrier that the mountains offer to the western currents from Mediterranean and from Atlantic, the region is under the influence of Balcan area, with the possibility to experience cold winters (record -13°C on January 4, 1979) even in Pescara.

That is for saying that the people from Abruzzo were used to face hard conditions of work in a life of sacrifices in order to obtain the food from the Earth.

Religion and history

Other important aspects of that region, as all regions of Italy, are the religious traditions. Now by the young generations, subjected to the globalization, these traditions are perceived more as touristic attractions, but the ancestral strength of these practices gains power as the youth matures.

In the mountains of Majella and Morrone the hermit Pietro Angelerio settled himself and a community of monk flourished in the fall of XIII century. Later in 1294 while he was in the mountain monastere of Sulmona he was elected pope, and he chose the name of Celestin V. He decided to be crowned in L'Aquila on August 29, 1294 the day of the feast of St. John the Baptist. After his death he was declared saint because of his many miracles.

The Perdonanza Celestiniana in L'Aquila on August 28-29.

This day become the first Jubilee, and the Jubilee of 1300 was inspired by this first event. A great ceremony was celebrated every year in L'Aquila from the evening of 28 to the evening of 29 of August: la Perdonanza. The 718th Perdonanza will occur right after the end of the ESOP meeting, and it is one occasion to visit the city of L'Aquila, the city founded by the "stupor Mundi" Frederic II of Svevia and twice destroyed by an earthquake in 1703 and in 2009. "Immota manet", fixed stays as the motto of L'Aquila says…

The church of Santa Maria in Collemaggio, built by saint Pietro Celestino, is one of the marvels of Abruzzo. There is the holy door opened on 28-29 August.

Summer in Pescara

The month of August is the warmest of the year. The Foehn wind through the Majella mountain, called Garbino, can rise the temperature of the air up to the record of 45°C of August 30, 2007, with very low humidity. The city is comfortable and the sea breeze makes the afternoon hours rather mild.

Pescara has some free beaches; one of them is 400 meter in front of the location of the congress, in the most central position of the city, very close to all hotels. Other beaches are equipped with all services, and the entrance is upon payment.

Gastronomical tradition in Abruzzo is incredibly rich, and nobody can complain of food in this region, which hosts the most famous school of Chefs de Cuisine in the World: the one of Villa Santa Maria.

La costa dei trabocchi, seaside in the surroundings of Pescara.

The invitation to attend the Clavius four centennial and the XXXI ESOP meeting and to know the Green Region of Europe, where also the sea is green as the pastures of the mountains (to quote Gabriele d'Annunzio, a famous italian poet born in Pescara) is made. Please go the website www.icranet.org/clavius2012

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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.

The Offices and Officers of IOTA

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http://www.occultations.org
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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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