The Newsletter of United Astronomy Clubs of New Jersey

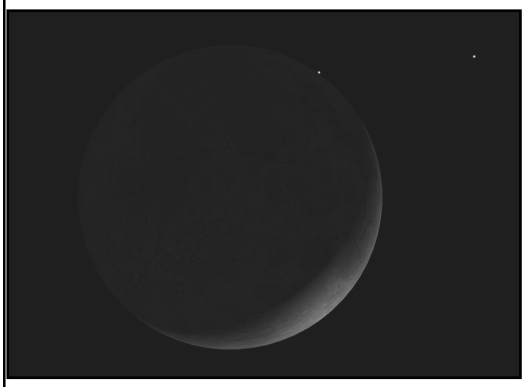
FOCUS

May 2010 **Special Lunar Occultation Edition** Editor, Diane Jeffer, astrodiane@gmail.com

Occultations by the Moon

Krishnadas Kootale, MMAS, NJAA

Over the course of its revolution around the Earth, the Moon occasionally passes in front of stars and planets. These eclipses, or lunar occultations as they are known, are great visual spectacles to watch. As the Moon's limb comes between us and a star or a planet that object vanishes from our view, instantly in the case of stars, which are point sources of light, and gradually in the case of planets as they have a discernible disc. As the Moon continues its eastward journey, the occulted object emerges from behind the other limb. Occultations of brighter objects such as planets and bright stars are easy to observe as they do not require large telescopes or sensitive imaging devices. They can be observed using modest equipment such as a pair of binoculars, or even with the naked eye.



Grazing Occultation of star 9 Geminorum, May 16, 2010, simulated using Starry Night–FOV 16x80 binoculars

A grazing occultation is even more exciting as the Moon's northern or southern limb just grazes an object. The graze has a narrow path, but to observers close to that path the object can disappear and reappear, sometimes repeatedly over a brief period of time, as hills and valleys on the lunar limb move over the object.

Data on timing and duration of the disappearance and reappearance of an occulted object is valuable from several points of view and complement other sources of data and information. They help refine our knowledge of the lunar profile which in turn helps estimate the diameter of the Sun during eclipses, and predict Bailey's beads during solar eclipses. The occultation data are also useful for refining the star coordinate system. Observations of lunar occultations have been instrumental in discovering binary stars and measuring their separation. This is especially useful for binaries that are very close. Super giant stars such as Antares do not appear as point sources of light like other stars, and hence do not disappear instantly during an occultation. Lunar occultations of such stars provide a method of estimating their size.

International Occultation Timing Association (IOTA) analyzes occultation data from around the world, and functions as the repository of information about occultations. Predictions of lunar occultations can be obtained from IOTA with detailed maps and graze lines. Occultations of bright objects are also published in *Observer's Handbook* from the Royal Astronomical Society of Canada, and in *Sky and Telescope* magazine.

Upcoming Events

June 5
Board Meeting
July 17
Annual Picnic
September 24-26
Symposium

UACNJ Officers

President
Dale Gary (AAI)
dgary@yahoo.com

Vice President
Gil Jeffer (NWJAA)
gil.jeffer@gmail.com

Secretary
Krishnadas Kootale (MMAS)
ckkrish@gmail.com

Treasurer
Diane Jeffer (NWJAA)
astrodiane@gmail.com

Trustee 2008-2010
Walter Rothaug (RAC)
wrothaug@gmail.com

Trustee 2009-2011
Jim DeLillo (MMAS)
jimdelillo@optonline.net

Trustee 2010-2012
Jim Norton (NWJAA)
norton@optonline.net

Communications Committee
Sherwood Waggy (NWJAA)
sherwoodwaggy@gmail.com

Credentials Committee
Ron Russo (MMAS, SSG)
ron@roned.com

Finance Committee
Karl Hricko (AAI)
hrickokj@embarqmail.com

Membership Committee
Diane Jeffer (NWJAA)
astrodiane@gmail.com

Observatory Committee
Gil Jeffer (NWJAA)
gil.jeffer@gmail.com

UACNJ Team Successfully Observes Lunar Grazing Occultation

Krishnadas Kootale, MMAS, NJAA

A team of observers from UACNJ reported successful observing of the grazing of the star 9 Geminorum by the three-day-old crescent Moon on Sunday, May 16.

The observations were made from the sidewalks of Green Hill Drive in Hackettstown, NJ, about 75 feet north of the official graze center line.

Greg Takesh, Warren Westura, Jim Norton, Dr. and Mrs. Lonny Buinis, Dale Gary, Gil Jeffer, and Krishnadas Kootale set up five telescopes—two for imaging and the remaining for visual observing—and one pair of binoculars. The sky was mostly clear except for some haze forming low in the horizon which eventually engulfed the Moon around the peak of the event at about 9:50 PM. This made visual determination of the graze somewhat difficult. However, analysis of image frames showed that the webcam had succeeded in capturing the occultation during which the star disappeared behind the mountains on the northern lunar limb for a little under five seconds. The occultation data was duly compiled and submitted to the International Occultation Timing Association.

An Observer's Impressions

Warren Westura, SHAA

This was by far the most fun I have had at a celestial event other than Hale-Bopp back in 1999. Kris did a yeoman's job in putting out good information about the event, printing out the line of occultation maps so that we could find what was the perfect place to observe and notifying the local authorities about our mission. It was so enjoyable that even the inevitable horizon haze enveloping the moon right at the critical time didn't really diminish the fun!

Jim Norton and I pooled our equipment to see if a DSLR with a hi-def movie clip could capture the grazing occultation of 9 Geminorum by the moon, and while we got some good moon video, we will have to really examine the clip closely to see if that six magnitude star actually recorded. Still, seeing a small group of astronomers being treated to a grazing occultation and a Lunar-Venus conjunction was amusing in it's own right; sharing a rare celestial event with a group of other enthusiasts made for a wonderful evening! Dale Gary seems to have gotten a really good video of the event on his computer and scope, and the variety of equipment brought by everyone added to the enjoyment of the event since so many varied views of the occultation were available! I just hope that I can tweak something out of my attempt!

Having the weather cooperate was a big plus and since we did have such a long lead time to prepare—thanks again to Kris—the opportunity was taken advantage of fully.

I have to remember the next time to bring the coffee and donuts! Wonder if it's too early to plan for the next transit of Venus?

Krishnadas Kootale, Dale Gary, Greg Takesh
Photos by Warren Westura

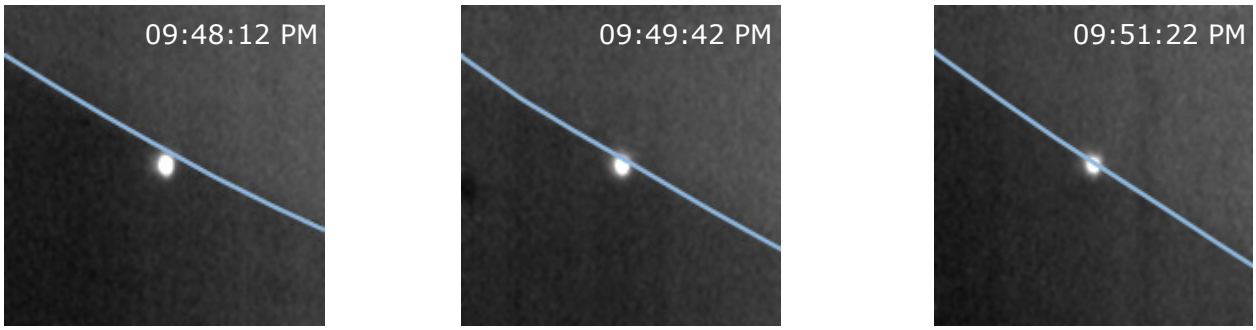
Grazing Occultation Timing Results

Dale E. Gary, AAI, NJIT

The May 16, 2010 grazing lunar occultation of 9 Geminorum (visual magnitude 6.21) was recorded with a 10-inch Meade LX200GPS equipped with a Philips Toucam II webcam. The Moon was at an elevation of 13 degrees at the time, and was entering a light haze, making the star image only faintly visible when recorded at 15 frames per second. The limb (edge) of the Moon that occulted the star was lit only by earthshine and was too dim to see in individual frames. However, the star was bright enough to find, center in the field of view, and achieve best focus. Everything was ready to record about ten minutes prior to the predicted disappearance.

Recording was begun about two minutes prior to the prediction, at 9:48:12 PM local time. A 36 MB AVI file of part of the recording can be downloaded at http://web.njit.edu/~gary/astro_images/. The entire recording is 5 minutes 34 seconds long. I was watching the video monitor during the recording and no one was sure whether an occultation had actually occurred. On playback of the video the next day, it was immediately obvious that the star had indeed blinked out for 4.54 seconds. The star was extinguished in less than one video frame (about 67 ms, or 1/15th of a second), and reappeared with equal suddenness. From the audio that one can hear in the AVI file, I was glancing at my watch at the time of disappearance, and when I returned to the monitor, the less than five-second disappearance was already over. (You can hear me saying, "It is still there," after it had in fact reappeared.)

I used VirtualDub to break the 2.2 GB AVI file into usable chunks of 400 frames (each about 27 seconds in duration). The three images below are stacks of 400 frames each with Registax 5.1, taken well before the time of disappearance (left frame), and then just before disappearance (middle) and just after reappearance (right). The frame size is 1 arcmin x 1 arcmin. The limb of the Moon is just faintly visible in the stacked images. The blue lines are added to heighten the visibility of the limb of the earthshine-lit Moon.



The Moon was sliding past the star at a rate of 0.625 arc seconds per second so it traveled a distance of 2.84 arc seconds in 4.54 seconds. At the distance of the Moon, this corresponds to 5.1 km, so we can infer that a mountain about 5 km wide clipped the star from our vantage point. For reference, the star images in the above frames are about three arc seconds wide.

The timing results, shown in the table below, have been reported to the International Occultation Timing Association (IOTA).

Longitude			74 47 50.5 W			Latitude		40 51 03.27 N		
Date (UTC)			**Time (UTC)**			**Star**	**Graze**	**Phenomenon**	**Limb**	**Duration**
YYYY	MM	DD	HH	MM	SS.SS	Number	Y/N			s.sss
2010	05	17	01	50	50.570	ZC956	Y	Disappear	Dark Limb	0.067
2010	05	17	01	50	55.110	ZC956	Y	Reappear	Dark Limb	0.067

Lunar Occultation of May 16, 2010: A Personal Log

Krishnadas Kootale, MMAS, NJAA

Our meeting point was spacious with ample parking space for the handful of people who were planning to attend, with a great view of the entire western horizon. Greg Takesh, Dale Gary, Warren Westura, and Jim Norton were already at the rendezvous point when I arrived. There were a couple of side walk locations in the vicinity that were closer to the graze center line and would definitely improve the chances of capturing the star in its magical act of disappearance and reappearance so we decided to set up our equipment there. I figured the elevation is probably around 850 feet and the distance from center line about 75-100 feet, *a la* Pythagoras, our net distance from the center line should be about 860 feet. At that distance, the predicted lunar profile gave about five seconds of vanishing act by the star. Not too bad! The sidewalk, though on a hilly climb, turned out to be flat and spacious enough for everyone's scopes and other gear, and the view wide and clear all the way down to the horizon. So we decided to set up camp there.

The moon was getting lower on the horizon—at the peak of the event at about 9:50 PM it would be just about 12 degrees altitude, nearly at a horizontal position by any measure. We got busy unloading our gear. Jim started setting up his SCT, which he was to pilot taking Warren's SLR camera as its payload; Dale had his scope and an imaging device ready to set up; Greg was on his way with his refractor; and I had a binocular setup. Gil Jeffer joined us and I continued my struggle to extend the wooden tripod legs which were held tight by the mount head bolts and the recent polish work I had on the legs. At half past 9, I gave up on extending the tripod legs and simply mounted the binoculars on the retracted tripod. A bit short, but it would work.

I took a peek through the binoculars and saw that the star, a tiny bright dot, looked almost a third of its way over the dark limb of the moon. We watched the star get closer and closer to the northern limb, as it took a course exactly on a tangent to the Moon. It is amazing how we can see the Moon move eastward in such a short time. It reminded me of the motion of Jupiter's moons that one could detect while looking at them, but only the moon was moving faster, a lot faster. In the meantime Lonny Buinis and his wife joined us. As we watched the bright dot move in for a brush with the moon's dark limb, glowing gloriously in earth shine, we realized the peak was quickly approaching. The star was almost brushing the moon on the 16 power binoculars, so I moved to Greg's refractor which, at more than 100X, showed a decent gap between the two objects. Dale's imaging device was locked on to the star and his laptop screen had a window with a big bright dot on it showing his tight grip on the star. On the upper side of the frame we could carefully see the dark limb of the moon. Dale was vigorously capturing frames at 15fps, and was a bit concerned that he might soon run out of disk space. Jim and Warren had their equipment locked in too. The crescent was crisp clear on the LCD screen. While Jim stayed at the scope to ensure the scope stayed on target, Warren shuttled back and forth different equipment making sure the SLR frame is consistent with the fields of view in other scopes. Gil lay on the ground as if to mimic the path of the star relative to the moon's northern limb where they were headed for their meeting. We made some comments about his position, but he was intensely watching the sky through a curious looking device and appeared totally focused on that.

The bright dot was now right at the edge of the northern limb. I am sure everyone was staring at their screens and eyepieces as I was through the binoculars. That view through the binoculars was simply beautiful. Visually, we weren't sure if we really saw the star blink or saw it disappear behind the hills on the moon, although I could swear I saw a blink once, and later disappear. However, there was no consensus on the visual, and a haze was beginning to engulf the moon at that moment from which it was not to come out. A peep through Greg's scope showed that the peak was over and the gap between the star and the moon had begun to widen. "Yep, it's over", Greg confirmed.

This was my first ever view of a lunar occultation, grazing or otherwise. Did the star actually blink or not, did it or did it not disappear behind the hills on the lunar limb for those few seconds before it was totally lost in the haze, I will leave for the image frames to settle. I take back a wonderful view of the moon, a crisp crescent about 10 per cent lit on the lower side, the other 90 per cent glowing in earth shine, with a sharp bright dot right at the northern edge, like a beautifully designed celestial pendant. That image will occupy a place in my memory, right along my first view of Saturn through a four-inch reflector!