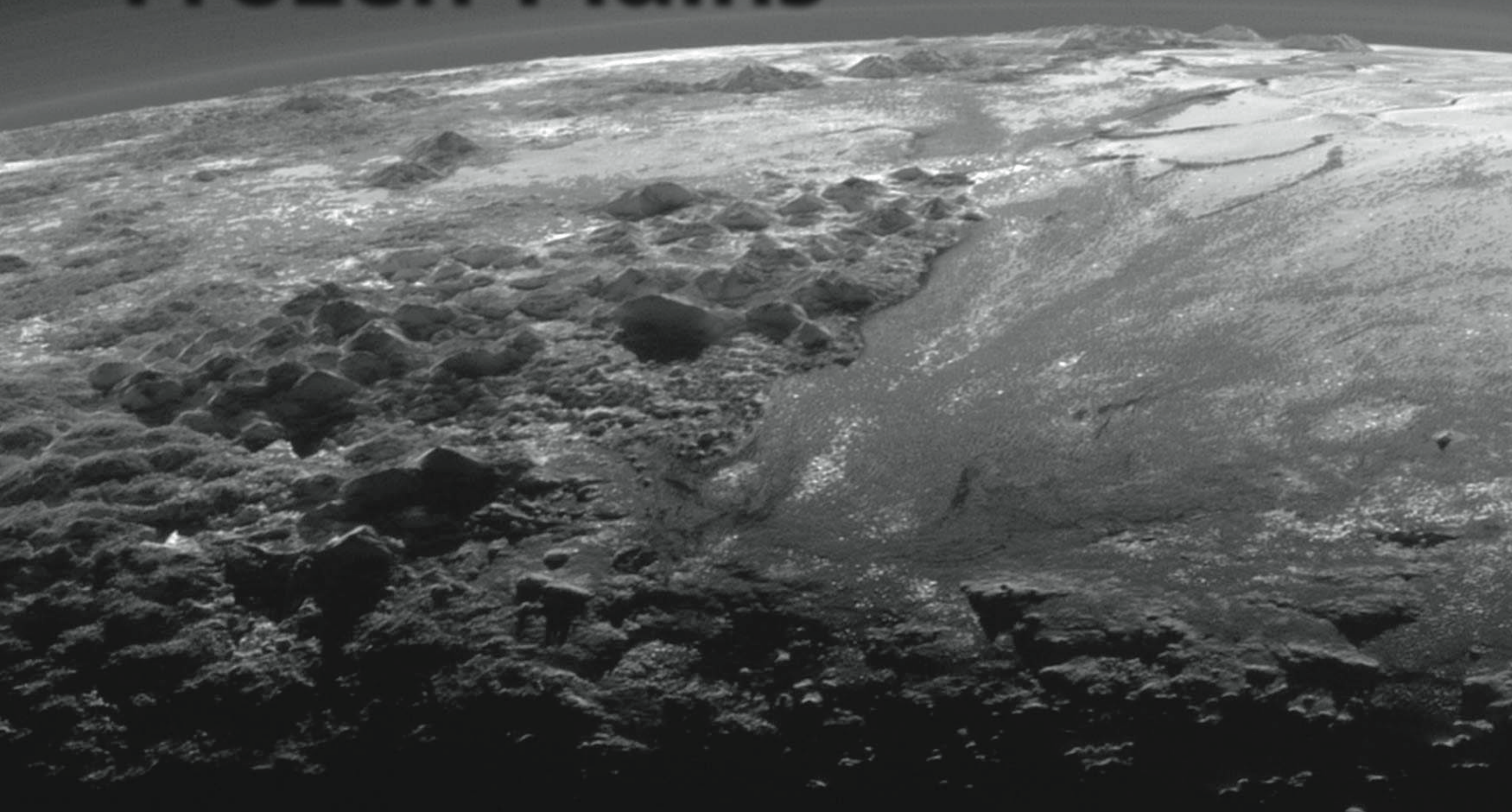
Journal for Occultation Astronomy

INTERNATIONAL OCCULTATION TIMING ASSOCIATION

2016 – 02

Majestic Mountains and Frozen Plains



Just 15 minutes after its closest approach to Pluto on July 14, 2015, NASA's New Horizons spacecraft looked back toward the sun and captured a near-sunset view of the rugged, icy mountains and flat ice plains extending to Pluto's horizon. The smooth expanse of the informally named Sputnik Planum (right) is flanked to the west (left) by rugged mountains up to 11,000 feet (3,500 meters) high, including the informally named Norgay Montes in the foreground and Hillary Montes on the skyline. The backlighting highlights more than a dozen layers of haze in Pluto's tenuous but distended atmosphere. The image was taken from a distance of 11,000 miles (18,000 kilometers) to Pluto; the scene is 230 miles (380 kilometers) across. The Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland, designed, built, and operates the New Horizons spacecraft, and manages the mission for NASA's Science Mission Directorate. The Southwest Research Institute, based in San Antonio, leads the science team, payload operations and encounter science planning. New Horizons is part of the New Frontiers Program managed by NASA's Marshall Space Flight Center in Huntsville, Alabama.

PIA19947: Closer Look: Majestic Mountains and Frozen Plains
http://photojournal.jpl.nasa.gov/catalog/PIA19947 http://www.nasa.gov/feature/pluto-wows-in-spectacular-new-backlit-panorama

Journal for Occultation Astronomy

Dear reader,

the 14th of September marked the start of a new era of occultation work: It was the day when the first release of the GAIA star catalogue was officially presented to the astronomical public. But for the occultation of a star by Pluto on July 19 this release came too late! Fortunately my long-time friend Ulrich Bastian, working as a leading-team-member at the Astronomisches Recheninstitut at Heidelberg, remembered my general interest in occultations. His workgroup followed his suggestion to present this star-position to all interested observer in advance making this the very first published GAIA-position of a star. The occultation by Pluto was recomputed and most successfully observed!

Although we now have a lot of interesting topics for articles there are not enough authors who have the time to contribute to the JOA. Therefore we will change the publishing terms of the JOA by producing it every time there are at least 12 pages to be printed. Additionally current and interesting topics will be presented more promptly.

As you certainly know there will be a solar eclipse on the 21st of August 2017. That has been the reason to reschedule the date of ESOP to September 15th-19th. Due to these facts IOTA-ES's board of directors decided that ESOP 2017 will take place in Germany, at Freiberg Saxony.

Unfortunately there are not always good news: Two of our most active astronomical friends passed away much too young: Alfons Gabel and Otto Farago.

Klaus-J. Bode

JOA 2016-2 · $ 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
- In case of pictures, mark them within the text like <picture001> where they should be positioned

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

A 13th Magnitude Asteroid Occultation Close to the Full Moon.

Testing the limits of occultation detectability of a WAT 120N+ under adverse lunar light conditions

Presented at the IOTA Annual Conference July, 2016

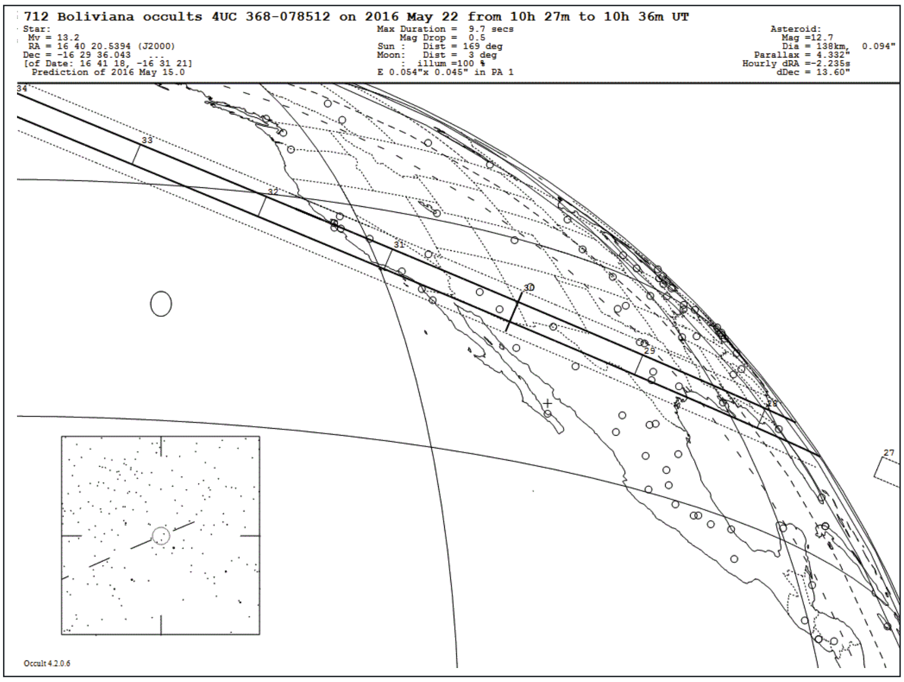
By Paul D. Maley, Carefree, AZ and Tony George, Scottsdale, AZ · [pdmaley@yahoo.com] and [triastro@oregontrail.net]
International Occultation Timing Association (IOTA)

Introduction

Asteroid occultation planning involves knowing one's equipment, personal capabilities and site-specific sky conditions. This includes a check of each element of an event before deciding whether it is worth attempting. For example, for an observer with an 80mm refractor, perhaps any occultation brighter than 10th magnitude, higher in elevation than 30 degrees and distance from the Moon of about 45 degrees could be considered a cutoff. Or still other criteria could be used. Much of this is uniquely subjective depending on a number of variable factors.

Now consider this. The target is a 13.2 magnitude star situated 3 degrees from a 100% sunlit Moon at an elevation of 30 degrees above azimuth 220. That azimuth puts it in the light bubble of Phoenix AZ as seen from the observer's location. A 0.5 magnitude drop was expected with maximum duration of 9.7 seconds. Under normal circumstances, these event characteristics dictate that it would be impossible and a complete waste of time even if one had a very large scope. The mere thought of a vast amount of incoming light producing a blinding whiteout of the field in a low light camera is an automatic rejection criterion.

However, after a long stretch of time without favorable occultations and a fair amount of desperation, one of the authors (Paul Maley) decided to attempt the occultation of 4UC368-078512 by the minor planet (712) Boliviana on the morning of May 22 from Carefree, Arizona.



Boliviana occultation visibility map courtesy Steve Preston

This paper is the documentation of the attempt and detectability limits determined from the video.

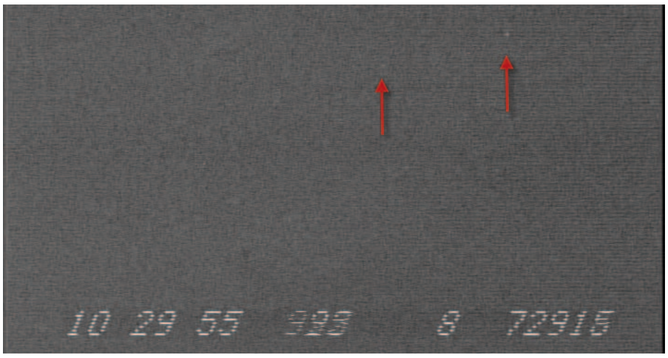
Observation and Equipment Details

A favorable sky forecast and diminishing winds allowed the author to use prepoint charts to set up a Celestron 11, Watec 120N and f/0.5 focal reducer at 08:43:50UT. A light shield was attached but it did not block any light due to the close proximity of the Moon. The telescope interior was not flocked in any way. To the left is a picture of co-author Paul D. Maley with the equipment used for the event.

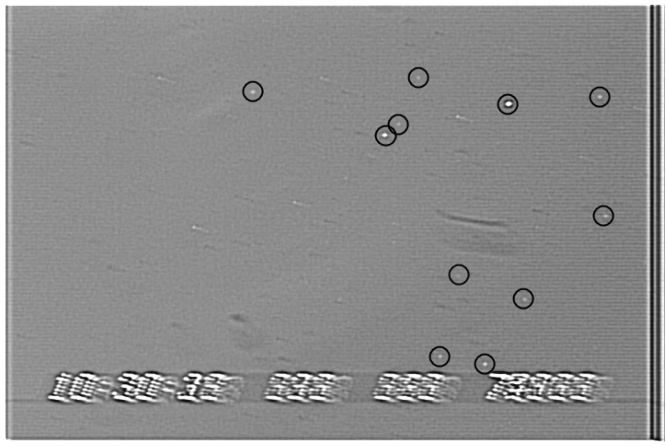
Central occultation was predicted to be 10:30:13. At different times a recording device (Canon ZR 80) was turned on to check and confirm that the field was where it was supposed to be in spite of light winds. As the Earth rotated and the Moon approached ever closer to the prepoint track the increase in moonlight became more evident. At 10:00:00 the field was swamped with moonlight and from then on the plan was to test the Watec at different settings to see if one or more would permit detection of any stars. An initial setting of SLOW 1 (2-field integration) was tested, but the final setting of SLOW 2 (4-field integration) was selected for recording the event. Beginning 45 seconds before central occultation the telescope drive was activated in order to increase the likelihood that stars might be captured. Explicit in this procedure was the expectation that the Earth had rotated the target star on to the field of view. The recording was terminated at 10:31:00. At no time were any stars visible on-screen during the real time recording process.

Results

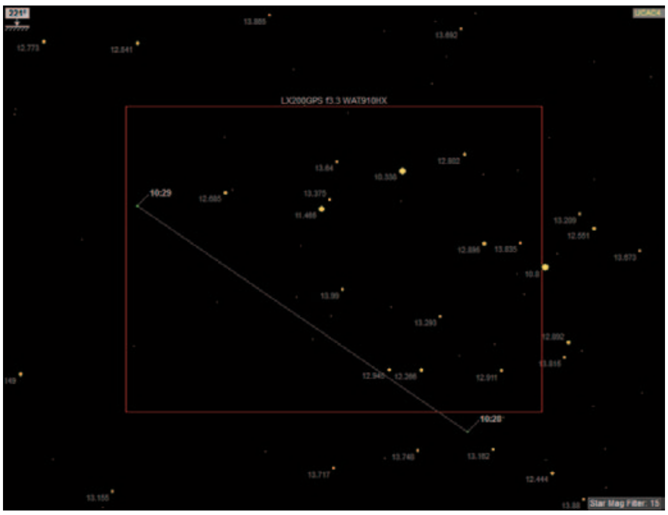
The recorded video showed no detectable stars on screen. The video was transmitted to co-author Tony George for analysis and determination of limiting star detectability and occultation event detectability. The video was analyzed using Limovie.1 There were two stars clearly visible on the video, however these stars could not be used to identify the target star or the general field of view recorded. The following graphic shows what was visible on the video (keeping in mind that nothing was visible to the author on screen at the time of recording).



Because the field of view could not be determined from the above graphic, Registax 5.2 was used to stack the frames of the video, registered on the brighter of the two stars visible, to bring out the detail of the various stars that were not visible so they could be used to identify the field of view. The resulting graphic follows.

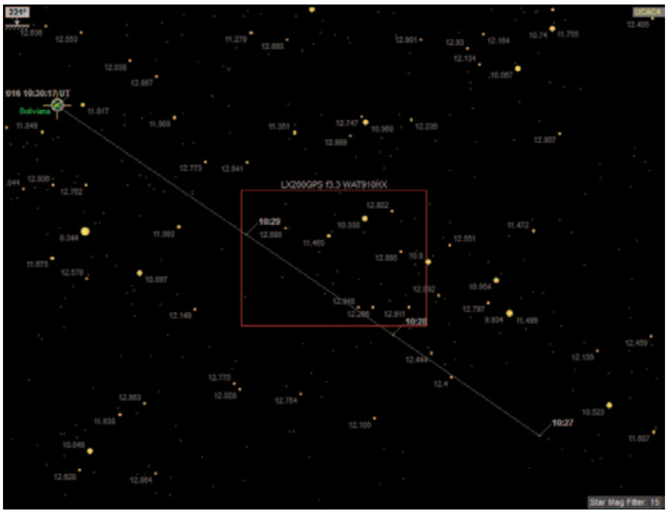


Bright streaks are 'hot pixels'. Dark streaks are dust motes on the CCD detector. All other point images are stars. Many of the 'stars' have been circled for clarity. C2A3 was used to identify the above 'field of view'. Here is the screen print from C2A that corresponds to the above graphic (co-author Tony George's f/3.3 field marker for his LX200GPS is shown; however, Paul Maley used a Celestron C11 for the observation at an equivalent f/5.0).



Using a comparison to the UCAC4 Catalog4, the brightness of the two bright stars was determined to be 10.338 and 11.465 magnitude respectively.

After the correct field of view was established, it was determined that the target star was NOT in the field of view at the calculated time of central occultation. Here is a graphic showing the relationship of the target star to the field of view of the video, along with the prepoint track of the star that the fixed camera field of view would follow as the earth turned:

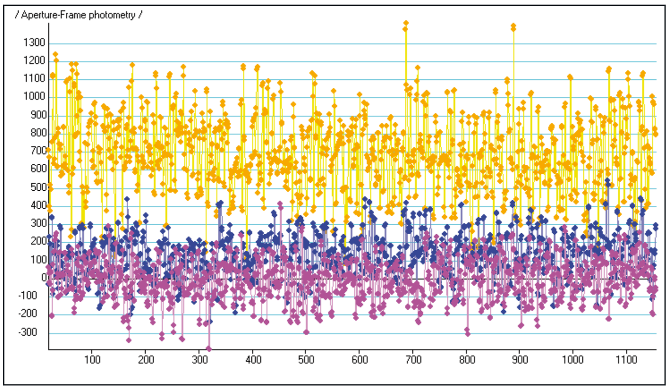


It was later learned that an anomalous prepoint chart entry error caused the predicted position to be one minute of time later than depicted on the charts. Regardless of this, the process of analyzing the data proved that stars down to magnitude 14 could be extracted from the video even though no stars could even be seen by the observer monitoring the Canon ZR flip screen!

Occultation Dectability Analysis

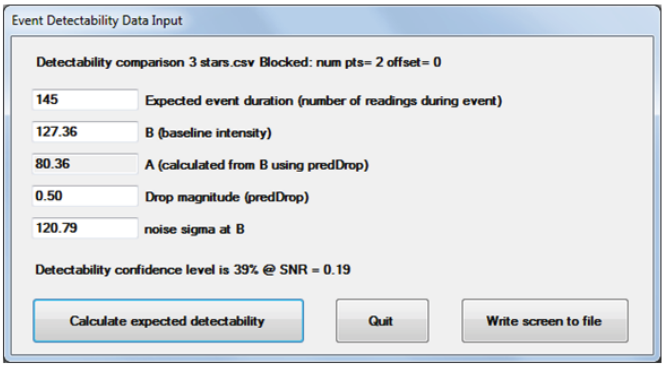
Even though stars down to 14th magnitude were recorded, it is not clear whether or not stars this faint could be reliably measured to determine if an occultation could be detected. To determine if this was possible, an additional analysis was performed.

First, the combined light of the Boliviana event (star + asteroid) was 12.2 magnitude. To simulate the potential to measure a star of this brightness in the glare of the nearby full Moon, Limovie was used to measure a light curve of the 12.266 magnitude star on the video. [Note: the star is not visible on the video, but an aperture was placed on the location where the star should be and a light curve was measured]. Here is the resulting light curve:



The gold trace is the 10.338 magnitude star. The blue trace is the 12.266 magnitude star. The magenta trace is a blank field with no star. The SLOW2 setting integrates 4 fields, so there are two data points of similar adu (analog to digital unit) value for each integrated reading. Occular5 was used to analyze the light curve and estimate the event detectability.

First the blue trace was analyzed. The average adu of the light curve is 127.36. The noise in the light curve is 119.93 adu. Therefore the signal-to-noise ratio of an event where the star totally disappeared would be 1.0, however the prediction for this event was a 0.5 magnitude drop. The duration of the event was 9.7 seconds, or approximately 145 readings (each reading represents the integration of 4 fields or two frames at 30 frames per second). The following graphic shows the Occular estimate of detectability.



Occular dectability of a 9.7 second event with a Δm=0.5

In order to be 'detectable' an event should have a detectability confidence level of 90% or greater. For the event light curve the detectability confidence level is 40%. This is far too low a level. The event therefore would NOT be detectable. The SNR (signal to noise ratio) of a 0.5 magnitude drop event is a meager 0.19 (Occular SNR = signal/2*sigma).

In order for a 9.7 second occultation event of a 12.2 magnitude star to be detectable with a full Moon only 3 degrees away using the author's equipment, the Occular detectability calculator indicates that a 2.5 magnitude drop would have to occur. See the following graphic:

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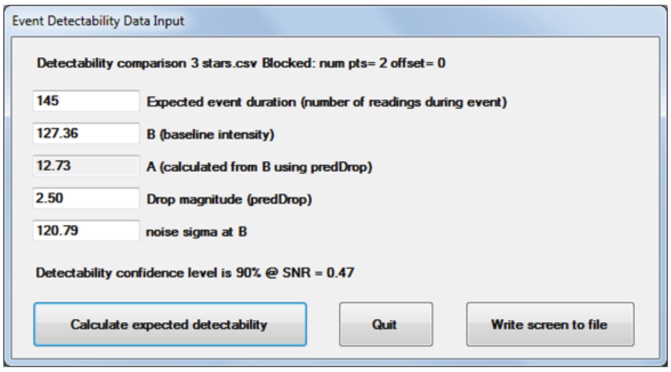
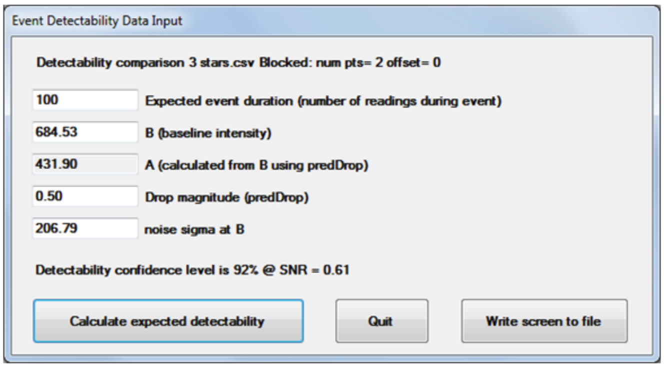


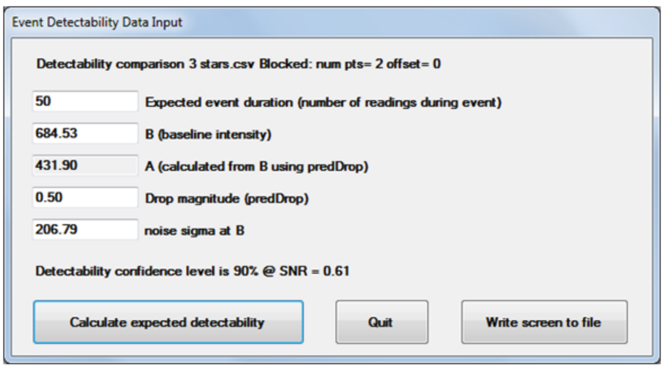
Occular detectability of a 12.2 magntidue star with a $\Delta m=2.5$

Next, the gold trace was analyzed. The average adu of the light curve is 684.53. The noise in the light curve is 206.79 adu. By iteration, using the Occular detectability calculator, it was found that a 0.5 magnitude drop event of 100 readings (6.69 seconds long) could be detected at the dectectability confidence level of 92%. See the following graphic:



Occular detectability of a 10.388 magnitude star with a $\Delta m=0.5$

Further iteration indicated that a 0.5 magnitude drop event as short as 50 readings (3.34 seconds) could be detected at the detectability confidence level of 90%, the minimum required to assure the event detected is real and not the result of noise in the light curve. See the following graphic:



Minimum Occular dectability of a 10.388 magnitude star with $\Delta m=0.5$

Conclusions

The co-author Paul D. Maley set out to attempt to record an occultation event of a target star + asteroid with a combined magnitude of 12.2 at a separation of only 3 degrees from a full Moon. Subsequent analysis of the video acquired indicated the target star was not present on the video. However, co-author Tony George determined that the predicted event would not have been detectable even if it had been in the field of view, as the magnitude drop was too low and/or the event was too short for the SNR of the event. Further analysis showed that an occultation of the 10.388 magnitude star (or combined equivalent magnitude) would have been detectable if the magnitude drop was 0.5 and the duration of the event was longer than 3.34 seconds.

The authors have documented that it is possible to record asteroidal occultations of 0.5 magnitude near the full Moon if the target star is magnitude 10 or brighter and the duration of the event is longer than 3 seconds.

The authors have also documented that it is possible to record asteroidal occultations of a 12.2 magnitude star if the duration of the event is 10 seconds and the magnitude drop is 2.5 or higher.

The above conclusions are valid for the telescope, focal reducer, camera and settings used by the author. Use of a different telescope, different focal ratio, or different camera will have different results. Observers are encouraged to test their equipment before attempting an observation.

(Endnotes)

1 LiMovie is Windows PC software developed by Japanese amateur Kazuhisa Miyashita that facilitates the analysis of light curves from captured video. The acronym stands for "LIght Measurement tool for Occultation observation using VIdeo rEcorder".

2 Registax 5.1 software for alignment/stacking/processing of images. Free software for alignment/stacking/processing of images. Copyright © 2010/2011 Cor Berrevoets (The Netherlands).

3 C2A (Computer Aided Astronomy) is a Planetarium software written by Philippe Deverchere that allows you to build detailed views of stellar fields for a wide variety of star catalogs. It is only available for the Microsoft Windows Operating System (all versions).

4 UCAC is an astrometric, observational program, which started in February 1998 at Cerro Tololo Interamerican

Observatory (CTIO) in Chile. All sky observations were completed at the Naval Observatory's Flagstaff Station in May 2004, and data reduction was completed in July 2009. The UCAC3 catalog was released on August 10, 2009 at the IAU General Assembly in Rio de Janero, Brazil. Bug fixes, reduction improvements, use of Northern Proper Motion data for proper motions and inclusion of APASS 5-band photometry lead to the final UCAC4, released in August 2012. UCAC4 is a compiled, all-sky star catalog covering mainly the 8 to 6 magnitude range in a single bandpass between V and R. Positional errors are about 15 to 20 mas for stars in the 10 to 14 mag range. Proper motions have been derived for most of the about 113 million stars utilizing about 140 other star catalogs with significant epoch difference to the UCAC CCD observations. These data are supplemented by 2 MASS photometric data for about 110 million stars and 5-band (B,V,g,r,i) photometry from the APASS (AAVSO Photometric All-Sky Survey) for over 50 million stars. UCAC4 also contains error estimates and various flags. All bright stars not observed with the astrograph have been added to UCAC4 from a set of Hipparcos and Tycho-2 stars. Thus UCAC4 should be complete from the brightest stars to about R=16, with the source of data indicated in flags. UCAC4 also provides a link to the original Hipparcos star number with additional data such as parallax found on a separate data file included in this release.

5 Occular 4.01 – Occultation Limovie Analysis Routine. Written by Bob Anderson and Tony George. Analyzes Limovie *.csv files for potential occultation events.

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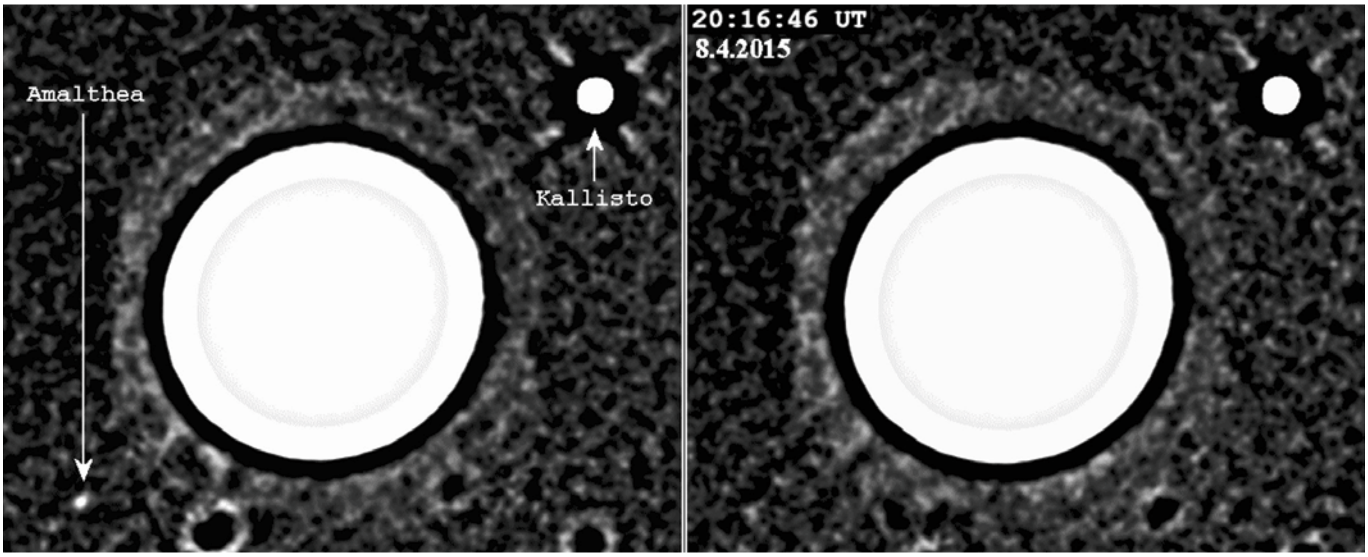
Two Eclipses of Amalthea

Bernd Gährken at ESOP 2015



Besides the 4 Galilean moons Jupiter has some 60 more moons that are much more difficult to observe. With one exception those moons were all discovered in the 20th and 21st century. Amalthea is an exceptional moon though. This 167km-big rock circles Jupiter inside the orbit of Io. Amaltea was discovered in 1892 by Edward Emerson Barnard and was both the first detection of a moon of Jupiter since Galileo's discovery in 1610 and also the last visual discovery of a Jovian moon. Even though Barnard was able to use the giant 36-inch telescope at Lick-observatory this discovery remains an incredible masterpiece due to the magnitude difference between Almathea and Jupiter of 1 : 2 Million and the maximum elongation of the moon to the planet's surface being less than half of that of Io!

Even using modern techniques the detection of Almathea is a difficult task. Usually a system of diaphragms is used to block the light of the planet. A large enough aperture allows photography in the methane band as a second option. At 890 nm there are absorption lines of methane, thus a filter blocks much light reflected from Jupiter while the moons gain in contrast. With a 50 nm wide methane band filter the magnitude of Almathea decreases from 14 to 18. Jupiter is still bright in the methane band but loses over 4 magnitudes thus improving the contrast to the moons. Another advantage is the red color of Almathea caused by the sulfur transfer from Io which lets Almathea get brighter in the infrared. Also the seeing is improved in IR, including the filtering out of much of the city light pollution.

Since Almathea needs only 12 hours to complete one orbit it might appear possible to record the moon in its maximum elongation each night. Only the spikes need to be in an optimum position not to cover Almathea which, when using a telescope on an azimuth mount, only happens within some 2 hours before and after Jupiter's culmination.

In 2015 the geometry of Jupiter's orbit caused mutual eclipses of the 4 Galilean moons that could be observed by the means of an amateur. Of course there also were eclipses of Amalthea making the recording of such an event a new challenge. Close to opposition Amalthea has maximum brightness but the eclipsing moon is always too close then, hiding Almathea by irradiation. The geometry is much better 2 or 3 months before and after opposition. IMCCE (1) had the data of hundreds of such eclipses, so events had to be sorted out where the eclipse would occur

close to maximum elongation of Almathea to give a slowly moving moon and the least irradiation by Jupiter,

with no irradiation of another Galilean moon in the field of view,

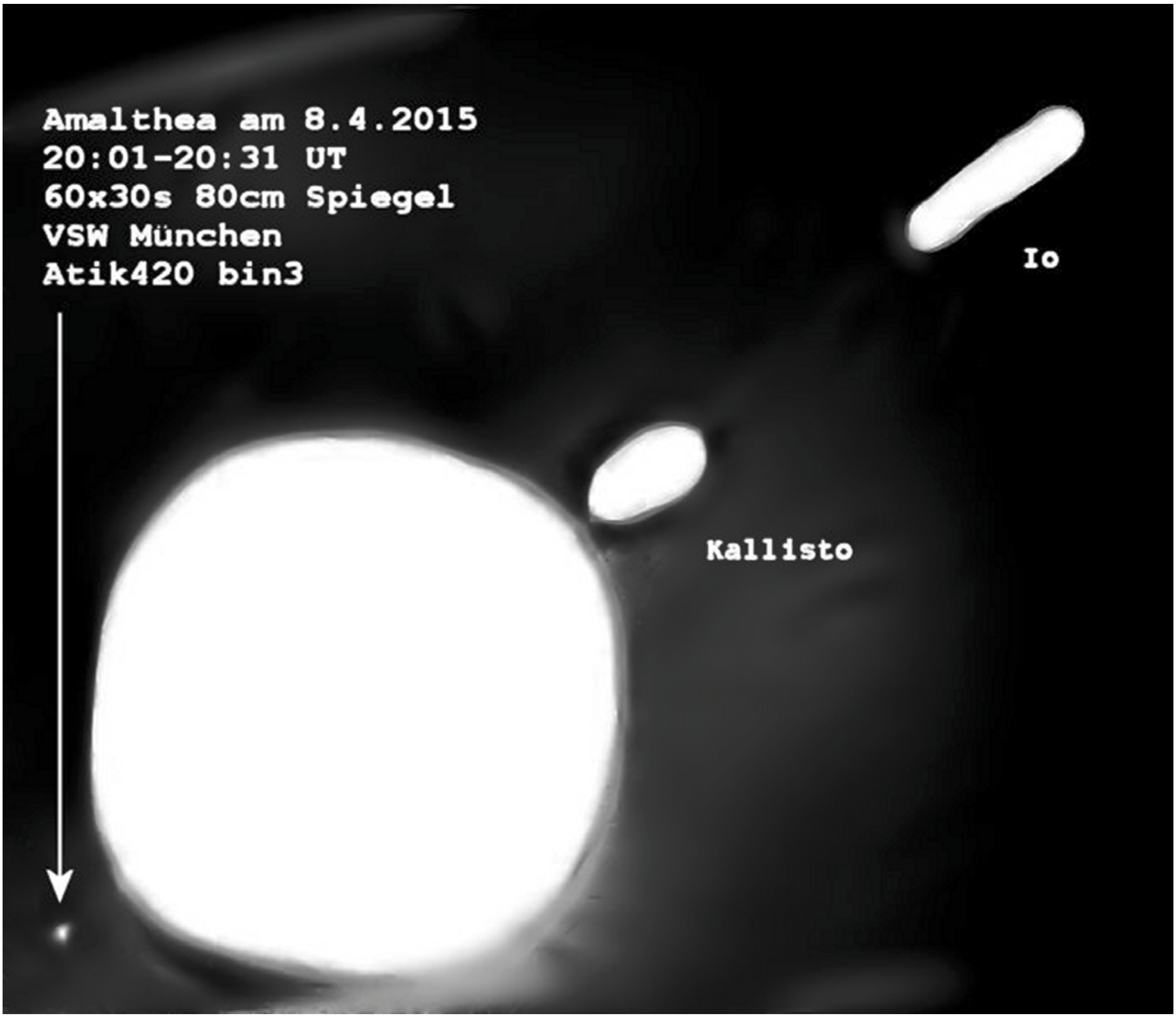
at sufficient altitude and some 2 hours away from the meridian and

with no background brightness caused by the moon or the sun.

The IMCCE-tables listed 5 matching events after opposition, and for 2 of those on April 7 and 8, 2015, the weather allowed an observation from Munich, Germany.

First the position of Almathea was simulated using the HORIZON (2) ephemeris. Single photographs were taken with exposures up to 30 seconds. The expected eclipse duration of 2.7 minutes thus should result in 5 pictures with an invisible Almathea.

All pictures were combined to find the correct positioning. The proper motion of Almathea relative to the eclipsing Kallisto was calculated and all single pictures were added considering this offset, resulting in trails of Kallisto and Io. As expected, Almathea appeared at the correct position.



The single exposures hardly revealed Almathea. For a better evaluation consecutively 3 pictures had to be added with a moving average. The moon disappeared at 20:17:01 UT and reappeared at 20:19:03 UT, matching rather well the predicted times (20:16:33 to 20:19:14 UT). Since the pictures combine a time span of 90 seconds there is a timing error of probably +/- 1 minute. Even so this successful recording caused much delight being possibly the first eclipse recording of Almathea ever done by an amateur and probably also the first one using the 890 nm methane band window instead of a diaphragm.

Another recording was made on April 7, 2015, for a predicted eclipse of Almathea by Ganymed. It was very astonishing that no eclipse could be seen at the predicted time even though the recording signal was very stable. Also a timing error could be ruled out due to the correct positions of the other moons. At IMCCE the surprise about this finding was less than expected. My report was answered very friendly, stating that for Almathea the ephemeris data is not as precise as for the larger Jovian moons. At the April 7-event the small Almathea was at the edge of the shadow cast by Ganymed and was just not reached by it. IMCCE promised an improvement of the ephemeris for the next mutual events in 2021.

Bern Gährken (Translation to English: Eberhard Riedel)

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PHEMU*

2014 - 2015 Mutual Phenomena of the Jovian Moons

The observation campaign at the astronomical workgroup of the Archenhold-Observatory in Berlin

Nico Wünsche · IOTA/ES

Every observer of planet Jupiter knows the phenomena of the Jovian moons, if a moon casts its shadow on Jupiter's clouds or gets hidden in Jupiter's shadow.

Approximately every six years we get more: since the orbits of the Galilean satellites are in nearly identical orbital planes, we can see mutual eclipses and occultations when the Earth crosses that plane.

The astronomical circumstances of the 2014-2015 PHEMU campaign were nearly ideal for observers in the northern hemisphere. Jupiter's opposition and the date of plane crossing were just a few days apart. Jupiter had a declination of about +21°.

At ESOP 2014 in Prague, Eleonore Saquet from the IMCCE gave a talk to motivate observers to make as many photometric observations as possible. She gave a short explanation as to why such observations are still scientifically valuable: the orbital perturbations of the Galilean moons are not yet fully understood. The observation of mutual phenomena is still the most precise way to measure the actual position of two moons besides sending a space probe to Jupiter.

***PHEMU – is a word made up by the IMCCE for "Mutual Phenomena" and has become a synonym for those events.**

Most observers of asteroidal occultations in Europe already use modern CCD or CMOS cameras for their observations. This equipment is well suited also for PHEMU observations.

The processing of the recorded images or video files can be done with the same software as for asteroidal occultations. Most European occultation observers were well prepared for this PHEMU campaign!

Again, the most serious obstacle for observations proved to be the weather. Many observations failed not because of technical problems but because of thick clouds...

Most observers of our group used a new type of camera in this campaign of PHEMU observations, a digital camera (QHYCCD) connected to a computer by USB. Compared to analogue Watec, Mintron and similar cameras there are many advantages. But we had to learn the hard way that we'd also got new problems. Timing an analogue video recording with a Video Time Inserter is very accurate and reliable. Precise timing of a digital video, transferred by USB to a MS Windows computer, proved to be a tough problem which cannot be solved entirely satisfactory. Each video frame has to be transferred into the computer first and then processed by the capturing software to get its time-stamp. There are variable delays, caused by the capture software, by the USB 2 bottleneck and also by the Windows operating system itself. You also have to accurately set the computer clock, which requires a permanent internet connection or a GPS receiver with a 1PPS-output and a piece of hardware, just to outline the issue.

For data mining and analysis we used the software Tangra. Fortunately, Tangra's author Hristo Pavlov responded quickly if someone reported missing features or problems with Tangra. More serious were the problems with early versions of the capturing software FireCapture. Its author Torsten Edelmann also quickly fixed reported bugs and made major improvements. But, you can repeat the analysis of an observation, you can't repeat the observation itself…

After successful observations and careful data processing, another challenge awaited the observers: reporting the data to IMCCE.

In our Berlin workgroup we had many discussions on how to understand the instructions on the IMCCE web page. It needed some e-mails to IMCCE to make it clear to us, what exactly was expected. This might have discouraged some observers from reporting their data.

At the workshop in October 2015 in Paris it was mentioned that only four German observers had reported PHEMU observation data to IMCCE. It seems quite unlikely that only four observers in Germany could successfully observe mutual phenomena of the Jovian moons...

Now the observers are waiting for a preliminary data reduction by the IMCCE, but this will take some time.

Beyond Jupiter

The world of distant minor planets

Since the degradation of Pluto in 2006 by the IAU, the planet Neptune marks the end of the zone of planets. Beyond Neptune, the world of icy large and small bodies, with and without an atmosphere (called Trans Neptunian Objects or TNOs) starts. This zone between Jupiter and Neptune is also host to mysterious objects, namely the Centaurs and the Neptune Trojans. All of these groups are summarized as "distant minor planets". Occultation observers investigate these members of our solar system, without ever using a spacecraft. The sheer number of these minor planets is huge. As of September 2016, the Minor Planet Center listed 678 Centaurs and 1769 TNOs. In the coming years, JOA wants to portray a member of this world in every issue; needless to say not all of them will get an article here.

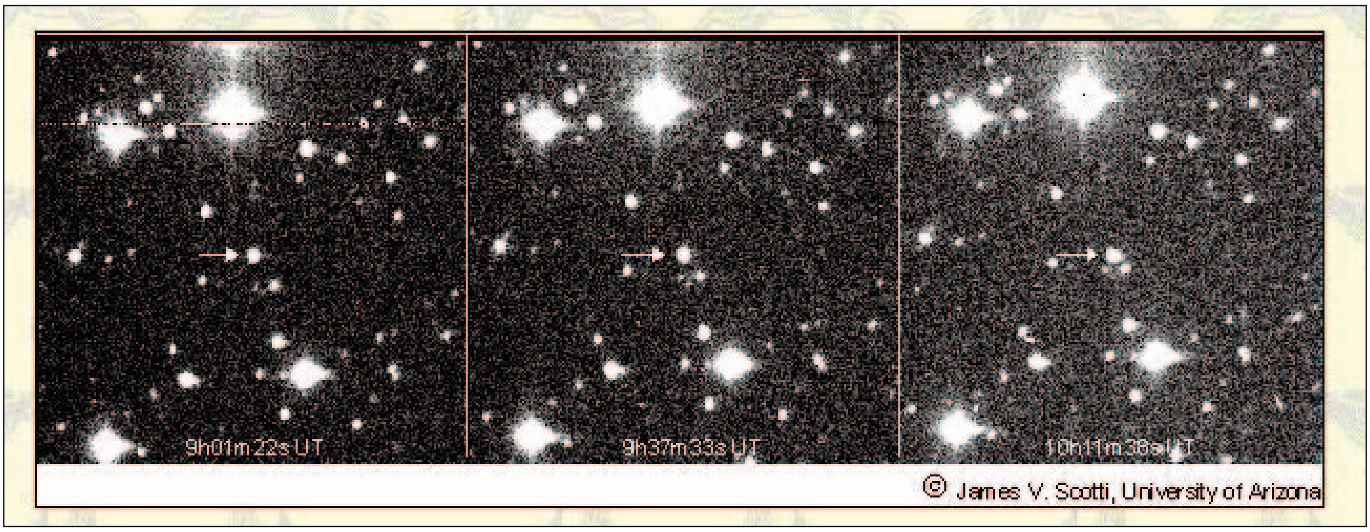
In this issue:

Focus on 5145 Pholus

Konrad Guhl (IOTA/ES):

Discovery:

The discovery of Pholus was a result of the Spacewatch project of the University of Arizona. The object was discovered January 9, 1992 by David Lincoln Rabinowitz at Kitt Peak National Observatory and got the preliminary name 1992AD[1]. Within the first month of observation, the noticeable red color (B-V=1.19; V-R=0.78) led to the nickname "Big Red". The discovery was announced in the IAUC 5511. In the following, pre-discovery observations at the Siding Spring Observatory in 1977 and 1982 as well as Palomar Mountain Observatory in 1989, 1991 and 1992 were recognised. The orbit shows the planet as a member of the family of Centaurs – a group of minor planets with the semi-major axis between the planets Jupiter and Neptune and a highly eccentric orbit.



Discovery photo of 1992AD:

The Name:

Pholus (Greek: Φόλος), as member of the family Centaurs, was named for a centaur. In Greek mythology, Pholus once hosted Heracles. In celebration of his guest, he opened a barrel of divine wine, given to all centaurs by Dionysus. The fragrant smell of the wine attracted and maddened the other centaurs, who were known for their brutal disposition and charged Heracles. Using poisoned arrows, Heracles killed the centaurs. As Pholus buried his slain kindred, he accidentally wounded himself with one of these arrows. Heracles tried to save him, but the poison proved too deadly. [Ref: Minor Planet Circ. 20523]

What we know:

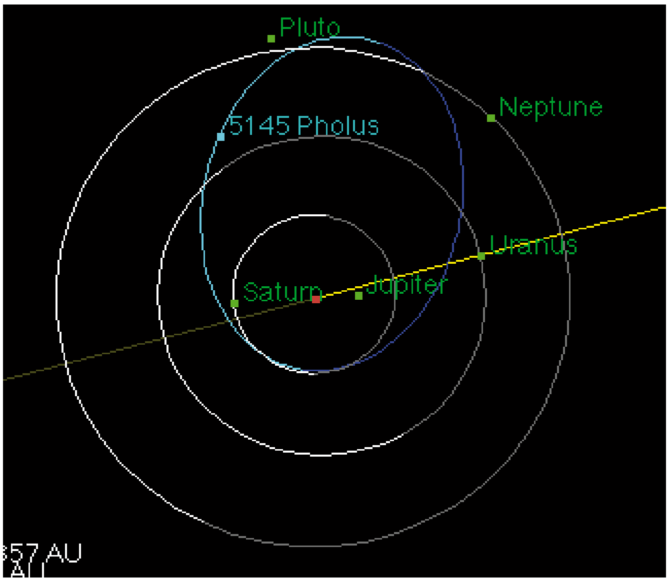
Pholus is a member of the Centaur group and the second Centaur (after Chiron) to be discovered. The photometrically calculated diameter is appr. 185 km. Light curves, measured by Buie and Bus[/2/], show a rotational period of 10 h. This corresponds with findings of two spatially segregated components according to the reflection spectrum[/3,4/]: A dark amorphous carbon area and an intimate mixture of water ice, methanol ice, olivine grains, and complex organic compounds (tholins). In contrast to other planets of the Centaur family, Pholus doesn't show any cometary activity.

Several occultation have been predicted, but to this day, no successful observations have been made.

The orbit:

The orbit is highly eccentric (0.57) and inclined to the ecliptic by 24°. It seems to be stable for now, but Pholus appears to have originated in the Kuiper belt.

The figure[/5/] shows Pholus' orbit crossing the orbits of Saturn, Uranus and Neptune.



References

/1/ Scotti J. V., D. L. Rabinowitz, 1992. „Discovery and Confirmation of the Asteroid 1992 JD."IAUC 5511.

/2/ Marc W. Buie and Schelte J. Bus, "Physical Observations of (5145 Pholus), ICARUS 100, 288-294 (1992)

/3/ Davis, Tholen and Ballantyne, „Infrared Observation of Distant Asteroids, Completing the Inventory of the Solar System, ASP Conference Series, Vol. 107, 1996

/4/ Cruikshank DP; et al., „The Composition of Centaur 5145 Pholus". Icarus. 135 (2): 389-407 (1998)

/5/ http://ssd.jpl.nasa.gov/sbdb.cgi?sstr=Pholus;orb=1;cov=0;log=0;cad=0#orb

Further Reading

/a/ https://en.wikipedia.org/wiki/5145_Pholus

/b/ http://ssd.jpl.nasa.gov/sbdb.cgi

/c/ http://spacewatch.lpl.arizona.edu/publications.shtml

/d/ http://www.minorp lanetcenter.org/iau/lists/Centaurs.html

In Memorian

Alfons Gabel

1952-2016

Alfons Gabel was an active observer of all kind of occultations with a range of instruments - from binoculars to a 1.2 meter telescope. He started as a visual observer with a DCF beeper and finally moved on to webcam and CCD observations.

His earliest asteroidal occultation report listed at the Occult database is the highly successful observation of (345) Tercidina in September 2002, where he observed this event visually from a mobile site near Freiburg with a positive result.

The following year he was a member of the LOC of ESOP XXII at Trebur, Germany. Beside many ESOPs he also attended the "Europlanet Occultation Workshop" in Paris in 2007.

In May 2004 he joined an expedition team to Namibia to observe a grazing occultation of Alpha Librae during a total eclipse of the moon.

In December 2009 another positive observation of an occultation was measured visually by Alfons at his home station. (599) Luisa occulted the target star for 4.6 seconds.

One of the best observed events in occultation history happened across Europe in 2010. The asteroid (472) Roma occulted a 3 mag star. This was the perfect event to introduce occultation work to other amateur astronomers. Alfons spread the word about this upcoming occultation on several blogs and newsletters. After the event he checked the incoming reports of the first-time observers. He found many errors at these reports (e.g. wrong time, difficulties in determination of the geographical position), which gave him a great amount of work to verify the reported data and finally adding these reports to the official database.

Alfons tried two times to record a "positive" of asteroid "Alphonsina" in 2003 and 2013 but he wasn't successful.

In 2014 he recorded another "positive" at an occultation by (56) Metis.

In January 2015 Alfons and Dr. Georg Piehler made light curve measurements of (216) Kleopatra with the T1T at Trebur for an upcoming occultation highlight by the asteroid two months later. Their data predicted that Kleopatra would present its elongated profile during the time of occultation. The reports after the occultation proved that their data was correct. Alfons was sad about his own attempt to observe the Kleopatra event. He was unsuccessful due to a technical failure.

Later that year Alfons was confronted with even worse news. His state of health decreased rapidly. When I met him at the hospital in January 2016 he summarised his life and came to a positive result - personally and astronomically. He never regretted any observation even if it was "negative" or "clouded out" at a mobile site.

At May 2016 Alfons was able to attend another astronomical event. It was the day of the transit of Mercury. Alfons was rolled on his bed into the garden in front of his room at the hospital. While he stayed in the shadow, I positioned the H-Alpha telescope with the DMK-camera to the sun. Alfons was able to see the image on the screen of a notebook connected with a long USB-cable with the camera. "There it is!" he shouted out loud as he recognised the small dot of Mercury in the front of the solar disk. Instantly Alfons started to explain to the doctors and the staff of the hospital in understandable words this seldom phenomenon. He did it with great excitement. Besides working with high accuracy this was his strong talent, which he used very often at public days at the Paul-Baumann-Sternwarte" of the "Astronomische Arbeitsgemeinschaft Mainz e. V." and the "T1T" of the "Astronomie Stiftung Trebur".

While watching the screen Alfons gave me advises to focus and frame the image and I was controlling the telescope in the sun. Finally we made some videos of Mercury near an active region until the sun disappeared behind clouds.

This was Alfons' last astronomical observation.

He passed away peacefully at June 30th 2016.

Oliver Klös, IOTA-ES ■

Ottó Faragó

1952-2016

Orbituary for Ottó Faragó

Last August, our dear colleague and friend Ottó Faragó passed away.

In the occultation community many knew him for over two decades as a dedicated member and friend. Though being a highly experienced veteran to occultation works, Ottó was always very modest about his contribution and preferred working in the background. The organization of the 18th ESOP held 1999 in Stuttgart was one of the few occasions in which his contribution became widely noticeable. In addition to that, Ottó was an important part of Stuttgart Observatory and continuously helped to reshape it.

For many astronomers Ottó was a great motivator and encouraged them to join him in his fascination for occultations and their measurement. He was able to communicate this devotion so that one got up happily and full of excitement at 4 a.m. in a windy winter's night to collect data for an unlikely hit.

Unforgotten to me are our great journeys to measure occultations, join conferences or just spend our holidays together. These wonderful, funny and instructive experiences formed a deep and special friendship between Ottó and me. Surely many other astronomers will remember similar experiences with Ottó. But more than this, he will be remembered for the uncounted occasions in which he helped without asking or wish of recognition. When he put ideas into practice, he did it with love for details and unique technical solutions.

We are grateful for his friendship, and although we all miss Ottó, he surely won't be forgotten and we will carry on his passion for astronomy.

Andreas Eberle, Stuttgart Observatory ■

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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http://www.occultations.org
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