The Valley Skywatcher

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M27 Dumbbell Nebula **Image by CVAS member Sam Bennici**

Northern Lights Delights

By Steve Fishman

I can clearly remember my first impressive northern lights show. Doug Caprette (CVAS member from the 1970's and early 1980's) and I did a week vacation capping it off at the July 1981 Stellafane amateur telescope makers' convention in Springfield, Vermont. On our first night out, we camped somewhere in the eastern part of the New York Adirondacks.

After dark, we walked over to a clearing to do some observing and noticed the sky was unusually bright considering it was past astronomical twilight and there were no nearby cities that would cause light pollution. It was an aurora and as the minutes wore on, it turned into a stunning display. At our zenith lay a circle of white aurora about 10 degrees in diameter. Radiating out from the circle, there must have been 30 symmetrical rays extending down to the horizon and covering the whole sky. In rapid motion, one ray would get brighter, then dim slightly, the ray next it would get brighter, then dim. The motion was so rapid, it appeared to take just a second or two for all 30 to brighten and dim as the light raced around our heads for several minutes.

That experience inspired me to learn more about the northern lights, photographic it and when possible, use whatever resources are available to predict when it may occur in the Chagrin Valley area.

One other factor that got me interested came from a mid-1980's OTAA presentation by Black river members Randy Beechler, Mike Harkey and Joe Manacci. A few years earlier, during solar maximum, they made several trips to upper Manitoba province to photograph the aurora, at 53-56 degrees north latitude. Google Thompson, Manitoba to see how far north they went. In October 1989, I made my first trip with Mike and Joe to do the same. After a 28 hour nonstop drive, we pulled into a rest area about 200 miles north of Winnipeg, crashed for a couple hours, then woke up at 10 PM as an orange, red, purple and yellow-tinged aurora came rolling out of a clear northwest sky.

The Source and Visibility of the Aurora

The Northern Lights (aurora borealis), also known as the Southern Lights (aurora australis) in the southern hemisphere, occur when highly charged particles from the solar wind follow the lines of magnetic force formed by the earth's core toward the magnetic pole. Collisions between these particles and atmospheric atoms and molecules cause energy releases in the form of auroras appearing in large circles around the poles. The most common auroral color, a pale yellowish-green, is produced by oxygen molecules located about 60 miles above the earth. Rare, all-red auroras are produced by high-altitude oxygen, at heights of up to 200 miles. Nitrogen produces blue or purplish-red aurora.

In the northern hemisphere, the magnetic pole is located in northern Canada near Ellesmere Island at 81 degrees north latitude and 110 degrees west longitude. This location, south of the geographic north-pole shifts the more active displays towards our 41½ degree latitude here in Geauga County than it does in the Eastern Hemisphere.

The 11-year solar cycle is a primary contributor to more active aurora. The more sunspots and solar activity, the more energy being released into space, which means more auroral activity. Solar cycle 24 is expected to peak in around May 2013, from an unusually long minimum that has extended 2 years past the 2007 low part of the cycle.

Monitoring and Predicting Aurora for your Location

Back in the pre-internet and pre-cell phone days, one low cost method was the Radio Shack Time Cube to listen to broadcasts of solar activity and the potential for auroral activity. The radio had 2 functions;

- A Weather radio, that picked up broadcasts in the region where you were listening.
- At the frequencies of 5, 10 or 15 Megahertz, a broadcast from the National Institute of Standards and Technology. At 18 minutes after each hour, several solar and auroral values are announced that helps the listener determine if an aurora is possible that evening. These values are updated every 3 hours.

From the early 1980's to the 2001-2002 period, the Time Cube was my best method to monitor solar/auroral conditions. Usually, I'd listen to a broadcast 1 to 2 hours before dark to determine if I would need to prepare for an auroral event.

In today's internet, wireless and cell/smartphone world, there are various sources of information. My 2 favorites are the NOAA / Space Weather Prediction Center at:

http://www.swpc.noaa.gov/ftpmenu/forecasts/wwv.html

and the Solar Terrestrial Dispatch at: http://www.spacew.com/.

The NOAA site produces that 18 minute after the hour report that can be pulled from their website at any time. A sample appears below from August 6 when there was a high possibility of aurora at our location:

:Product: Geophysical Alert Message wwv.txt
:Issued: 2011 Aug 06 2105 UTC

 # Prepared by the US Dept. of Commerce, NOAA, Space Weather Prediction Center

 # Please send comments and suggestions to SWPC.Webmaster@noaa.gov

 # 3-hourly messages issued this UT day.

#

 # Geophysical Alert Message

#--

Solar-terrestrial indices for 05 August follow.

Solar flux 109 and mid-latitude A-index 27.

The mid-latitude K-index at 0000 UTC on 06 August was 7 (207 nT).

Space weather for the past 24 hours has been strong.

Geomagnetic storms reaching the G3 level occurred.

Solar radiation storms reaching the S1 level occurred.

Space weather for the next 24 hours is predicted to be strong.

Geomagnetic storms reaching the G3 level are expected.

Solar radiation storms reaching the S2 level are expected.

An explanation of the items:

Solar flux - measures the intensity of solar radio emissions. Over the past 21 years I've been tracking the above statistics (almost 2 solar cycles), I've recorded values ranging from 65 (May 4, 1996) to 367 (January 31, 1991). The numbers are higher around sunspot maximum.

Mid-latitude A-Index – Measures the behavior of the magnetic field. This is a daily value averaging the K-index that is reported 8 times a day every 3 hours. I've recorded values ranging from 0 to 180. The 180 value was recorded on October 30, 2003 followed by a 147 the following day. Those 2 days produced the last major auroral storm seen in northeast Ohio.

Mid-latitude K-Index – This is a primary value that I use to decide if there is chance of spotting aurora. As noted earlier, this value is produced 8 times a day at 3-hour intervals. Values range from 0 to 9. If a 4 is announced, I will continue to monitor the K value over the next few 3-hour periods. A K value of 5 and above puts me on alert to prepare for an aurora event that evening.

Space Weather for the past 24 hours and *for the next 24 hours* – The following tables are from the NOAA / Space Weather Prediction Center. This reports the maximum level observed over the past 24 hours.

My primary focus is on the Geomagnetic Storms (G) value. The August 6, 2011 report predicted a G3 value over the next 24 hours, which indicated a potential K value of 7 as shown in Table 3.1. That caught my attention and I continued to monitor events for the next 24 hours. Unfortunately, the earth was not in the direct path of the Coronal Mass Ejection event (known as a solar flare), so there was no material aurora event in Northeast Ohio. Aurora was reported north of 45 latitude on the evening of August 6.

NOAA Space Weather Scales

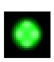
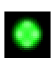
Geomagnetic Storms	Solar Radiation Storms	*Radio Blackouts*	Descriptor
G5	S5	R5	Extreme
G4	S4	R4	Severe
G3	S3	R3	Strong
G2	S2	R2	Moderate
G1	S1	R1	Minor

Table 3.1 - Geomagnetic Storm levels	
Planetary K indices	**Geomagnetic storm level**
K = 5	G1
K = 6	G2
K = 7	G3
K = 8	G4
K= 9	G5

Both tables courtesy of NOAA / Space Weather Prediction Center.
http://www.swpc.noaa.gov/Data/info/WWVdoc.html

The Solar Terrestrial Dispatch website is another valuable source of information. They provide visual signals to potential aurora at high, mid and low latitudes as shown below:

Auroral Activity Lights
(green=none, yellow=possible, red=strong)

High Lat:  **Mid Lat:**  **Low Lat** 

In addition, they provide real-time images of the aurora oval. (A high-latitude ring of permanent aurora, girdling the geomagnetic pole). During my 3 Manitoba trips in 1989 and early 1990's, we were far enough north to see the oval every clear evening. Depending on the daily solar activity, the oval ranged from very faint to very bright.

To the right is a sample from early September 2011 under quiet solar conditions. When very active with K index values of 5 and up, the yellow oval becomes crimson red and extends further south. This website has many other links with alerts, daily reports, aurora reports from around the world and solar images.

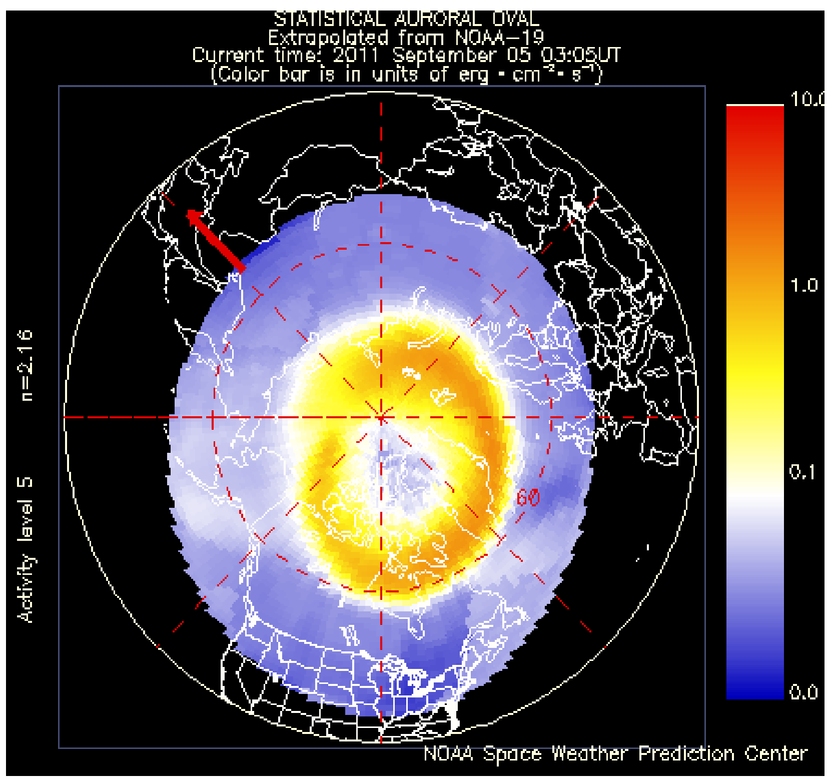


Photo courtesy of The Solar Terrestrial Dispatch.

And, for those with Smartphones, the website, http://spaceweatherphone.com/, will send a voice message alert to your cell phone noting potential aurora, geomagnetic storming and a few other sky events. This service costs $4.95. I don't use this service because I don't have a smartphone, but if anyone in CVAS gives it a try, I'd like to hear about your experience.

This service and the 2 websites cited earlier make aurora prediction easy, fast and realtime. A great improvement over the good old days where I had to wait for 18 minutes are each hour to listen to the old Radio Shack Time Cube.

As we approach solar maximum in a couple of years, there should be plenty of opportunities to see the aurora from northeast Ohio between now and a couple years after solar maximum. Just monitor the websites noted in this article every day, sign up for alerts on the space weather phone, have fast speed film available for your film camera, a fully charged set of batteries ready for your digital camera and a location ready to run to when that time arrives. ♈

Photographing the Aurora

It's fairly easy to photograph the aurora. Suggestions:

- Try to find a darker sky site. While the brightest aurora can be seen by the naked eye in a suburban area, a photograph will pick up obnoxious light pollution.
- Use a sturdy tripod.
- For those using slide or print film, 200 ASA speed and higher is recommended. Use similar settings for digital cameras. Digital cameras are a preferred method because of the near instant gratification of the results.
- A wide-angle lens in the 28-35 millimeter range is best to capture the view. Unlike galaxies, clusters, planets and other astronomical events captured by astrophotographers, this event requires a wide view.
- Keep exposures between 15 and 30 seconds, depending on the aurora's brightness and the natural sky glow/light pollution. The aurora can exhibit noticeable movement in a few seconds, so keep exposures short to avoid a blurred view.
- Make a movie from a series of photos. During a November 7 aurora, I took several photos with an Olympus 3.2 Megapixel digital camera at the Cleveland Metroparks Polo Field. I did not move the camera, kept the focal length at 35 millimeters and all exposures were at 15 seconds. I used some freeware to stitch the photos into a movie that can be viewed on youtube at the following link. The video is a little jerky, but it gives you a sense of motion, shape and light intensity that the aurora exhibited over this 3 minute period:

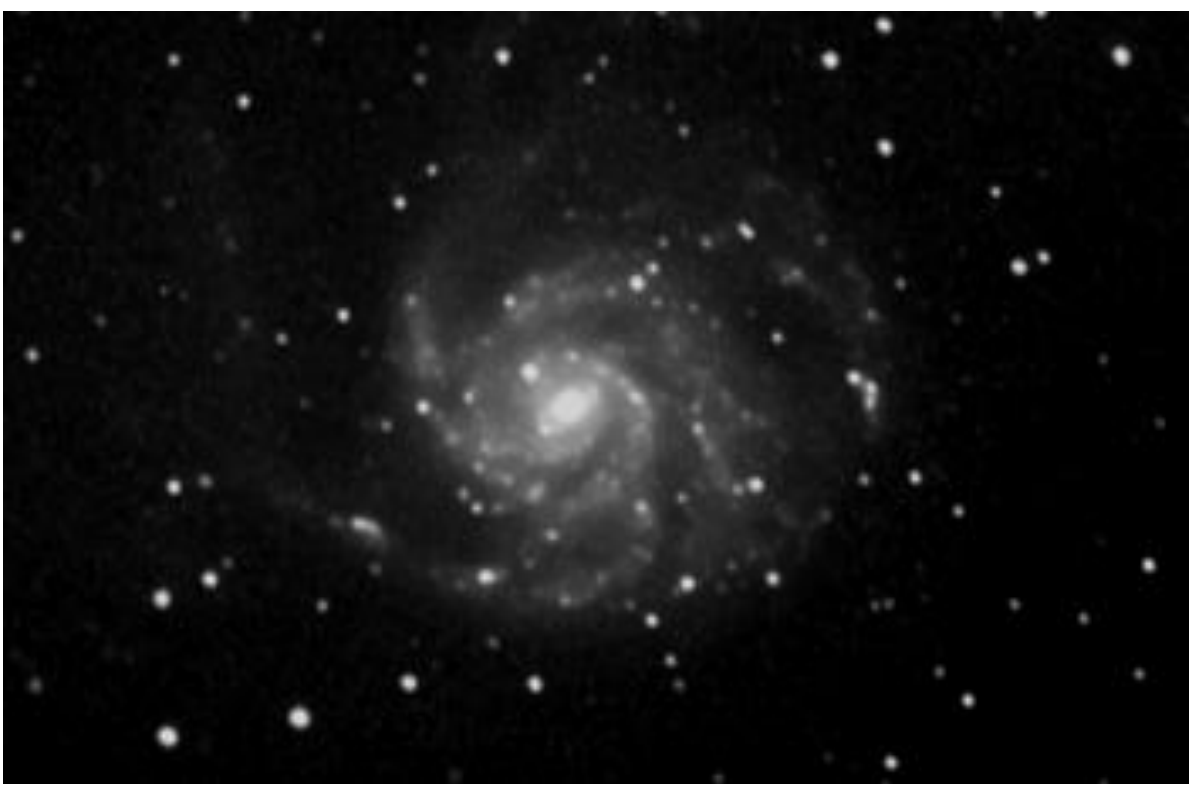
  http://www.youtube.com/watch?v=8Z2PnZchYSg

Most important advice is don't give up. The aurora from northeast Ohio is a rare event. During solar maximum we can average about 20 events a year. At solar minimum, 3 years and more can elapse with no observation. I almost missed the November 7 event as I sat in my car from 9 PM until 1 AM, not seeing any clue of aurora. Right after 1, there was an obvious ray coming out of the north, then the whole sky lit up for about 20 minutes.

Astronomy Pictures of the Season (1)

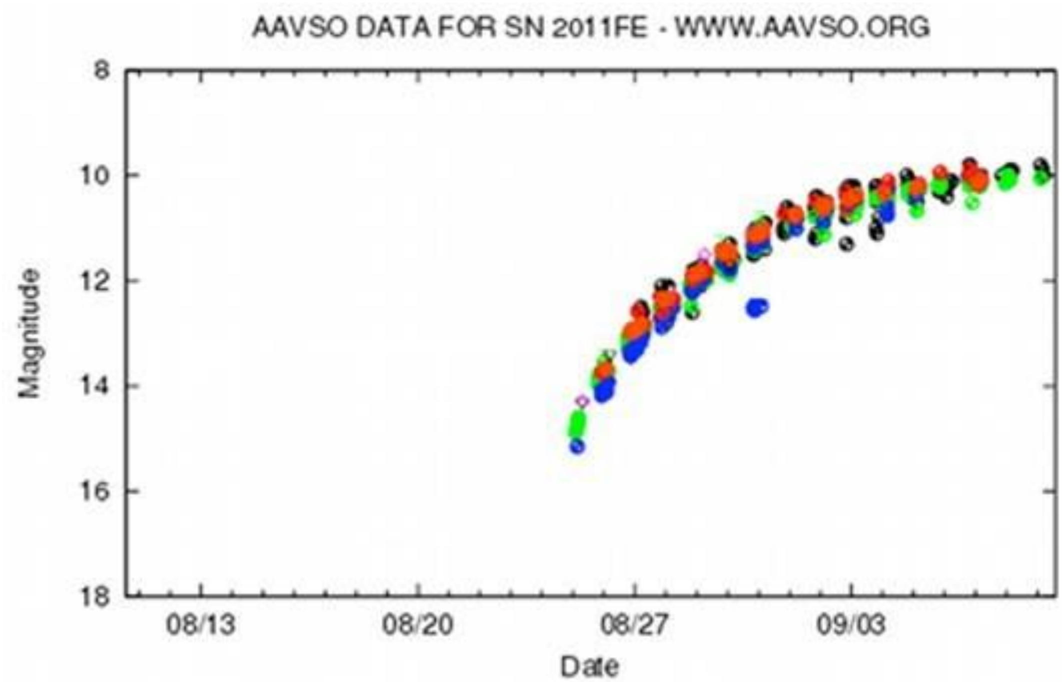
Supernova SN 2011fe in the Pinwheel Galaxy M104
By Russ Swaney and Sam Bennici

M101 with Supernova SN 2011fe recorded September 1, 2011 by CVAS member Russ Swaney.



M101 recorded in April 2006 by CVAS member Sam Bennici.

On August 24th, astronomers at UC Berkeley and Lawrence Berkeley National Lab discovered a Supernova in M101, the Pinwheel Galaxy, located in Ursa Major. The Grand Canary Telescope in the Atlantic split the light into an information-rich spectrum that showed it was a Type 1a supernovae, which originate from White Dwarfs.



A light curve showing SN 2011fe's change in brightness since Aug. 24. Credit: AAVSO

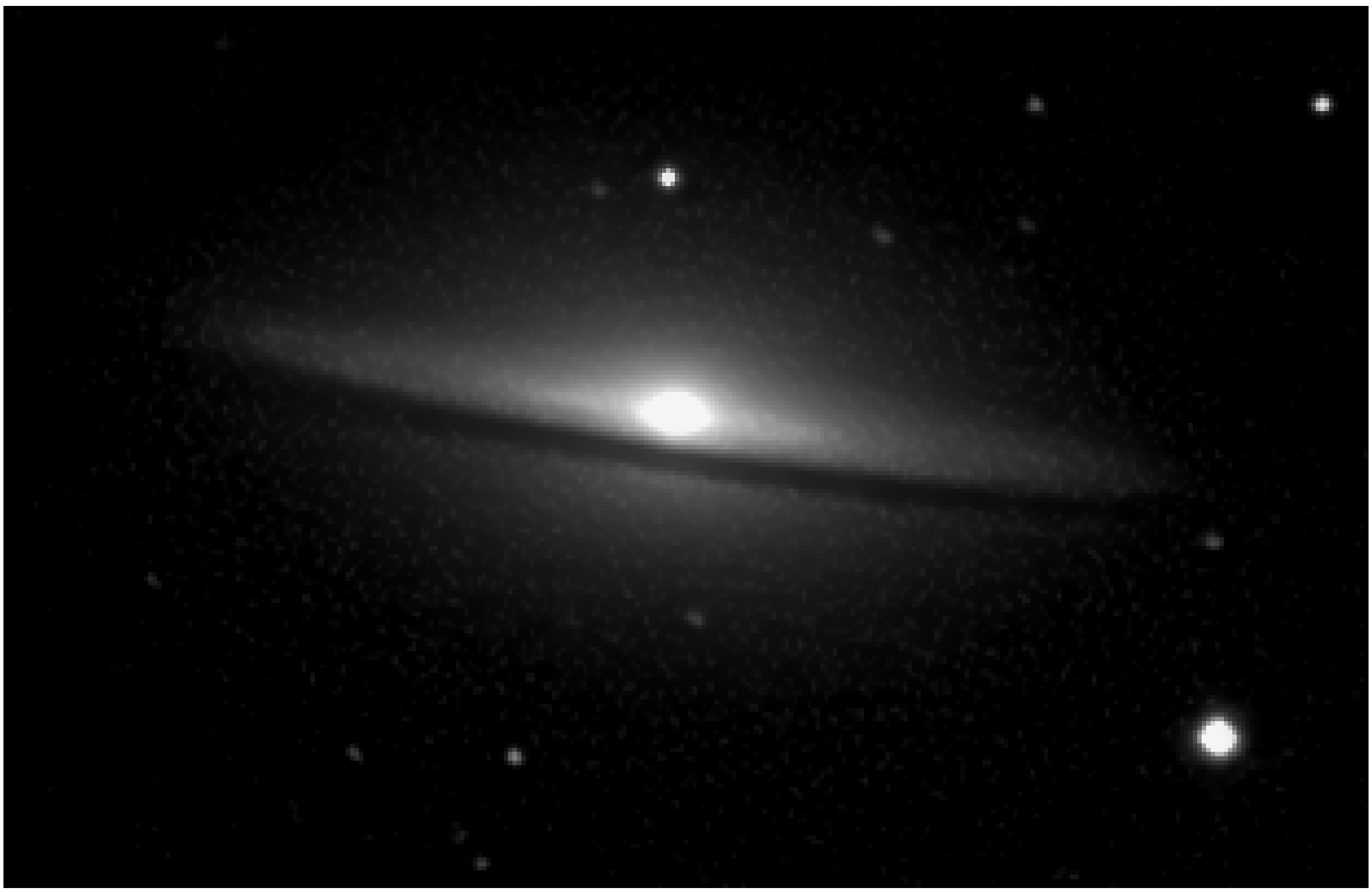
Russ's image was recorded with a 10-inch Schmidt-Newtonian telescope at F4 and a QHY9 CCD camera. Ten exposures, 240 seconds each in length, were calibrated and processed with Maxim DL. Levels and curves were adjusted in Photoshop.

Sam's image was recorded with a homemade 5-inch Maksutov-Newtonian telescope at F3.3 and a Starlight Express MX516 CCD camera. Total exposure 61 minutes. The telescope was visually guided with an illuminated reticule eyepiece.

Astronomy Pictures of the Season (2)

The Sombrero Galaxy M104
By Sam Bennici

Located in the constellation Virgo, M104 is an unbarred galaxy roughly 28 million light years from earth. Notable features included a large central bulge and well defined dust lane. The Sombrero Galaxy has been the official CVAS logo since the late 1960's.



The galaxy was captured here in April 2004 with an 8-inch Schmidt-Cassegrain telescope at F5 and a Starlight MX516 CCD camera. The telescope was guided visually using an illuminated reticle eyepieces. 64 minute total exposure.

Astronomy Pictures of the Season (3)

Comet C/2009 P1 Garradd and M71
By Russ Swaney

M71 was initially classified as an open cluster. But recent observations indicate features characteristic of globular clusters. In mid-August 2011, the comet's sky motion brought it to within a few arcmins of M71. The direction of motion is evident by the elongated trail due to the time elapsed imaging.

Image recorded on August 26, 2011 at Indian Hill Observatory with 10-nch Schmidt-Newtonian telescope at F4 and a QHY9 CCD camera. Ten exposures, each 240 seconds in length, were calibrated and processed with Maxim DL. Levels and curves were adjusted in Photoshop.

Astronomy Pictures of the Season (4)

Autumn Astronomy
By David Mihalic

Autumn in Cleveland is arguably the best season of the year for observational astronomy. Cooler drier air has moved into the area bringing with it more transparent skies that are so much better for deep sky observing. There is also a bonus for autumnal viewers. Darkness falls much sooner and thus we still have access to much of our favorite summer sky objects. Even though it's autumn, the Summer Triangle is still with us!

Some of my favorite objects to view during this season are the Andromeda galaxy (M31) and the globular cluster (M15) in Pegasus. M31 is fun because I like hunting it down with binoculars first. It is an easy target to find because it is so bright. I can even see it easily from my Cleveland Heights home and I live in a red zone. M15 is a rather compact globular and is also a very bright object making it an ideal target even for small telescopes.

Some facts about M31:
Andromeda is the nearest spiral galaxy to our own but still at an immense distance of 2.5 million lights years. It has an apparent magnitude of 3.4 making it visible to the naked eye under dark skies. In my 8" telescope all I see is the extremely bright core that fills my eyepiece at a 1 degree field of view. There is an ever so slight hint of a dust lane in my view. I think under darker skies I could easily make out some lanes of dust. Did you know that our own Milky Way galaxy is predicted to collide with the Andromeda galaxy in perhaps 4.5 million years or so? What other galaxies might you have observed that are even now engaged in a cosmic collision?

The Andromeda Galaxy M31, Image acquisition by Jim Misti, Image processing by David Mihalic.
32" Ritchey-Chretien telescope.

Some facts about Messier 15:

M15 is a bright globular cluster located in the constellation Pegasus, not too far from our above mentioned mythological friend, Andromeda. Globular clusters surround our galaxy as they do most other galaxies in the universe. They are among the oldest objects in the universe with M15 being one of the oldest of the old at 13.2 billion years of age! The exact mechanism of creation of these cities of stars is not known. But they make for excellent viewing in telescopes 4” (102mm) and up. Obviously the larger your aperture the more stars you will resolve.

It is about 33,600 light years away with an apparent magnitude of about 6.2. M15 is believed to be composed of over 100,000 stars. It is visible as a small fuzzy blob in binoculars and begins to resolve with 6” of aperture. It is a very compact and bright object in my 8” scope with many stars resolved.

The Globular Cluster M15, Image acquisition and processing by David Mihalic.
20-inch corrected Dall-Kirklam telescope.

Where Have All The Dark Skies Gone?

Part 2

By John Gorka

In our previous article we discussed the effects of light pollution on the night sky. In this edition of the *Valley Skywatcher* we will address other ways that outdoor lighting can affect both people and the world around them.

One of the main reasons proponents put forth the need for bright nighttime lighting is for our safety and security. While a majority would recognize the need of outdoor lighting for these purposes, do we really require lighting levels equal to that inside a football stadium in order to be safe? Does bright lighting actually make us safer at night or do we just *feel* safer because of it? If we only feel safer, perhaps we let down our guard and are not as aware of our surroundings as we would otherwise be.

Consider a 1997 study of the National Institute of Justice (NIJ) submitted to the U.S. Congress in February of that year. Its assessment of the impact of lighting on crime reads as follows: "We may speculate that lighting is effective in some places, ineffective in others, and counterproductive in still other circumstances."

In other words there is no clear indication that bright outdoor lighting will lower crime rates.

This same report cited the example of lighting at an ATM. An ATM user might *feel* safer in such a bright location because he or she can see the surrounding area, but the lighting also makes the patron more visible to a criminal. The NIJ report summed up this situation by saying, "Who the lighting serves is unclear."

When it comes to vandalism, a number of school districts in the U.S. have switched off their outdoor lighting to save money. Initially there were concerns about increased vandalism as a result of this policy, but school officials found that the incidences of such activity actually dropped. It seems that the perpetrators found no fun in not being able to immediately see the results of their actions.

The San Antonio School District in Texas recorded vandalism damage reduction from $160,000 to $41,000 annually when it instituted a dark campus policy as far back as the 1970s. School districts in San Jose, TX, and Spokane, WA, have experienced similar results.

In 1991 the Pittsburgh *Post-Gazette* printed an editorial stating that crime had increased in areas of the city where lights were added. It seems that felons need light just as much as honest citizens.

While these results are not being used to propose that we turn off all outdoor lighting, they do illustrate that high levels of nighttime lighting do not automatically go hand-in-hand with lower crime rates. In some instances an opposite effect has resulted.

In addition to studies about the effect of lighting on crime, more and more work is being done to study the effects of lighting at night on human health.

For example preliminary work has shown evidence that even low levels of light in the bedrooms of infants may lead to myopia later on. This would include light from night lights left on in the room.

A BBC news report from 2003 revealed that researchers at a science conference in Denver, CO, had produced evidence showing that exposure to bright light at night could lead to a higher level of breast cancer. The data presented correlated well with research done in Denmark on the same subject.

The theory suggested was that exposure to light at night suppresses the body's production of melatonin, a hormone only produced under dark conditions. This hormone not only is involved in the control of the body's natural rhythms but also in the body's nighttime immune system.

Photo biologist, Joan Roberts, has spoken on this subject at more than one annual meeting of the International Dark-Sky Association in Tucson. An ABC News report from May 2001 quoted her as saying that melatonin fights diseases including breast and prostate cancer. Even a little light in your bedroom at night (perhaps from a nearby streetlight) can switch off melatonin production.

In the future more studies will undoubtedly be done on the effects of lighting on human health. But even if some of the preliminary evidence is anecdotal, doesn't it make sense to avoid exposing ourselves to unnecessary light levels at night by either switching lights off or reducing the amount of light to which we are exposed?

Although modern society has evolved to the point that we have tried to make night as bright as day (at least in our cities), it seems that we are fighting the natural order of things. After all it is naturally dark at night.

Our misuse of light at night for mere cosmetic purposes has had some drastic consequences in the animal world. We won't speak about sea turtles here since there are none that we know of in northern Ohio. However, each year millions of migrating birds, which use the moon and stars to navigate, are killed when they fly into structures such as buildings, bridges, and telecommunication towers because the birds are confused by all the manmade illumination. In 2005 about 700 dead birds were found around the Terminal Tower in Cleveland. These are the same birds that keep the insect population down. Lose a few million birds and you gain a few billion insects.

Admittedly, this article has only touched on some of the consequences that result from the misuse of lighting at night. However, when opportunities arise, we can now all try to share our concerns about nighttime lighting not only because of its effect on astronomical observations but also because of the growing body of evidence of its deleterious effects on both humans and animals.

Clear and dark skies to all. ♈

President's Corner

By Ian Cooper

2011 has been a fruitful year for CVAS, highlighted by our association with the Geauga Park District's 50th anniversary celebrations and dedication of the Oberle Observatory at Observation Park.

Before going into the benefits, though, it's important to recognize the passing of our dear friend, Marty. His insights, abilities, and dedication to everything we love and share was inspirational to all. He will be missed.

CVAS has accomplished more in the preceding 12 months than in any similar time-frame since our founding. The work and accomplishments of our members is a topic of discussion at astronomical groups worldwide, in no small way due to the CVAS association with Oberle Observatory at Observation Park.

To call the dedication of this facility a "success" is limiting its value. Over 1,500 people attended the ceremony, on what we all would consider a night offering only a few "sucker holes." The true value of this latest addition to GPD is in its educational potential for decades of future astronomers, and CVAS should be proud to be involved from concept through completion.

2011 was also a year during which CVAS realized an immense improvement in its web site. Now we have the opportunity to expand the CVAS name worldwide. Indeed, a look at the web site analytics leads to one visitor who's checked into our web site, multiple times, from Kiev, Ukraine. Go figure!

This has been a year of unprecedented publicity for CVAS. There is no reason we cannot sustain this momentum, to place our knowledge and skills in front of newer, larger crowds for years to come.

It has been a privilege to sit before you these past three years. My focus has been, and shall remain, on seeing CVAS grow stronger – and second to none. ♈

Supernovae Hunting, Watching and Waiting

By G. W. Gliba

Supernova SN 2011fe was discovered in the galaxy M101 at Palomar Observatory on August 24, 2011 at magnitude 17.2 with the 1.2-m Oschin Schmidt telescope. It is a type-Ia and the brightest extragalactic SN visible from the USA since 1972E in NGC 5253, also discovered at Palomar Observatory with the 1.2-m Oschin Schmidt, that time by Charles Kowal, a friend of some CVAS members who worked at the NASA Hubble Space Telescope. SN 1972E reached 8.5 magnitude! On the night of August 30th I observed SN 2011fe near downtown Greenbelt, Maryland. It was seen in my 8-inch SCT, and later in only a 3-inch F/5 refractor. The 3-inch is the finder for that telescope. The galaxy was very hard to see in the moderate light pollution; with only the core being seen with averted vision with the 8-inch, but not a trace of the galaxy was seen in the 3-inch finder. At that time I estimated the SN to be around 11th magnitude. By the end of the first week in September it reached 10th magnitude!

There was another fairly bright SN that I saw with my wife Lynne in M51 at the Goddard Astronomy Club Observatory located at the Goddard Geophysical and Astronomical Observatory (GGAO) at NASA's Goddard Space Flight Center (GSFC) in Beltsville, Maryland on Springfield Road on June 24th in a 12-inch Meade GoTo SCT. That was the best view I had of it as it was at maximum brightness then (12.5). This was the third SN in M51 in 17 years, and the brightest of the three. The first two of these three SN were also seen with Lynne. We saw the first one with the 16-inch F/18 Boller & Chivens Cass, which was 13th magnitude in the spring of 1994. We saw the second one at Mountain Meadows, West Virginia near our cabin with our neighbor Ed Abel's 22-inch F/4 Dobsonian in the summer of 2005, which was about 14th magnitude. So, we have been lucky to have seen all three SN in M51 together. This is the first time that I have seen three SN in the same galaxy. Looking for SN discoveries before they fade from view is a challenging, fun, and rewarding sport.

Although seeing three SN in M51 is a bit unusual, the galaxy NGC 6946, which also goes by the name, 'Fireworks Galaxy', has had no less than nine SN seen in only 96 years, four since 1980, two of which I have seen (1980K & 2004et). I have also seen two SN in M100 (1979C & 2006X) of the five seen in that galaxy in 104 years. Although it may seem like I have seen a good many, there have been several that I've missed since seeing my first one in 1974, SN 1974G in NGC 4414. I missed some due to bad weather, lack of a large enough scope, lack of dark enough skies, or just didn't hear about them in time to observe them. Some were seen in dark skies and some in light polluted skies. For instance, of the two SN that I have seen in NGC 6946, 1980K was seen near downtown Greenbelt, Maryland in my 8-inch SCT, when I couldn't see the parent galaxy at all, but when I saw 2004et from our cabin in Mathias, West Virginia, I saw the beautiful spiral arms of that galaxy too in our 20-inch F/5 Dobsonian. Quite a different situation.

There were two SN seen in one year's time in the galaxy M74 (2002ap & 2003gd), both of which I missed, even though I tried to see them both. I missed one due to the high mountain winds, and the other due to cloudy conditions. However, even though I missed a few of the SN brighter than 14th magnitude for one reason or another, I have managed to see 38 of them in 37 years time using scopes ranging in size from 3-inch to 22-inch aperture. Most of the SN seen were between magnitudes 11 and 14, but besides SN 2011fe, SN 1993J in M81 reached 10.5 magnitude, and SN 2004A in NGC 6205 was 15th magnitude.

The galaxy NGC 6205 is very close to the well known globular cluster M13, so it was easy to locate. It was also very cool looking at M13 with the 20-inch Dob, and then sweeping over to NGC 6205 nearby to see this relatively remote SN in the deeper sky beyond. Hunting for SN is a fun sport, and I have found most of them by just star hopping, but I needed a good Star Atlas to do this. I used the American Association of Variable Star

Observers (AAVSO) Variable Star Atlas, which has all the Messier and NGC objects, and shows stars down to 9.5 magnitude. Finding a good picture of the parent galaxy for each SN, showing the foreground Milky Way stars, is also important.

It is important to keep a list of transient objects like SN that you see, because as you get older you will see many comets and novae as well, and it will be hard, if not impossible to remember them all. For instance, I have also seen 91 comets, and 18 galactic novae. I started keeping a list early on when I could still remember them all, including their names, when I saw them, how bright they were, etc., and I'm glad I did. That is also why I knew a lot of the information for this article, with some help from our friend Google of course. I have also made sketches of some of the notable comets I have seen. So, either a simple observers list or logbook is important. Recently I tried to get the AAVSO to give me credit for the magnitude estimates of about a dozen eclipsing binary minima I did for the binary observer's group at the Swiss Astronomical Society (BBSAG) back in 1973. But after contacting the BBSAG we discovered that only the times of minima were kept. So I lost credit for about 100 magnitude estimates for the AAVSO. Ouch! Had I kept a good observing log, I would still have the individual magnitude estimates in a logbook to give to them. In hindsight, I should have written them down in one place way back then.

Although most of the SN that I have seen so far have been in galaxies that are New General Catalog objects only, 13 of the SN were seen in Messier Objects. Besides the ones seen in M101, M51, M100, and M81 mentioned already, I have seen SN in M83 (SN 1983N), M66 (SN 1989B), M58 (SN 1989M), M84 (SN 1991bg), M96 (SN 1998bu), and M88 (SN 1999cl). Although the average number of SN I have seen is about one per year for 37 years, I saw none for five years from 1975 to 1980, and none from 1985 to 1989, but was able to see four in 2004 and this year, and three in 1998. There were a few years that I also observed two. So they really are random events. As I mentioned, luck was somewhat important, but so was access to dark enough skies, IAU circulars, and the Internet. From 1980 on I had access to the IAU circulars at the NASA/GSFC before the Internet. I found out about SN 1974G in NGC 4414 because Tony Mallama called us from the NASA/GSFC. I saw that one, the first SN I ever saw, with Denny Jefferson's 12.5-inch F/7 along with Denny and Tom Quesinberry. I was also lucky to see a bright telescopic meteor pass through the field while I was observing it, which surprised me so much I nearly fell off the observing ladder!

Most older folks remember SN 1987A in the LMC, which reached 2.8 magnitude and was an easy to see object with the naked-eye in deep southern skies. This is the extrinsically brightest extragalactic SN known since the star S Andromedae, which was a SN in M31 visible to the naked-eye in 1885, which reached 5.8 magnitude. It was seen naked-eye by the noted visual observers Lewis Swift and E.E. Barnard. Of course, that was before its true nature was known, but as M31 is considerably larger than the Milky Way, one would expect that we are now overdue for another. As cool as this prospect is, it still may not happen in our lifetime, but when you also consider that Tycho's star of 1572, and Kepler's of 1604 were so long ago in this galaxy, that we are also overdue for a Milky Way SN, perhaps in our lifetime. Also, considering that Kepler's SN reached -2 magnitude, and Tycho's was -4 magnitude, we will be in for quite a visual treat. Or if we really get lucky, we will see one like SN 1006 in Lupus, which got up to -8 magnitude and was easy to see in the daytime! Keeping track of SN and trying to observe them yourself is just another fun way to expand your astronomical knowledge and observing experience. I recommend that you add them to your observing schedule. ♈

Reflections

Stately, self-possessed, a murk of mingled stars and gas clouds presenting itself to the eye in hues of silver to charcoal to India ink, a galaxy is so commodious as to contain, I should think, more stories than anyone, anywhere, shall ever come to know.

Timothy Ferris, *Seeing In The Dark*, 2002

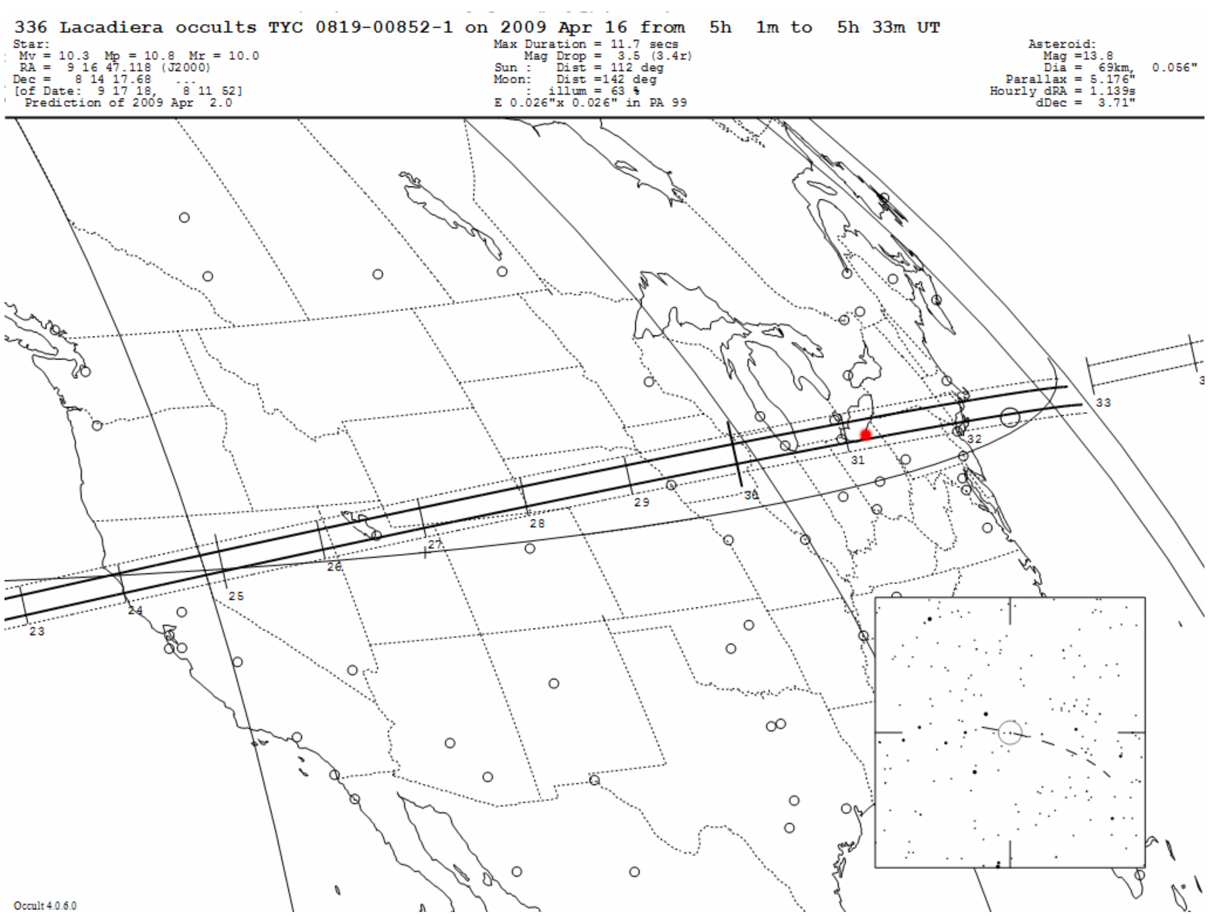
336 Lacadiera Occultation - April 16, 2009

By Bob Modic

There are over 500,000 known asteroids that orbit the Sun. Most of these objects are too small to resolve in Earth-based telescopes, so our knowledge of their size and shape is very crude. As they move across the sky, many asteroids pass in front of (occult) stars as seen from Earth. Photometry of these occultations provides a simple way to measure the diameter and shape of asteroids. On April 16, 2009, I observed an occultation of 10.3 magnitude TYCHO 0819-00852-1 by the asteroid 336 Lacadiera. This paper presents my observations of this occultation.

Observations

The IOTA issues predictions every month for dozens of asteroid occultations. Most occultations can be seen only from a narrow path due to the small size of most asteroids. The prediction for the 336 Lacadiera occultation is shown below (courtesy of Steve Preston). My observing location is shown by the red dot.



The field around TYCHO 0819-00852-1 was recorded with a low-light video camera from roughly 5:20 to 5:37 UT on April 16, 2009. Video frames were acquired at a rate of 29.97 fps. Every video frame was time-stamped using a KIWI GPS time inserter and recorded to a portable VCR. This method of time-stamping is accurate to +/- 0.001s with respect to UTC. Transparency was good but the seeing was fair during the observation time.

Equipment Used

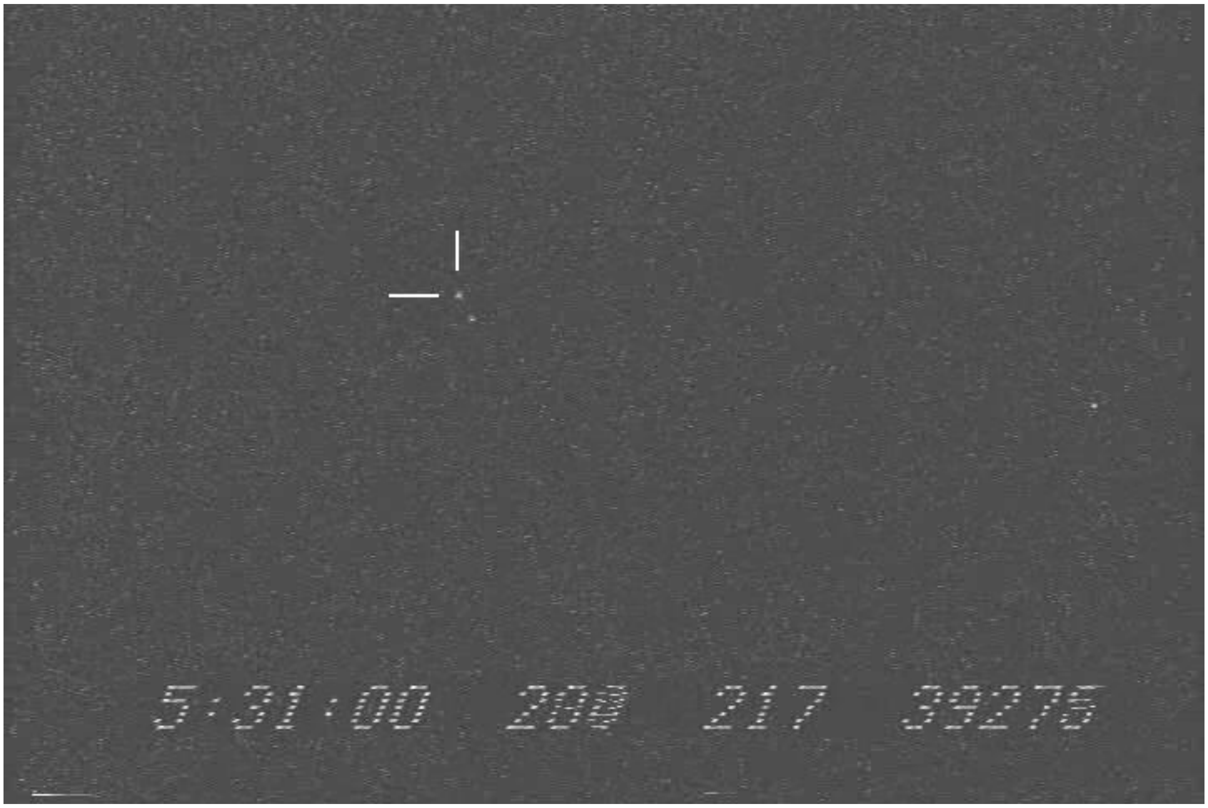
- Telescope: 20.0cm f/5 Newtonian Reflector
- Camera: PC-164C
- Filter: none
- Exposure: 0.03s
- Time Source: GPS

Location

- Richmond Heights, Ohio, USA
- Latitude: 41d 33' 50.5" N
- Longitude: 81d 30' 03.0" W
- Elevation: 257m
- Datum: WGS84

Observer: Robert J. Modic (IOTA)

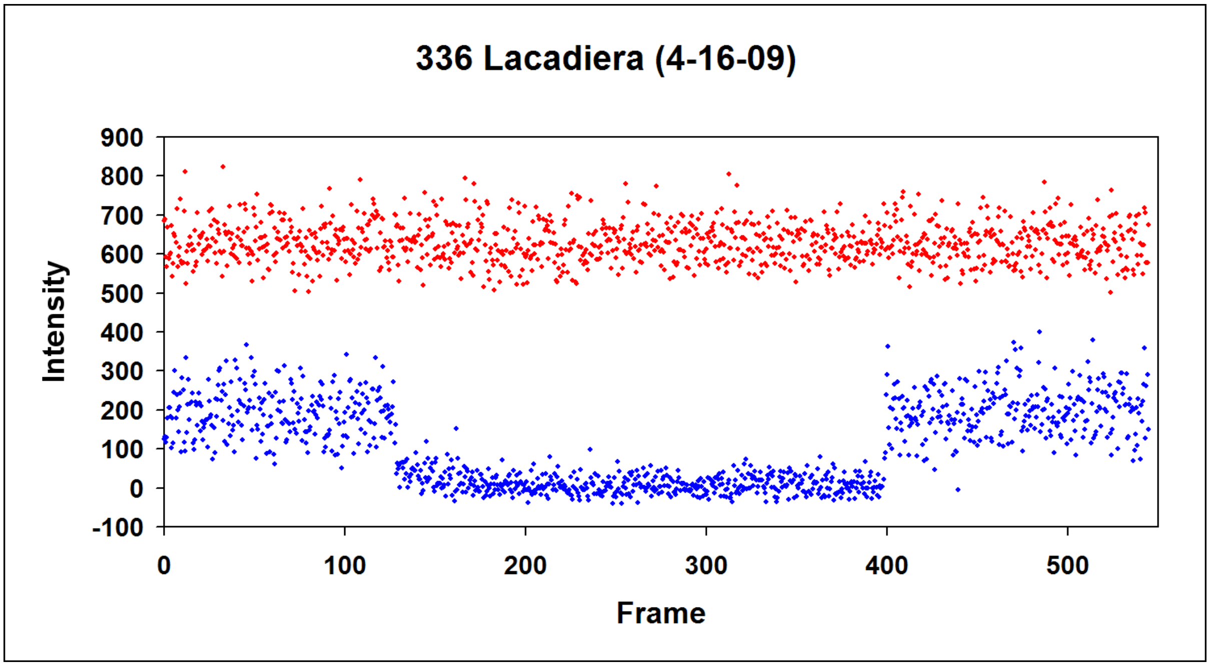
Below is a frame from the video of the occultation. TYCHO 0819-00852-1 is the marked star. North is up and the width of the frame is about 16 arc-minutes.



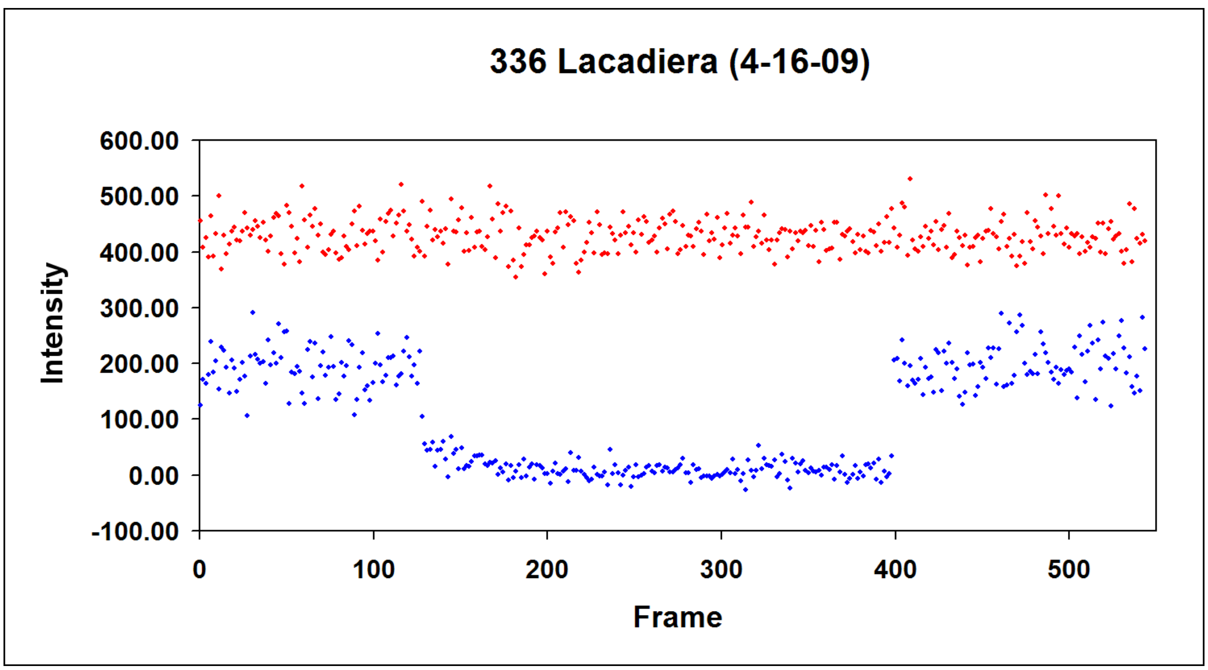
A video of the occultation can be downloaded here: http://www.rjm-astro.net/336_Lacadiera_(4-16-09)xvid.avi. This video file is 6.7 MB in size and uses the XVID video codec.

Reduction

The occultation video was digitized and transferred to a computer for measurement. Aperture photometry was performed on the digitized video using LiMovie, a program created by Kazuhisa Miyashita specifically for the measurement of occultation videos. LiMovie has the ability to measure the two fields that make up each frame of interlaced video, allowing a time resolution of 0.017s to be obtained. The first plot below shows the measurements of each field (0.5 frame). TYCHO 0819-01259-1 was used as the comparison star.



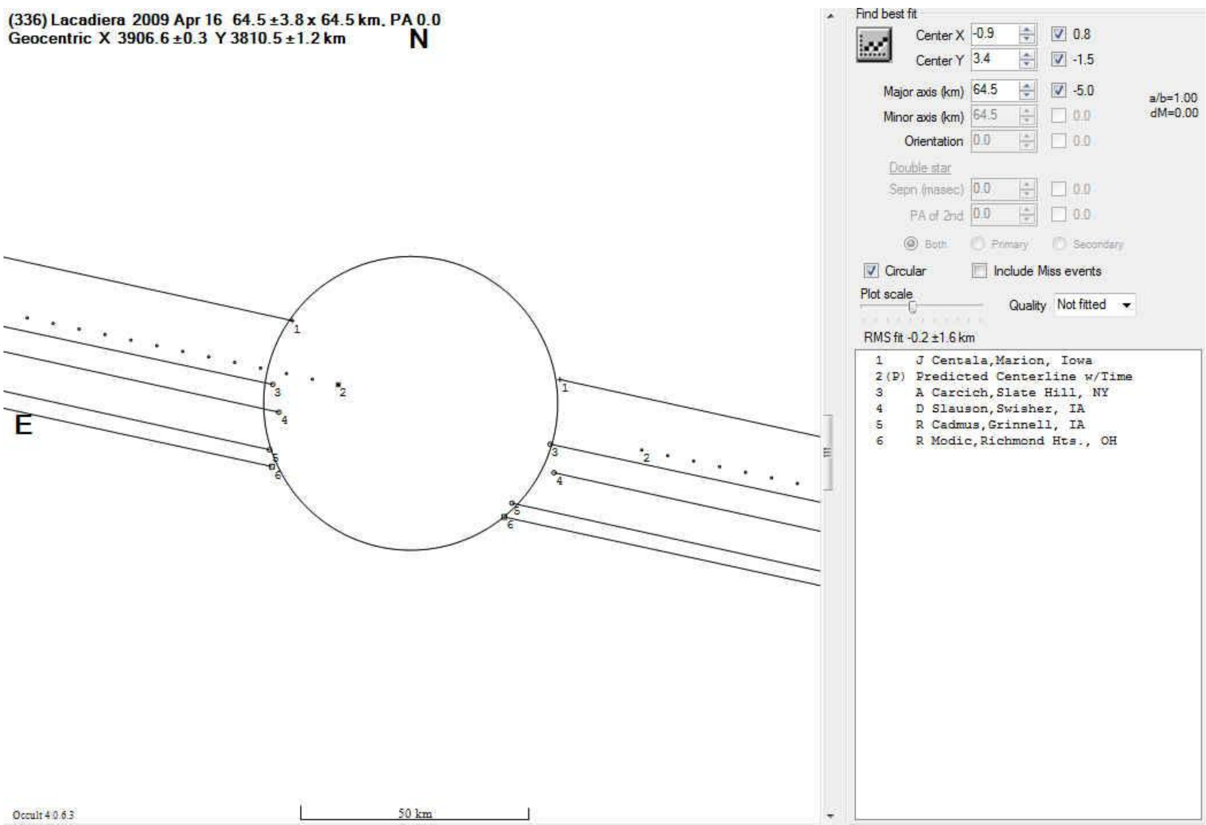
The plot above shows the intensity of the sky subtracted fluxes of the occulted star (blue) and comparison star (red) plotted vs. frame number. An aperture of 6 pixels diameter was used for this plot.



The plot above is the same as the first except that each point is a 3 field (1.5 frame) average to help reduce noise. As shown by the plots above, an obvious occultation occurred close to the predicted time. According to my measurements, the star disappeared at 5:31:04.271 +/- 0.017 UT and reappeared at 5:31:13.296 +/- 0.017 UT. Each event was instantaneous.

Discussion

My observation of the 336 Lacadiera occultation represents one chord across the profile of the asteroid. By combining my chord with that of observers at other locations, a better idea of the asteroid's size and shape can be obtained. There were four other observers who saw the occultation. A plot of the observed chords from all five observers is shown below (courtesy of Brad Timerson).



This profile shows 336 Lacadiera to be 65 +/- 4 km in diameter with an approximately round shape.

Resources

Additional information about occultations and the software used to analyze these events can be found here:

http://lunar-occultations.com/iota/iotandx.htm

http://www.asteroidoccultation.com/

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

Geometric Optics

Part 2

By Dan Rothstein

This presentation was given at the February CVAS meeting using the Blackboard Optics equipment and lasers. It attempts to describe some of the theoretical principles behind what we know about telescopes. Here I have tried to work around the lack of demonstration equipment and figures, and I have used as few equations as possible. Part one of this article described reflection and appeared in the summer 2011 Valley Skywatcher. Part two below will describe refraction.

Refraction at an interface When light passes from one medium to another, its speed changes. The speed in the medium is determined by an experimentally determined number called the index of refraction. This index is the ratio of the speed of light in a vacuum (186,000 miles per second) and the speed in the medium. The index for air is 1.0003, so for most purposes it can be considered to be the same as a vacuum. The index of refraction for water is 1.33. The index for most common glasses lies between 1.46 and 1.96, depending on the chemical composition. For instance, the rare-earth glasses have high indexes which allow shallower curves and lighter weight lenses. Unfortunately, as will be seen later, the index varies slightly with the color of the light. Diamond has one of the highest indexes, 2.42, which is why a diamond sparkles so much. The high index means the light bends more, which allows more facets to be cut, creating more internal reflections than with any other material, resulting in much more sparkle than with something masquerading as a diamond. Generally, the denser the medium, the higher the index of refraction. Looking deeper at why light reflects off a metal surface, for conductors the index of refraction is a complex number, creating an attenuation factor which rapidly decreases the amplitude of the ray as it tries to propagate into the metal. When the light passes into the second medium and its speed changes, its wavelength will change, but to maintain the continuity of the fields, its frequency does not.

Again the path of a ray of light depends on its orientation to the normal, in this case the normal to the interface between the two media. If the ray crosses into a large block of another medium perpendicular to the interface between them, the light changes speed, but its direction does not change. If the ray is not perpendicular to the interface, in addition to slowing down, the direction will change. The standard analogy to explain why is a column of soldiers marching from a dry field obliquely into a field of mud. The soldiers on one side, who reach the mud first, tend to slow down before the soldiers on the other side do, causing the column to turn. The angle measured from the normal in the original medium is again called the angle of incidence, while the angle from the normal in the second medium is called the angle of refraction. When light enters a medium with a higher index of refraction, its direction alters toward the normal, or the angle of refraction is smaller than the angle of incidence. The same path will be followed if you reverse the direction of travel, so if the ray enters a medium with a smaller index, it bends away from the normal, or the angle of refraction is larger than the angle of incidence. The precise mathematical relationship is that the index times the sine of the angle is the same in each medium. If the second medium is a block which has two parallel faces, the incoming beam will bend toward the normal upon entering the block, but then will bend away from it by the same amount on leaving, the end result being the emergent beam will be parallel to the incoming beam, just offset from its original path. This also explains why a prism bends a beam of light. For a light ray which enters a prism (parallel to its base with its apex upward), the ray bends toward the incoming normal and then away from the normal on exiting the prism, but since the two normals aren't parallel, the net effect is that the ray bends (downward in this example) toward the base, and the larger the apex angle of the prism, the more the net deviation. As light strikes a more dense medium at higher and higher angles the beam must bend farther and farther from the normal. Eventually the angle of incidence reaches what is called the critical angle. At the critical angle, the angle of incidence is such that the beam is refracted along the interface. At any higher angles, the angle of refraction would have to be greater than 90 degrees (which isn't allowed since it would leave the second medium), using all the light to reflect off the interface instead of refracting into the denser medium. This creates what is called total internal reflection. This critical angle for an air-glass interface is 41.8 degrees. This allows the back surfaces of a 45-45-90 degree prism to act as mirrors in a pair of binoculars or star diagonal without being aluminized, giving it a much longer useful life, and reflecting 100% of the light instead of the 90% of a typical aluminum coating.

Image formation by spherical refracting surfaces

One can consider a double convex lens (with two spherical surfaces, which are the easiest surfaces to create) to be an infinite set of truncated prisms stacked on top of each other, the two faces of each not quite parallel, the apex angle of each highest at the rim of the lens and decreasing toward the center, so the edges of the lens will deviate the light the most while the center doesn't deviate the light at all. This creates the focusing action of a lens: the larger the curvature of the surface, the shorter the focal length. A plano-convex lens will focus light passing through it, but its focal length will be longer than a lens with a curve on both sides (a double convex lens). The normal lens has two perpendicular symmetry axes, the optical axis becoming the symmetry axis that passes through the widest part of the lens, in its center. Since the angles of incidence and refraction are again on opposite sides of the normal, rays coming from above the optical axis of the lens will converge to a focus below the optical axis and rays from below the axis will converge above it. The image of an arrow pointing up will be reversed left to right, and up to down, but not front to back as in a flat mirror. This type of image (in both mirrors and lenses) is called inverted, not perverted like for a flat mirror.

The image of an object at infinity forms at the focal point, but where that is depends on the thickness of the lens. The normal simplification used is that if the lens is "thin", all the bending can be considered to occur along the symmetry axis of the lens (the one perpendicular to the optical axis). In this case the focal length is measured from the center of the lens. In doing ray tracing one must still consider the refractions at both interfaces, but the results aren't much different than the simplified model. However, if the lens is "thick" in comparison to the focal length and diameter, the oppositely curved portions don't meet exactly at the edge, but are separated by a cylindrical section of glass. Like inside a prism, one has to take into account the path of the ray inside the lens to find where the ray refracted from the first surface encounters the second surface. Similarly if there are several lens, their separation greatly affects the total focal length of the combination, as in a zoom camera lens. For example, most eyepieces contain multiple lenses, but where is its effective focal length measured from? The focal length of most eyepieces is usually measured from its field stop, which for different designs and focal lengths can be almost anywhere inside the eyepiece barrel. In a set of parfocal eyepieces, their focal points are the same distance from where they bottom out in the draw tube, so that when you focus one, any of the others will be in focus at that same place.

A problem that arises for lenses is that the index of refraction is color dependent: blue light is bent more than red light. This results in the focal length of the lens in blue light being shorter than for red light, not by much, but by enough to separate the colors to our eyes. This dispersion creates color fringes on opposite sides of the image, blue on one side and red on the other, especially for bright sources. This is the origin of a lens's major defect: chromatic aberration. For a convex surface, blue focuses closer than red; however for a concave refracting surface, red focuses closer than blue. This will allow an achromat (two properly shaped lenses: a double convex lens and a meniscus or plano-concave lens of different refractive indexes) to remove most of the chromatic aberrations. However, the doublet can't remove all of the dispersion, since green light will focus between red and blue. This is why an apochromat (a triplet which is designed to focus red, green and blue at the same point) has even better color performance than the achromat, but you have to pay even more than for an achromat. This is why refractors are so much more expensive than a reflector of the same diameter. The shorter the focal length, the more severe both spherical and chromatic aberrations become. Before about 1810, when the achromat was invented, refractors were always single lenses of very long focal lengths (f/100 and up) to minimize these aberrations, making them very awkward to use. Chromatic Aberration only affects lenses, since with a mirror the light never has to pass through the glass, but spherical aberration will also affect mirrors. The spherical surface must be converted to a paraboloid one (deeper in the center than a sphere with the same focal length) to cure the problem, which again is more severe at short focal lengths. Part of the brilliance of a diamond is also due to its high dispersion. Other aberrations such as coma appear when off-axis rays are considered.

Magnification There are two different magnifications: linear and angular. The image size for a star (the central spot of the Airy disk) is very small if it has no aberrations, but still apparent, so talking about the linear magnification of a point source is meaningless. You can't change the size of the prime focus image for an extended object, since the linear size depends only on the focal length of the objective. For the sun (or the moon), which is ½ degree across in the sky, the exact formula is: the prime focus image diameter of the sun in inches is equal to the focal length (in inches) divided by 108. So, you really can't talk about the magnification of the telescope objective alone. However, for a terrestrial object that is not at infinity, where the image is not a point, the linear magnification can be defined as the linear size of the image divided by the linear size of the object. If light rays going through different parts of the lens (or mirror) actually intersect, you can actually put a piece of paper there and see where the rays intersect to form an image. This is called a real image. If the rays diverge, you cannot get them to intersect, but your mind traces them back to where they seem to intersect on the opposite size of the lens (or mirror). This is called a virtual image and no light actually intersects there. A good example of a virtual image is the image formed by a flat mirror. No light actually reaches behind the mirror, but your brain imagines that it does. To observe the image of objects at infinity created by a telescope one of course has to add an eyepiece, which is another lens or series of lenses.. The parallel beam entering the objective diverges beyond its focal point and the eyepiece converts this diverging beam into another parallel beam that enters your eye. For this to be true the separation of the objective and the eyepiece is must be equal to the sum of their two focal lengths. Your mind creates an image from this combination that is virtual and at infinity, as the object is, but larger than the object. This produces an angular magnification (the ratio of the angular size of the image divided by the angular size of the object) which becomes the focal length of the objective divided by the focal length of the eyepiece. The brightness of a point source depends only on the diameter of the objective, but for an extended source the brightness of the image will also depends on the focal length. The longer the focal length the larger the size of the image; so, the bigger the image the more area the light is spread over. This decreases the overall brightness of that image. Many characteristics of images depend not only on the focal length, but on the ratio of the focal length to the diameter of the objective, which we know as the f-ratio, or in photography as the f-stop. The severity of most aberrations are highly dependent on the f-ratio, becoming more noticeable at small f-ratios.

Antireflection coatings Whenever light passes from one medium into another with different properties (notably a different refractive index) part of the light is reflected (r %) and part is transmitted (t % = 100-r %). The ratio of the reflected and transmitted intensities is primarily a function of the difference between the refractive indices and the angle of incidence. The relative amplitude of the reflected light is [(1-p)/(1+p)] where p is the ratio of the refractive indices, and the intensity (brightness) is the square of this. An uncoated air-glass interface (crown glass) reflects about 4% at normal incidence (perpendicular to the interface). In a multi-element lens system, reflection losses would be quite high if antireflection coatings were not used (the transmitted amount would be $[.96]^x$ where x is the number of interfaces from air to glass). For 10 such surfaces, the transmitted beam would drop to only 66% due to reflection losses alone. Reflection losses remain about 4% per surface until angles of incidence exceed 30 degrees, rising rapidly to 100% at grazing incidence.

One consequence of the wave properties of light is the concept of interference. When two light waves intersect, the amplitude of the sum can range from zero to the sum of the amplitudes, depending on the relative phases of the two waves. If the two arrive in phase (both maximum at the same place and time) they reinforce each other, called constructive interference. If they arrive 180 degrees out of phase (half a cycle, with one maximum while the other is a minimum), they cancel each other out, called destructive interference. In intermediate cases, one gets a result intermediate between these two extremes, but not a pure sine wave. Thin film coatings rely on interference. Thin films are dielectric materials, whose thickness is comparable or less than the wavelength of the light. When a beam of light is incident on a thin film, some of the light will be reflected from the front surface of the film and some will be reflected from the back surface of the film. The rest will be transmitted. The two reflected beams will interfere with each other. The result depends on the thickness of the film as a fraction of the wavelength of the light inside the film (which is the wavelength in air divided by the index of refraction). To create complete destructive interference in the two reflected beams, the thickness of a single layer coating (at normal incidence) must be an odd number of quarter wavelengths of the light. If this is true, no light is reflected and all the light is transmitted through the film into the coated material. For complete transmission, the two reflected beams must also be of equal intensity. This condition is realized when the refractive index of the film is the geometric mean of the indexes of the air and the glass, or the square root of the index of the glass substrate. For typical glasses, there is no material with an index low enough to exactly match this requirement, about 1.38 at a wavelength in the middle of the visible spectrum. The substance which comes closest is Magnesium Fluoride, which can reduce the reflectance of a single layer film to about 1.5%. Such coatings work extremely well over a wide range of wavelengths and angles of incidence (in fact they work better at steep angles). For best results, all surfaces should be coated (known as fully multicoated). Some doublets are only coated on the exterior surfaces, not on the surfaces which are between the lenses, which decreases the amount of transmission. ♈

The CVAS 10' Dome

By Ken Fisher

At our August meeting, Ian had mentioned that our dome was looking a bit rough and asked what we could do to clean it up. This was the beginning of an informative journey. I would like to pass along what I've learned in this process so that down the road, we can maintain our dome properly.

Steve F. and Larry took Marty's truck for a road trip and picked up and installed our dome in 2003. It was manufactured by Technical Innovations and is one of the Home Dome line of products they offer. As far as I know, in the 8 years that have since passed, it has had no maintenance. My expectation was, that once I got up there and cleaned it, we would again have a nice smooth shiny white dome just like when it was originally brought to Indian Hill. So, a few weeks ago, armed with Joy dish detergent, a scrub brush, and 14 gallons of clean water, I set up my ladder and began scrubbing down our dome. Here's how it looked when I began (I had already done the shutter)…

The grey streaks just turned out to be dirt. Initially I wasn't sure if this was staining or some sort a vegetative growth on the surface, but it just turned out to be regular old particulate dirt. Fortunately, the dish detergent and water was the perfect mix and after about 8 hours of scrubbing, rotating the dome, getting back on the ladder, scrubbing again, rotating the dome again, etc… it cleaned up pretty nicely.

Here's a picture of the cleaning in progress…

And here's how the dome came out after I was finished…

While initially this would seem to be the end of the story, I found something a bit strange while cleaning the dome. The surface, rather than being really nice and smooth and shiny as I had expected it would be, was instead a dull, kind of matte finish and to the touch, it almost felt like you were rubbing your hand over chalk. I started asking questions and kicking around on the internet to see what this was all about. As it turned out, the answer was that our dome was deteriorating. We have a fiberglass dome and it has a resin known as gelcoat as its outer surface. This gelcoat, over time and exposure to the weather and UV, actually oxidizes. Naturally I wanted to do whatever I could to restore and protect our dome.

I placed a call to Home Dome and talked with them. I posted a thread on the internet. And I went to West Marine in Cleveland – they are a retail marine supply shop dealing with the boaters and I figured that our dome was pretty much the same as a boat hull so West Marine might have some good insight. After about a week of gathering information, it seemed like the best course of action was to restore a good finish to our gelcoat and then to apply a UV protecting polish. I spent a bit of time looking over various products and eventually settled on 3M Finesse-It as the compound I would use to buff out the gelcoat. I borrowed my brother's orbital buffer and, running it at about 3,500 rpm, proceeded to start buffing out the dome. I also purchase a bottle of Meguiar's Flagship Marine Wax to apply to the dome once I had gotten back a good surface. This combination of products seems to be doing the trick. After buffing, I've gotten a nice smooth surface on the dome. After that, I apply the polish/wax and it shines up really well.

From what I've been able to gather, it sounds like the polish will last 3 – 6 months so it would be a good idea to apply this stuff to the dome once or twice a year in order to keep the surface protected. Below are a couple pictures that illustrate how the dome looked after it was cleaned but before it was buffed and polished, and then another image of after it was buffed and polished. The final image is just a snap shot of the products used.

I am not yet finished buffing and polishing the dome and it has taken a whole lot of time and a whole lot of effort (not to mention a horrific sunburn just thrown in for good measure). I'm fairly confident that once it's done, only a regular polishing will be required. But to future caretakers of our observatory – you will be saving yourself a ton of work if you maintain this regularly. Hit the dome with a good UV protecting wax at the beginning of each year, keep your shirt on while doing it, and this beauty should last quite a good deal longer! Current replacement cost of this exact dome is about $8,000 so we should do what we can to preserve it.

After buffing and polishing…

And the products used…

Backyard Astronomy with Porro Prism and Image Stabilized Binoculars

By Paul Grubach

In the spring of 2010, the "astronomy bug" bit me. In order to learn the science and become a skilled amateur astronomer, experienced astronomers suggested that I learn the heavens and constellations first with the naked eye and binoculars, and then graduate to a telescope. With due regard for this sage advice, I immediately purchased what many consider to be standard binoculars for the beginning backyard astronomer, the 8 x 56 Celestron SkyMasters (porro prism model).

For the modest price of approximately $150 (purchased on the Internet), they give the neophyte an acceptable view of common astronomical objects. The large aperture translates into good light collecting ability. The magnification is low enough to allow the binoculars to be hand held pretty well, even while standing erect. If even more "steadiness" is desired, bracing oneself in a chair eliminates some vibration in the image. Being well made and not too heavy, they are also tripod adaptable. According to my experience, any higher magnification (such as my 10x Eagle Optics Rangers) requires a tripod to be usable for viewing the heavens. By reducing the magnification from "10x" to "8x" eliminates the need to purchase a tripod. There may be astronomers reading this who can steadily hold 10x or even 15x binoculars for good viewing, but I am not one of them.

On a clear night, Jupiter and two of its moons can be seen: the planet appears as a bright disk bordered by one or two points of light, the Galilean Moons. Mars appears as a red point of light. Venus appears as a very bright disk, but I could never make out its phases. In all of these images there was some minor distortion. The number of stars visible with these binoculars seem incredible to a budding backyard astronomer like myself. Using averted vision, the most majestic sight I saw was Andromeda Galaxy (M31): it appeared as a hazy patch distinctly elongated. The open cluster of Pleiades is a very interesting site in these binoculars, and I could make out the nebulosity in Orion (M42) somewhat well. The planet Saturn appeared differently than stars: it seemed to glow rather than twinkle, but there is no indication that it has any rings.

For beginning and veteran astronomers, however, who really want the best binoculars available, the Image Stabilized models are the way to go. They give one a much clearer, sharper, and vibration free image of sky objects than conventional porro and roof prism binoculars, and are certainly far easier to use and more portable than a telescope. An added advantage is that they also can be used for long distance bird and nature study. Nevertheless, the reader must be forewarned: they are quite expensive. The Canon 15 x 50 Image Stabilized binoculars that will be discussed cost around $1,040 over the Internet, inclusive of the neck strap and lens caps that were purchased separately.

My observations on August 16, 2011 at 1:30 AM in my front yard confirmed (in my mind) the optical superiority of the 15 x 50 Image Stabilized binoculars over the 8 x 56 porro prism model. I turned both binoculars to Jupiter and its Galilean moons.

Point the Image Stabilized (IS) binoculars at Jupiter and you see a bright dot wandering around in the field of view. Press the image stabilization switch on for the Canon 15 x 50 IS binoculars and the planet and its moons instantly become visible. (The IS system is powered by two AA batteries.) While they cannot subtract all movement they do get rid of the little shakes that make hand held viewing so difficult. With the IS binoculars I received a clear and sharp image of Jupiter and four of its moons—Io, Europa, Ganymede and Callisto. It must be emphasized that I could clearly differentiate four points of light around the planet, which appeared almost distortion free. With the 8 x 56 porro prisms I could just barely make out two of its moons and the image of Jupiter had some distortion around the edges. So, the 15 X 50 Canon binoculars gave me superior resolution as compared to the 8 x 56 Celestron model.

With both glasses I also observed Andromeda Galaxy, M31. Once again, I got a sharper and clearer view with the Canon IS 15 x 50s. In late June, I observed Saturn with the IS binoculars, and the 15x is enough magnification to see that Saturn is obviously not round: this is not apparent with the 8 x 56 Celestron optics.

In the early morning hours of August 20, 2011, I turned the IS binoculars to the Moon. I was duly impressed with the detailed, sharp and distortion free image of, for example, the Apennine Mountains and the crater, Plato. You certainly can see these features with the Celestron glasses, but the resolution is much better in the IS binoculars.

In my opinion the IS system works extremely well. As with all such systems, they eliminate the "jiggle" that ruins the view with binoculars of about 10x or greater, but there is still some residual, slow "wander" because of larger scale movements that the user makes, but they stop everything more than enough to give an excellent view. Even in my light polluted front yard the IS binoculars are providing very satisfying views of the night sky. They are a bit heavier than regular binoculars, but are not uncomfortable, especially if I brace my elbows against my body or the arm of a chair. I can use the binoculars with my glasses on due to the 15 mm eye relief. Since the lens barrels don't rotate, intra-ocular distance is adjusted by actually moving the oculars. They are kind of stiff but that is good because they stay in place once you get them set.

Of course, the 15 x 50 IS binoculars are far more convenient and easier to use than binoculars on a tripod. Nevertheless, they can be tripod mounted. There may be a problem, however, changing the batteries when the binoculars are mounted on a tripod. Unlike most binoculars where the tripod mounting is at the objective end where the two barrels rotate on, for the Canon it is at the bottom of the binoculars near the center of the tubes which don't rotate. Since the battery compartment is just in front of it, you may have a difficult time getting to it when the binoculars are tripod mounted.

In summary, I believe the Canon 15 x 50 Image Stabilized binoculars are excellent optical devices for “backyard astronomy” and worth the steep price. ♈

Talks & Presentations

July

CVAS member Steve Kainec described star hopping techniques for visual observers at our July membership meeting. Star hopping is a method of moving the telescope manually from a known position to a target in steps. The importance of knowing the identity of the bright stars and their relative positions was discussed. A typical star hop may require the telescope to cross many individual fields which are identified by referencing various star charts. Steve’s presentation includes many examples and tips, and can be viewed on our website: Star Hopping

August

CVAS member Mariah Pasternak spoke to a large group of attendees at the Lake County Metroparks annual Super Star Party on August 13, 2011. Mariah’s talk centered on observing our moon, and covered many aspects not normally considered by the casual observer. Mariah’s presentation was enthusiastically received by all in attendance, and can also be viewed on our website: Our Moon

September

At our September membership meeting, CVAS member Ron Baker spoke about observing asteroids with a CCD camera. With the use of astrometry and photometry, backyard astronomers can measure many characteristics of asteroids. These include orbit definition, rotational period, absolute magnitude, orientation of spin axis, and even estimates of size and shape. Ron’s presentation is available on our website: Observing Asteroids with CCD

CVAS Officers (2011)

President:	Ian Cooper	Director of Observations:	Bob Modic
Vice President:	Russ Swaney	Observatory Director:	Ken Fisher
Treasurer:	Steve Fishman	Historian:	Dan Rothstein
Secretary:	Larry Boros	Editor:	Ron Baker

Constellation Quiz

By Dan Rothstein

1. Name the only constellation which has the same name as its brightest (2nd magnitude) star.
2. Which bright stars form two lines that intersect at Sirius, forming "The Egyptian X"?
3. This figure of a young boy with a bow and arrow, half clad in flowing robes, was originally introduced by Hadrian to commemorate a favorite young lad who drowned in the Nile, sacrificing himself in the hope (foolish we would think today) of prolonging the emperor's life. Name this constellation which has come in and gone out of favor several times since Roman times, and the modern constellation where it was found.
4. This figure was the celestial symbol of philanthropy to the Greeks as well as the name we know it as now. Another name it had was Victor Arionis, from the Greek story of Arion, who was rescued by this creature after falling overboard on a sea voyage. In the nineteenth century it somehow got temporarily biblicized as Job's Coffin. The Hindus, from whom the Greeks are said to have borrowed the figure, called it Zizumara (however, the same name was also used for Draco).

Answers to last issue's questions:

1. The circular shape of Corona Borealis was described (in the January 1997 *S&T*) as Crustum Deorum, the Pizza of the Gods. Its two brightest stars were renamed by John L. Jones and his drinking buddy amateurs as epperonius and Caseus (the cheese). The Northern Pizza also has its obvious southern hemisphere counterpart.
2. The figure we use today for this region is Hercules. In old drawings it is the figure of a man holding the body of a three-headed serpent, trampling the huge monster with both feet or sometimes kneeling on it. Bayer described the southeast region of the constellation as Ramus Pomifer, the apple branch. Its three shoots may be associated with Hercules' labor to recover the golden apples of the Hesperides. Hevelius described it as Cerberus the three-headed dog that guarded the underworld, including the area around Omicron and Xi in the eastern part of the constellation.
3. The Arabs recognized two stars as the "props of heaven." Spica was the unarmed prop. The armed prop, also known as the "bear guard", is Arcturus who follows Ursa Major around the pole guarding his flock.
4. Bufo, the common toad, is one of 13 constellations invented by English MD John Hill (1716-1775). It is composed of about 15 stars, making a conspicuous cluster that can be seen in my *Norton's Star Atlas* south of Libra. The second magnitude star making up the toad's eye is probably κ Libra, south of γ.

2011 Fall Skies

October

1	Sat	Mars 0.17° SSW of the Beehive Cluster (12 UT)
6	Thu	Venus 1.7° SSW of Saturn (21 UT)
8	Sat	Draconid or Giacobinid meteors
11	Tue	Delta Aurigid meteors
16	Sun	Uranus crosses the celestial equator (12 UT)
18	Tue	Epsilon Geminid meteors
21	Fri	Orionid meteors
22	Sat	Mercury at aphelion (6 UT)
24	Mon	Leo Minorid meteors
28	Fri	Moon 0.57° WSW of Mercury (1 UT)
29	Sat	Jupiter at opposition (2 UT)

November

9	Wed	NEO 2005 YU55 closest approach < 1 lunar distance, mag 11.1, sky motion 9 arcmin/min (0 UT)
11	Fri	Mars 1.3° NNE of Regulus (1 UT)
12	Sat	Northern Taurid meteors
16	Wed	Leonid meteors
25	Fri	Partial eclipse of sun – Indian Ocean
22	Mon	Neptune at opposition (23 UT)

December

6	Tue	Phoenicid meteors
10	Sat	Total eclipse of moon – Pacific Ocean
14	Wed	Geminid meteors
22	Thu	Winter solstice (5:30 UT)
23	Fri	C/2009 P1 Garradd at perihelion (19 UT)
29	Thu	Venus 1.3° SSW of Saturn (23 UT)

Notes & News

Marty Niemi, Observatory Director at CVAS for many years, recently passed away. Marty was instrumental in assembling and maintaining our telescopes and observatory buildings. A memorial fund has been established in Marty's name.

CVAS members participate regularly in star parties held at various locations throughout Lake and Geauga counties. These events are scheduled throughout the year (see our website for details). August was a particularly busy month as CVAS supported two large events. On August 13, the Lake MetroParks annual Super Star Party was held at Penitentiary Glen. This year's event attracted over 500 astronomy enthusiasts. Later in the month, 1500 visitors participated in the 50th anniversary of the Geauga Park District, which was held at the new Observatory Park. These events provide a great opportunity for people to look through a variety of telescopes and learn about the night sky in the company of knowledgeable observers.

Research on the characteristics of main-belt asteroid (604) Tekmessa is described in an article by CVAS member Ron Baker published in the *Minor Planet Bulletin* (2011) Vol 38, Number 4, 195-197. The study is based on CCD observations recorded at the Indian Hill Observatory, and other observatories located in Colorado and New Mexico.

The CVAS website is the place to go for information about upcoming events and activities. In addition to a special member's login, there is a host of astronomy related information, and links to interesting and useful sites. Send suggestions to webmaster, Russ Swaney russ_swaney@ameritech.net.

The Valley Skywatcher has a long tradition as the official publication of the Chagrin Valley Astronomical Society. All material in this issue has been written and provided by individuals within our membership community. CVAS welcomes astronomy related contributions from all members and friends, and this journal provides a unique opportunity to share your interests. Published quarterly, the next issue will be available near the end of December. If you would like to contribute material to the publication, please contact the editor, Ron Baker rbaker52@gmail.com.

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