

Gemini

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Stories Wanted: *Gemini* is written entirely by our members, for our members! *Gemini* needs your stories... how you first became interested in astronomy, how your interest has evolved over the years, equipment you use, star parties and events you've attended here and elsewhere, how you've encouraged others — especially young people — to get involved in this fascinating hobby. Submit your stories to: brownreuegene66@gmail.com

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A Tour of the Griffith Observatory

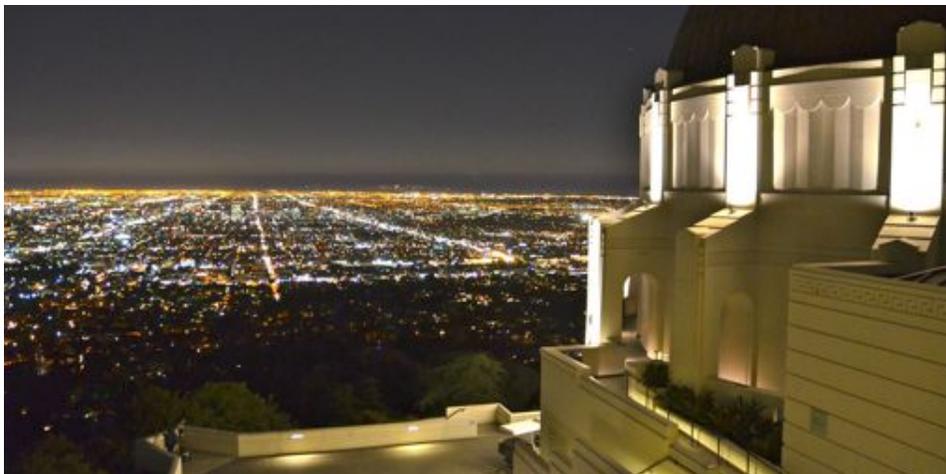
By Dennis Fazio

So many of us can trace our keen interest in the wonders of the sky to that first time we peered through a telescope and saw something not visible to us before. For me it was a star cluster through Mike Lynch's big Dob outside the Maple Grove Library. For Griffith J. Griffith, a wealthy mining syndicate owner at the turn of the last century, it was a view through the 60" Mt. Wilson telescope. He declared, "Man's sense of values ought to be revised." He was also quoted as saying: "If all mankind could look through that telescope, it would revolutionize the world."

After consulting many experts on astronomy and public education (including George Ellery Hale, founder of the Yerkes and Mt. Wilson observatories), he established a trust fund with the goal of eventually building an observatory that would contain solar and celestial telescopes, a scientific theater, and a museum (the Hall of Science) to illustrate the place of humanity in the vastness of space and time. For celestial viewing, he specified in his will that the telescope was to be at least 12 inches in diameter and complete in all its details and was to be located high and above the Hall of Science.

In 1930, the Griffith trust again turned to George Ellery Hale, then in the process of planning the 200" Palomar Telescope, for assistance. Hale provided his artist, instrument designer, architectural consultant, and the figurehead of the amateur telescope-making movement, Russell W Porter. He chose the 12" Zeiss refracting telescope as being the best for fulfilling Griffith's intentions that all the public be able see the night sky and be inspired as he was. The \$14,900 order from Carl Zeiss Company of Jena, Germany, was assembled and installed in the dome in 1935 and opened to the public. Since then, the telescope has been used by more than seven million visitors on every night the observatory is open.

Griffith Park is spread across the highest and most mountainous part of the City of Los Angeles, northwest of the downtown center. It is the home of the observatory on its south side and the great Hollywood sign in the northwest corner, next door to the famous Forest Lawn Cemetery. Nestled at the south-central part of Griffith Park's hills, the observatory has a commanding view of the Los Angeles basin, similar to those scenes you often see in movies or TV shows from Mulholland Drive. On rare occasions, the sky is clear in the late afternoon, but it was its usual hazy gray on our visit, so we didn't get much of a daytime view of the city.





The observatory does have some real science research ongoing, but its primary purpose is to provide access for all citizens to the experiences of astronomers, giving plentiful admittance to its instruments and its educational displays. The solar telescopes, including a white-light image, spectroscopic image and, most impressively, the spectrohelioscope, a hydrogen-alpha filtered image that provides all the surface and corona details we never get to see, are available all day.

The vast majority of evenings are clear of clouds in the Los Angeles area, providing ample viewing opportunities for the public. The observatory frequently opens its 12" Zeiss refractor for access, and a long line is formed even on weeknights. They supplement this with a pair of Celestron 12" NexStars out on the front patio. Although they don't provide the same kind of overall experience as the historic Zeiss in the big copper dome, the images through the Celestrons were just about as good, and there were no crowds; you practically had them to yourself. The operators had one scope pointed at a double star and one at the Orion Nebula. For those, like me, new to astronomy, it was an amazing image, in spite of punching through probably the worst light-polluted and most particulate-matter-polluted skies in the world. Jupiter was high in the sky at that time, but the staff person said the sky was much too unstable to get a decent image. Having recently wowed myself with the view through my new 6" NexStar, I was disappointed not to get a glimpse of the largest planet through its big brother.

Of course, the view looking down is as spectacular as the view looking up, with the whole Los Angeles basin spread below. Views of downtown Los Angeles, Hollywood and beyond are extensive and brightly lit, providing a complementary and highly geometric artificial universe of stars. The evening winds had pushed much of the obscuring haze out of the way to provide a memorable sight.

The science exhibits inside rank at among the best I've seen. There is a huge wall image of the Virgo cluster, probably 20 feet high and 100 feet wide. One of my favorites is the Cosmic Connection, a 150-foot, 14.6 billion year timeline of the universe from the Big Bang to the present, accompanied by a chain of celestial jewelry. It's a nice visualization of how great is the distance of time from the beginning. There is also a cloud and a spark chamber, each showing tracks as particles from space pass through them. The cloud chamber was pretty lively, with tracks appearing and fading every few seconds.

We usually schedule our visits to family in Pasadena during the colder months, which precludes a trip up the mountain to the Wilson Observatory right next door. Some day we'll have to alter that pattern a bit. In the meantime, the Griffith Observatory and the Jet Propulsion Lab are two of the best amateur astronomer destinations if you're in the LA area. JPL needs a two-week advance reservation, but Griffith is almost always open for a spontaneous visit with no admission charge. It's designed for all ages, so do take the kids if they're not too worn out from the Universal Studios tour.

Further information

Observatory home page: <http://www.griffithobservatory.org/>

Details on the Zeiss telescope: <http://www.griffithobservatory.org/exhibits/bzeiss.html>

Details on the solar telescopes:

<http://www.griffithobservatory.org/exhibits/bcoelostat.html>

Details on the exhibits: <http://www.griffithobservatory.org/bexhibits.html>



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Minnesota's First Occultation Timing: Nicollet and Fremont at Pipestone Quarry

By Gary A. Davis

Last June's transit of Venus, and stories about the transits from the 18th and 19th centuries, help remind us that when one celestial object obstructs the view of another, we're given a chance to learn something new. The term "occultation" commonly refers to events where a visually larger object, such as the Moon, blocks a visually smaller object, such as a star or planet. Timing the occultations of stars by asteroids has led to discoveries of binary stars and, when done by a well-placed team of observers, can tell us something about the size and shape of an asteroid. The occultation of a 9th magnitude star by the planet Uranus in 1977 revealed that Uranus, like Saturn, has a system of rings.

The French astronomer Ismael Boulliau (Bullialdus) is credited with the first recorded telescopic observation of a star occulted by the Moon in the year 1623. During the 19th century, explorers and practical astronomers timed the beginnings or endings of occultations to estimate longitudes, and on June 30, 1838, Joseph Nicollet and John Fremont timed an occultation of Spica by the Moon at Pipestone Quarry in what is now southwestern Minnesota. Joseph Nicollet was a French scientist and astronomer who led three exploratory surveys into the upper Midwest between 1836 and 1839 and later oversaw the drafting of what, for its time, was the state-of-art map of the upper Mississippi River watershed. John C. Fremont later became famous as an explorer of the American west, ran for president in 1856, and was one of the generals defeated during Stonewall Jackson's Valley Campaign during the Civil War. In 1838, Fremont was a newly appointed 2nd lieutenant in the Corps of Topographical Engineers, serving as Nicollet's assistant and second in command.

Reproduced here, courtesy of the Minnesota Historical Society, are Nicollet's and Fremont's descriptions of their occultation timing. This is a translation of Nicollet's French:

Occultation of Virginis by the dark limb of the Moon. Immersion at 11 hours 2 minutes 34 seconds by the chronometer, or at 10 hours, 43 minutes, 7.28 seconds local mean time. Telescope had a magnification of 140 times. Sky partly cloudy, the Moon separated from the clouds and its disk very complete at the moment of the observation. The emersion invisible. It was lost in the clouds and very near the horizon.

Fremont made a separate timing with a smaller telescope but reported the same chronometer time.

Pipestone Quarry was and still is a well-known source of pipestone, or catlinite, a soft, red stone much valued by Native Americans for carving pipes and other ceremonial or decorative objects. Nicollet and Fremont visited Pipestone Quarry during an exploratory survey of the divide separating the Minnesota from the Missouri River, and the geographical data collected during the survey were later used in Nicollet's famous map. Pipestone Quarry was chosen as one of the geographical control points which fixed the survey's data to the global latitude-longitude grid, so it was essential that the quarry's global position be determined as accurately as possible. To that end, between June 29 and July 4, 1838, Nicollet and Fremont made an extensive set of astronomical observations, including their occultation timing.

In principle, estimating longitude from an occultation timing was straightforward: One took the observed local time of the occultation, subtracted this from the corresponding time at Greenwich, England, and multiplied the difference by the Earth's rotation rate, 150/hour. In practice, however, things were a bit more involved. The first problem was to accurately determine local time without knowing one's longitude. Even an accurate chronometer gives local time only for a particular meridian

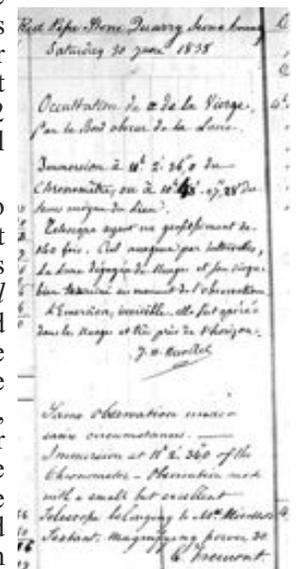
(Central Standard Time is local time only along the meridian centered in the Central Time Zone) and with the insults endemic to wilderness travel the accuracy of a chronometer, even for its specified meridian, became problematic.



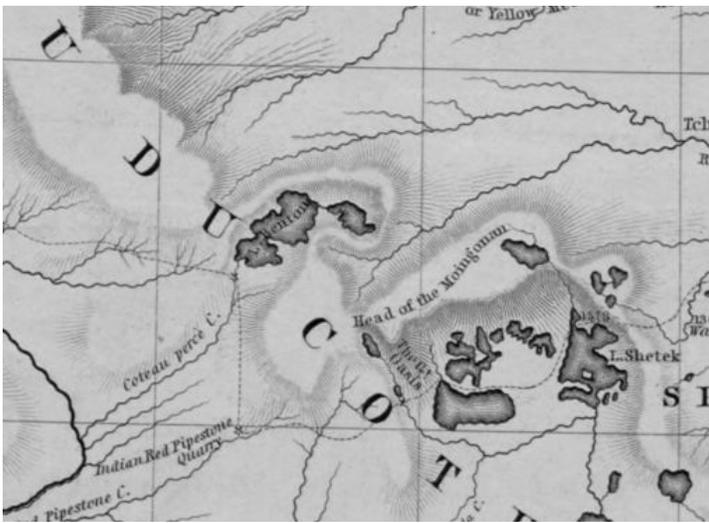
Detail from Nicollet's map, showing the route of the 1838 expedition.
(Courtesy of the Library of Congress)

The first requirement was to determine from astronomical observations the difference between the chronometer's reading and local time. On the evening of June 30th, in addition to observing the occultation, Nicollet and Fremont made four time shots using the stars Altair and Arcturus. In a time shot, the altitude of a celestial object is measured using a sextant and artificial horizon, while recording the time of the observation as given by the chronometer. The altitude measurement and a lengthy computation gave an estimate of local time; comparing this to the recorded chronometer time gave the extent to which the chronometer was slow or fast. The average of the four time shots on June 30th indicated that the chronometer was 19 minutes, 26.72 seconds fast compared to the local mean time at Pipestone Quarry.

The second problem was to determine the corresponding time at Greenwich. Predicted occultation times were not published in the *Nautical Almanac*; instead, it provided information which a knowledgeable individual could use to do the computation. In what is, at least to me, the most straightforward method for reducing an occultation timing, the computer (a human being doing the computations) starts with a good estimate of the place's latitude and an initial estimate of its longitude and, using data from the *Nautical Almanac*, computes a predicted time for seeing the occultation at the estimated place. The difference between this predicted time and the observed time is used to correct the initial longitude estimate. As it turned out, computation of the longitude estimate for Pipestone Quarry was outsourced, and here we encounter two interesting but less well-known figures from the early history of astronomy in the United States.



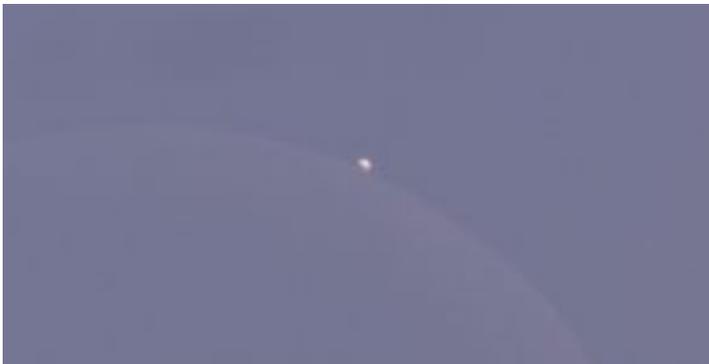
Record of the June 30, 1838, occultation timing by Nicollet and Fremont.
(Courtesy of the Minnesota Historical Society)



Detail from Nicollet's map, showing the expedition's route from Lake Shetek to Pipestone Quarry. (Courtesy of the Library of Congress)

In his *Report Intended to Illustrate a Map of the Hydrographical Basin of the Upper Mississippi River*, written while the map was under preparation, Nicollet stated that two reductions of the Spica occultation were computed. The first was by Father Augustin Verot, a priest of the Society of St. Sulpice and instructor of mathematics and science at St. Mary's College in Baltimore. Fr. Verot was born in France in 1805, was ordained in 1828, and in 1830 was sent to St. Mary's College. In 1832 he and Nicollet observed a transit of Mercury across the Sun; between 1832 and 1838, Fr. Verot timed several occultations and eclipses which Nicollet included in an 1842 paper read to the American Philosophical Society. In 1858 Fr. Verot became a bishop, overseeing parishes in eastern Florida, where he remained until his death in 1876. His longitude estimate for Pipestone Quarry was 96° 21.75'.

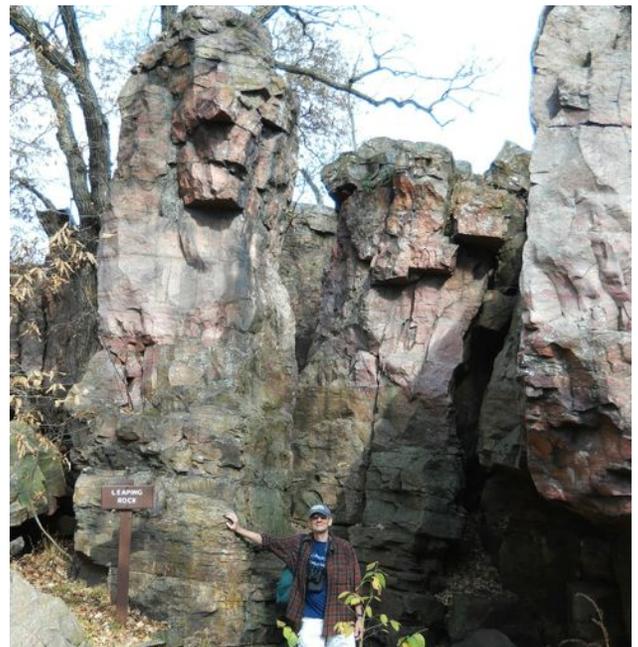
Nicollet also noted that Fr. Verot had used predicted positions for Spica and the Moon taken from the *Nautical Almanac*, which tend to differ from the actual positions. Corrected, after-the-fact positions were preferred, and Nicollet stated that an updated longitude estimate was later computed by a "Mr. S. C. Walker." Sears Cook Walker, an 1825 graduate of Harvard College, was, at the time of Nicollet's acquaintance, an actuary for a Philadelphia insurance company and the unofficial director of the Philadelphia High School Observatory. There he mentored several assistants who later became professional astronomers. Gifted with both a facility for languages and a mastery of mathematics, Walker was able to follow the developments reported in European astronomical journals, not the least being advances in predicting and reducing eclipse and occultation observations. Walker contributed to making the practice of astronomy in America equal to that in Europe, as shown by his role in a controversy about the discovery of the planet Neptune.



Daytime occultation of Venus by the Moon, August 13, 2012.

Neptune was discovered in 1846 by astronomers at the Berlin Observatory, following a prediction of its existence and position by the French astronomer and mathematician, Urbain Le Verrier. Walker was able to locate two previously unrecognized observations of Neptune made in 1795, and he used these to compute improved estimates of Neptune's orbital parameters. These differed significantly from those used by Le Verrier, enough so that the Harvard mathematician Benjamin Peirce claimed that Le Verrier's accurate prediction was a "happy accident." Although the consensus now gives credit to Le Verrier, this was arguably the first time American astronomers were able to go toe-to-toe in a dispute with Europe's best. Walker's estimated longitude for Pipestone Quarry was 96° 17.75'.

How accurate were these estimates? In his report, Nicollet gave the location of their astronomical station at Pipestone Quarry as "near the Chimney," a tall column of rock now called Leaping Rock, after Fremont's antics on the 4th of July. Last year my wife and I took a road trip to Pipestone Quarry as part of a project to visit places where old-time practical astronomers had made important observations. When I stood on the high ground about 20 feet from Leaping Rock, my GPS receiver gave a longitude of 96° 19.26', and my own reduction of the Nicollet/Fremont occultation timing, using data from the 1838 *Nautical Almanac* and a reduction method described in the 5th edition of William Chauvenet's *Manual of Spherical and Practical Astronomy*, was 96° 18.15'. (Chauvenet, a professor of astronomy at Washington University during the mid-19th century, was one of the assistants who studied with Walker in Philadelphia.) At Pipestone Quarry's latitude, one arc-minute of longitude equals about 0.8 miles, so we have differences ranging between approximately one and two miles, depending on how the reduction is done. At the scale used for Nicollet's map (1/1,200,000) this translates to differences of no more than 0.1 inches in Pipestone Quarry's position as plotted on the map.



Leaping Rock at Pipestone Quarry.

Leaving the Quarry, Nicollet and Fremont continued north and west to the Big Sioux River before turning east and returning to Fort Snelling via the Minnesota River. In 1839 they led an expedition by steamboat up the Missouri River to what is now Pierre, South Dakota, then overland to Devil's Lake, and finally south and east back to Fort Snelling. They then returned to Washington, D.C., to draft reports and complete the great map. There were plans for a new expedition into the American west, but Nicollet's health failed, and he died in September, 1843. Fremont was given charge of the new expedition and the rest, as they say, is history. 🇺🇸

Where Else Can You Find Saturn on Display at Kroger's?

by Thomas Arndt

Several years ago I saw an article in *Sky and Telescope* about a solar-system model centered on a planetarium in Peoria, Illinois, and I thought that if I were ever out that way I would have to stop and see it. This past October I finally got my chance. My wife Kim and I drove to Louisville, Kentucky, to see our niece get married. While we were making our plans, I remembered the Peoria model and wondered whether it still existed. I looked on the Internet, but I couldn't find any references to it more recent than 2009. I did find lists of locations, with addresses. I called Bradley University, the supposed site of the model Jupiter, but the woman who answered the phone had no idea what I was talking about. I mentioned that it was supposed to be in Olin Hall, so she connected me with someone in the biology department (No, I don't understand the reasoning there) who acknowledged that she worked in Olin Hall but knew nothing of any planet model hanging in a stairwell.



Neptune at Roanoke Motors, with author

The Lakeview Museum and Planetarium was closed for moving, so I couldn't call them. The main page of the website redirected me to the site for the new Riverfront Museum, which had few details. I was wondering if the model still existed. I figured that we would find out when we got there.

Being a twentieth-century sort of fellow (GPS? What's that?), I went to my local AAA and asked for a map of Peoria. They didn't have any on hand, but they said they could send me one. About a week-and-a-half later it showed up in my mailbox. Now I could start planning a route. Most of the sites were within a few miles of the planetarium, but the outlying planets were well out. Uranus was south of town, in a suburb called Pekin. Neptune was about twenty miles away to the northeast in the small town of Roanoke. Pluto (dwarf, schmorf!) was two counties northwest, in Kewanee. Eris was in distant Macomb.

We would be traveling southeast-to-northwest on the way back to Minnesota, so Pluto, in Kewanee, would be our last stop. Neptune,

in Roanoke, seemed like the best first stop. The other objects, except for Eris, were all at locations on my Peoria map. Most of the locations were indoors, at various businesses, so we'd need to be in town during business hours. I was able to learn the hours of some of the businesses by looking at their websites, but not all of them.

We got into Roanoke about 3:00 p.m. on Monday afternoon. It was a little weird to tell the woman at the reception desk at Roanoke Motors that I was looking for the planet Neptune, but she knew just what I meant and directed me across the showroom to where the big blue ball was hanging from the ceiling, ring and all. It was the first indication we had that our detour to Peoria was not in vain after all. I took a couple pictures of it. Kim took one of me under it, to show the scale, and we headed for the door. The receptionist wanted to know where I was taking my astronomy class; apparently most of the other people who came in to see Neptune were astronomy students at one of the nearby colleges, completing a regular assignment. I told her that I am just a hobbyist from Minnesota. I was a little surprised when she asked me which planet it is. I failed to notice at the time that there is a plaque on the wall describing the model. It says, "Community Solar System" and "You have reached the orbit of the planet Neptune." She apparently failed to notice it too.

She and Kim seemed about to start up a conversation which could last a long time, but we still had some driving to do to get to Peoria. I wanted to see as much as possible before businesses closed for the evening, so we jumped in the car and headed west again.



Earth, at Beachler's Vehicle Care

We crossed the Illinois River via the McClugage Bridge into Peoria and followed War Memorial Drive to University Street to find Beachler's BP Station. It turned out to be a Shell Station (the universe is always changing, after all). The young woman behind the counter asked us whether she could help us, and we told her we were looking for planet Earth. What a setup line! She could have asked us what planet we were from, but she simply pointed to the display on the wall showing the planet Earth. At the scale used, Earth was about the size of a softball. The plaque indicated that the scale is 42 feet to one-million miles, or 1:1,257,108. (I used this factor in the accompanying table to calculate what the sizes should be.) At the time, I didn't even think about the Moon. It would have been about the size of a ping-pong ball, three meters from Earth.)

Next stop: Mercury, at the Peoria Camera Shop in the strip mall at 4700 N. University Street. The strip mall was a number of unconnected buildings. We had to drive around for several minutes before locating the camera shop. We walked in. A saleslady met us.

“May I help you?” “We’re looking for Mercury.” “Oh. Through that doorway, on the left.”

We went through the doorway. Looked left. Looked right. No Mercury. We went back to the saleslady for more instructions. “I’ll show you.” She led us through the doorway. “It’s right here.” She pointed to a blank wall. “Oh! Well, it was right here. Just a minute—I’ll ask.” She went to confer with a colleague and came back a minute later. “I guess they’ve taken it. The museum is moving, and someone came and got it.” We thanked her, took a picture of the wall where Mercury had been, and left.

This lent an air of urgency to the search. We had to find the remaining planets before they disappeared. Venus was next, at Brown Printing on West Glen Avenue.

No trouble. Venus was still there, on a wall behind the counter at the print shop. We couldn’t get close enough for me to put my hand up next to it, but I did get a decent picture. The fellow behind the counter told us about the students who stop by for extra credit for their astronomy course. He knew about the move but had no idea when someone would be coming by to pick up his planet.

Now we headed west on Glen Avenue to find the School House, a store for educational equipment and the last reported position of Mars. The parking lot was north of the store and the door was at the northwest corner. The place was big and had a lot of interesting things for sale. The kid in me (never far from the surface) wanted to browse the entire place. The sales clerk was a little disappointed with us, I think, or tired of people coming in and not buying anything. “Mars is over in that corner,” he said, directing us to the southeast. I was recognizing the “Community Solar System” plaques now. It still had not occurred to me to wonder why we didn’t find one at Neptune, but so far all of the objects we’d visited other than Neptune were softball size or smaller and were mounted right on the plaque. The red planet was a little bigger than a golf ball.



Sun, at the planetarium, with Venus at third contact

Next it was to the planetarium, 1125 West Lake Avenue, to find the central object of the model. (I’ve lived in the Twin Cities all my life, and I have a difficult time saying “University Street” and “Lake Avenue.”) I seemed to recall from the S&T article that the exterior planetarium dome had been painted yellow to represent the Sun. When we got there, it was not the dome but a section of the wall representing our favorite star, and it was looking a little the worse for wear. Kim pointed out a rainbow in the sky. I took a picture of it, and then she took my picture by the planetarium entrance. We got there just in time for Venus’s third contact.

Next we headed for the campus of Bradley University, the last

known location of Jupiter. South again on University Avenue—Street! I didn’t need a map to tell me when we got there; there were plenty of young adults carrying books around. We found a place to park and walked a block south to Olin Hall, at Bradley and Elmwood Avenues. The stairwell at the northeast corner has windows all the way up, and it was easy to spot Jupiter from the street. We went inside and climbed the stairs. This model was big (over a meter in diameter) and beautiful—someone obviously put a lot of time and effort into painting it realistically. The Great Red Spot was easy to find. Nearby, on the walls, in addition to the “Community Solar System” plaque, were smaller plaques indicating the sizes and distances of some of Jupiter’s satellites, and one plaque describing Sheldon Schafer, who was the driving force behind the model. This was very cool, but it left me wondering two things: 1) Why were the Bradley University Web pages for the solar system model down?; 2) How could someone work in Olin Hall and not know that the model of Jupiter was there?



Jupiter, compared with Kim

Next stop was Saturn, at Kroger’s grocery in East Peoria, open 24 hours. We figured we could get there before they closed, so we took a dinner break at the Bob Evans restaurant. I’d like to say hello to Sean, our waiter, who not only demonstrated excellent reflexes but also helped us enjoy our meal and find Kroger’s. Sean had no idea about the solar system model, even though he’d been living in Peoria for years. It makes me wonder what’s going on in the Twin Cities that I don’t know about.

It was dark when we arrived at Kroger’s. Just inside the entrance was the “Community Solar System” plaque, but we looked around and could not see Saturn anywhere. We wondered if maybe the Mercury-snatcher had been here too, but when we asked the lady at the pastry counter, she said “No, it’s just hard to spot.” She led us back outside, and there between the ceiling of the entryway and the roof overhang was a ringed sphere nearly a meter in diameter. We might never have spotted it without her help. I took several pictures but failed to get a good one. At one point I went inside the store to photograph it through the windows. A clerk wondered what I was doing, and I could see the “aha!” moment when he remembered what was just outside the window. Kim and I were both tired by this

time, and we went in search of our hotel.

The next morning, after checking out, we headed east toward the river again, and following a rather twisty road we located the Forest Park Nature Center. In an outdoor display case was the model of asteroid Ceres. Unfortunately I had to take a picture through the display case, so there was a lot of reflection off the glass and the picture did not turn out well. Ceres was about the size of a marble.

We crossed the river and headed south to Mineral Springs Park in Pekin, Illinois. Here we found, in the Sunken Garden, not only Uranus (the only object of the model to be displayed outside), but also a huge, elaborate sundial (“Sundance, the World’s Greatest Sundial”) and a smaller solar-system model with just four planets. Uranus was depicted with a vertical ring system and a nearly featureless disk on a brick pedestal. The sundial gnomon towered over us and cast its shadow onto a series of analemmas laid out in the grass to indicate both time and date. We were fortunate to be there on a sunny but cool day. The model consists of five posts. One has a brass-colored ball to represent the Sun. The others, at appropriate distances, represent the planets out to Mars, with tiny specks in the glass to show the sizes of the planet models. The glass displays for Earth and Venus were broken.



Neptune at Roanoke Motors, from below

Now we headed toward the Kuiper Belt—Good’s Furniture in Kewanee. I was a little concerned about how to find Good’s, because although I had a map of Illinois and could find Kewanee, I had no

map of Kewanee. Fortunately, Good’s turned out to be on the main street (called, surprising enough, “Main Street”) north and south through town. But that wasn’t my only navigational problem. Even after I found Kewanee in Illinois and Good’s in Kewanee, I still had to find Pluto in Good’s. It is a really big store, taking up retail space on four floors spread over three city blocks. Plenty of room for Pluto to be lost in; no wonder it took Clyde Tombaugh so many years to pin it down. After searching on our own for five or ten minutes, I broke down and, against all my male instincts, asked a saleslady for help. “Up one floor and across the skywalk.” Okay. We took the elevator up and walked across Main Street to find Pluto (and Charon!) waiting for us. Pluto was about marble size; Charon, pea size. The later-discovered satellites were not represented.

Across the aisle was a newspaper article about a group of bicyclists riding from the Lakeview Planetarium in Peoria all the way out to Pluto in Kewanee. It mentioned the speed of light being about seven miles per hour. The author apparently forgot (or was unaware of) what Einstein told us: Time is not invariant; the speed of light in a vacuum is invariant. If you scale down the distances, you also have to scale down the time. This would make Earth’s orbital period about a quarter of a second and Pluto’s about a minute. After that, we headed for home. Eris will have to wait for some other trip.

With the relocation of Peoria’s museum, the planets will be moving to new homes. The new web page (<http://www.peoriariverfrontmuseum.org/whats-happening-now/the-dome-planetarium/community-solar-system>) does not yet mention any details but promises an improved model to open in 2013.

And now, a brief editorial: Why does the IAU think that the same term is appropriate for both Jupiter and Earth, but a different term must be used for Pluto? Does it think that Earth is more similar to Jupiter than to Pluto?

I’d like to thank the friendly and courteous people at Roanoke Motors, Beachler’s Vehicle Care & Repair, Peoria Camera Shop, Brown Printing, the School House, Bradley University, Kroger’s, Pekin Parks and Good’s Furniture for letting us traipse around their facilities without buying anything. Thank you to Sheldon Schafer, wherever you may be, for setting up the model. I also thank my lovely wife Kim for the use of her digital camera (my camera still uses film), for posing for some of the pictures, for her patience in putting up with my orbital eccentricity, and for being willing to follow me around the solar system during her vacation time.

Object	Actual Radius*	Scale Radius	Semi-major Axis*	Scale Distance	Sidereal Orbit Period*	Scale Period
Sun	695,508 km	5.532 mm				
Mercury	2,439.7 km	19.4 mm	57,909,227 km	$4.606 \cdot 10^2 \text{m}$	87.97 day = $7.6006 \cdot 10^6 \text{s}$	$6.046 \cdot 10^{-2} \text{s}$
Venus	6,051.8 km	48.1 mm	108,209,475 km	$8.608 \cdot 10^2 \text{m}$	224.70 days = $1.9414 \cdot 10^7 \text{s}$	$1.544 \cdot 10^{-1} \text{s}$
Earth	6,371.0 km	50.7 mm	149,598,262 km	$1.189 \cdot 10^3 \text{m}$	365.26 days = $3.1558 \cdot 10^7 \text{s}$	$2.510 \cdot 10^{-1} \text{s}$
Moon	1737.5 km	13.8mm	(384,400 km)	(3.058)m		
Mars	3,389.5 km	27.0 mm	227,943,824 km	$1.813 \cdot 10^3 \text{m}$	686.98 days = $5.9355 \cdot 10^7 \text{s}$	$4.721 \cdot 10^{-1} \text{s}$
Ceres	476.2 km	3.8 mm	413,690,250 km	$3.290 \cdot 10^3 \text{m}$	4.60 years = $1.5 \cdot 10^8 \text{s}$	1.155s
Jupiter	69,911 km	556.1 mm	778,340,821 km	$6.191 \cdot 10^3 \text{m}$	4,332.82 days = $3.7436 \cdot 10^8 \text{s}$	2.978s
Saturn	58,232 km	463.2 mm	1,426,666,422 km	$1.135 \cdot 10^4 \text{m}$	10,755.70 days = $9.2929 \cdot 10^8 \text{s}$	7.392s
Uranus	25,362 km	201.7 mm	2,870,658,186 km	$2.283 \cdot 10^4 \text{m}$	30,687.15 days = $2.6514 \cdot 10^9 \text{s}$	21.09s
Neptune	24,622 km	195.9 mm	4,498,396,441 km	$3.578 \cdot 10^4 \text{m}$	60190.03 days = $5.2004 \cdot 10^9 \text{s}$	41.37s
Pluto	1,151 km	9.2 mm	5,906,440,628 km	$4.698 \cdot 10^4 \text{m}$	90553.02 days = $7.8238 \cdot 10^9 \text{s}$	62.23s
Eris			10,180,122,852 km	$8.098 \cdot 10^4 \text{m}$	561.37 years = $1.772 \cdot 10^{10} \text{s}$	140.9s

(*source: <http://solarsystem.nasa.gov/>)

(Additional pictures for this story are on my website, www.thomasarndt.net/photo_gallery/Peoria/Peoria.html.)

MAS Patron Members

MAS offers a patron membership to those members who wish to contribute a little extra to help support MAS activities. Patron memberships are established by constitution at 2-1/2 times the regular membership rate—currently \$70 annually for a patron membership. The \$42 additional contribution is tax-deductible. It is used to fund equipment acquisitions, facility improvements, further outreach activities and more. We would like to thank the following patron members as of December 16, 2012. 🐼

Tom Alm	Alex Danzberger	Thomas Hawkinson	Michael Lawrence	Robert Seabold
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MAS Board Minutes for November and December

By Roxanne Kuerschner, secretary

November

Cherry Grove Observatory Update: It is moving forward. Siding is on site waiting to get put up. We need bigger crews to make the work move forward faster. The work that is done is looking very nice. **Sylvia Casby Observatory and Classroom:** The floor is poured, the piers are poured, the conduit is laid, and the inspector has approved the work. We are ready to start framing. There will be a work party Saturday, November 17. **Board Elections:** Everything is in order. The announcements are in the forums and MAS lists. **Color Brochure Printing:** Merle can no longer do this. He will get it down to one side. Mark will take it over; the cost will be comparable. **Expansion of Board:** There is concern that maybe the MAS board needs to expand to include more members, possibly the site coordinators. They will be contacted first to see if this is something they would be interested in. If so, a major change in the constitution would be needed, as this is not addressed. **Web Team:** The overhaul of the Web is still in progress.

December

Special Discussion: Expansion of the Board: No changes will be made at this time; more options were discussed. **Constitution Issues:** We need to have the constitution reflect our current technology. Maybe we need a way to get electronic voting into the constitution, as most of our membership does not attend the monthly meetings. Passing any changes would be almost impossible. **Sustainability Plan:** MAS needs to have a plan for the future. What do we need to do to maintain what we have?

What are the goals for MAS? One suggestion is that each site needs to come up with goals specific to that site. **Cherry Grove:** The board will take over the selling of the scope from Cherry Grove after talking about it at the next meeting. The committee needs to come up with a final budget. We need to close the 2012 books. **Sylvia Casby Observatory and Classroom:** The classroom has tarp on the roof. Merle will be out there tomorrow to get ready for the work party on Saturday. It will get tarpaper on the roof so the electrician can come out. **Color Brochure Printing:** Mark is taking this on. Merle will update it and then give it to Mark. The general flier is done. Cherry Grove is done. **Takahashi Mewlon 300 Telescope Donation:** Merle says it will fit in the observatory; this will allow us to have two scopes in the new observatory. This one is a visual for planetary viewing. Cost to MAS is maintenance and insurance. The dome slit is sufficient. Motion to accept this donation with the understanding that it initially will be part of the Sylvia Casby Observatory. Motion carried. **Star Party Schedule for 2013:** It looks good for star parties. Northern Nights Star Fest will be in September—good! **Nomination of Jerry Jones as Observing Chair:** The nomination was accepted. **Go/No Go Calls:** With the exception of the big events, people should be on their own for determining the weather. The LLCC has to know whether it is on or not. If it is not on the LLCC won't get the area ready for us. Someone will check with Ken to see if we can default it to on for the LLCC. We will have to publish this on the website and forums and at the general meetings. Even though there are other people than MAS members who show up to the star parties, it is at their own risk if they are not members. 🐼

Messier Marathon March 8

by Jerry Jones, observing chair

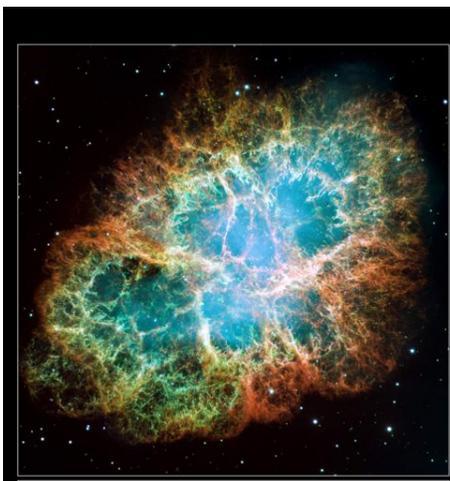
Our first star party of 2013 is scheduled for the weekend of March 8, with the Messier Marathon at both Onan and Cherry Grove. This is perhaps the most well-known and celebrated event of the Northern Hemisphere. During the second weekend of March, amateur astronomers all over the planet will take part in what is known as the Messier Marathon—the attempt to view all 110 objects of the Messier List in a single night. It is a daunting task, but it is one that has been occurring every March, even before Gerry Rattley of Dugas, Arizona, was the first to complete it on March 23/24, 1985. What took Charles Messier (and Mechain) 24 years to complete, we can do in one night!

In 1757, Charles Messier was an astronomer for the French Marine Observatory. He was hunting comets (he found 20 during his lifetime) but kept running into objects that looked like comets

but were not; they never moved. In 1758, Messier made his first entry into his log—M1—known today as the Crab Nebula in Taurus. As he continued to hunt for comets, he also kept a log not only of the faint fuzzies that he discovered but also those discovered by others. Over his lifetime, Messier



M101: Pinwheel Galaxy



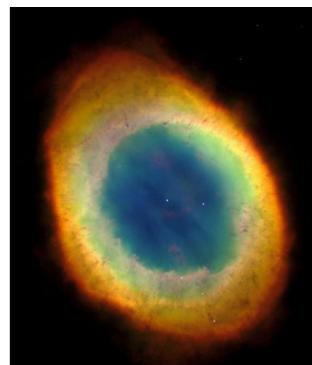
M1: Crab Nebula

logged and published a list of 103 (seven were added later) of the best and brightest deep-sky objects. One of his telescopes was a 200mm reflector (probably with a speculum mirror), but his favorite was a 100mm f/11 refractor. That's good news for us. It means that his list is visible to those of us who own scopes 6" or even smaller.

The trick to running the Messier Marathon is in the preparation, both in equipment and time management. The equipment rule for the marathon is that anything is allowed as long as it is not GoTo. The challenge is not just seeing the objects but finding them. Here are some great suggestions by John Barra of Peoria Astronomical Society: www.aosny.org/AOSMessierMarathonTips.pdf.

Some good books on the subject are Don Machholz, *The Observing Guide to the Messier Marathon*, and *The Year-Round Messier Marathon Field Guide* by Harvard Pennington (the big red book).

As the weekend gets closer, I'll be putting some other helpful hints, star charts, etc., on the observing SIG forum. The sites for the Marathon will be Onan and Cherry Grove, and there will be an official Go/No Go decision. If you have any questions, feel free to contact me via the MAS Web site or at jjones7777@aol.com. Happy preparing for the Messier Marathon. Here's to clear skies! 🍀



M57: Ring Nebula

New MAS Star Party Go/No Go Policy

by Jerry Jones, MAS observing chair

With the 2013 star party calendar, the MAS board has decided to alter the current policy for determining the Go/No Go status of star parties at Cherry Grove and LLCC. In the past, this decision was made by our intrepid, out-going observing chair, Bill Kocken. However, with the plethora of weather-predicting Web sites, the need for an official call has become unnecessary. Consequently, here are the new Go/No Go rules for CGO and LLCC:

1. Regarding Cherry Grove, there will no longer be any official MAS statement either on the Web site or by phone regarding the Go/No Go call. Individuals will be personally responsible for their own decisions regarding the weather.
2. Regarding LLCC, there will be no official MAS statement unless it is clearly a No Go and the star party is canceled due to weather. Beyond that, individuals will be personally responsible for making their own decisions regarding the weather. If the star party is canceled, it will be posted on the Web site by 4:00 p.m. as usual.
3. This new policy does not alter the policies for Onan or Casby/Metcalf.
4. There will be an official Go/No Go call for the following star parties: Messier Marathon, Virgo Venture, and the 4M (MAS Mini-Messier Marathon). This is due to the fact that these events involve a bit more coordination.

This new policy will require us to be a bit more aware of the weather. To help us do just that, here are the tools that Bill has used:

- First and foremost, get to know the Clear Sky Chart. You can

find links to these Web sites at the bottom of the MAS homepage. You can also use this drop-box link: <http://dl.dropbox.com/u/21732102/sun-csc.html> to see all of them in one place. Be warned that some of the charts are sponsored and get updated more quickly than others. Make sure you check to see how recently it was updated. And don't forget to check the underlying maps. They can be very helpful in determining if the site is in the middle of a wonderfully huge spot of clear weather or if it is on the edge of something nasty.

- There are numerous weather services available. The first to check out would be the National Weather Service hourly forecast that can be found through the MAS homepage, then choosing LLCC or Cherry Grove weather, then the National Weather Service text and graphical forecast. The Hourly Weather Forecast Graph is great because it can show you cloud cover, temp, humidity, wind, etc., hour by hour in two-day segments. The infrared satellite loop is helpful for finding up-to-the-hour conditions.
- After this, there are multiple weather sites available. To name three: weather.unisys.com; www.weather.com; www.wunderground.com
- We may consider using the forums to determine who is attending a particular star party as well as checking on the weather.

Armed with these tools, we should be well prepared to take on the pesky and often uncertain Minnesota weather.

Thanks to Bill Kocken for his help both in predicting the weather in the past and for the suggestions written above. 🍀

Directions to the Star Party Locations

For maps and further details about the sites, please go to our website at www.mnastro.org/facilities.

Baylor Regional Park and Onan Observatory

To reach Baylor Regional Park, head west on Minnesota Highway 5, through Chanhassen and Waconia, to the town of Norwood-Young America. Turn right onto Carver County Road 33 and continue approximately two miles north. Baylor Regional Park is on the right side of the road, marked with a prominent sign. When entering the park, stay to the right and follow the road approx 1/4 mile.

When visiting the Baylor Regional Park, MAS members are requested NOT TO PARK OR DRIVE on the grass. There is a drive up to the observatory which can be used for loading or unloading or handicapped parking only.

For an alternate route from the southern suburbs, take U.S. Highway 212 west to Norwood-Young America. Turn right at the second traffic light onto Carver County Road 33. Continue two miles north to the park entrance.

Cherry Grove

Cherry Grove is located south of the Twin Cities, in Goodhue County, about 20 miles south of Cannon Falls. To reach Cherry Grove, head south on Highway 52. On 52 about six miles south of Cannon Falls, and just past the Edgewood Inn, is a large green highway sign for Goodhue County Rd. 1 "WEST". Turn right, and follow County 1 straight south for about sixteen miles until you arrive at a "T" intersection with County A. The observatory is immediately at your right, nestled in the shoulder of the "T". Parking is permitted on the site, or along the road, preferably County A.

Metcalf

Head east from St. Paul along Hwy. 94. Exit at Manning Avenue (exit #253) Turn south (right turn) and then almost immediately turn left onto the frontage road (Hudson Road S). Continue east on the frontage road for about 1.5 miles. Turn right onto Indian Trail, checking the odometer as you turn. Follow Indian Trail south for just about 1.1 miles, where you'll see an unmarked chain-link gate on the right, opening onto a dirt driveway with slight up-slope. This is the the entrance to Metcalf.

Belwin / Joseph J Casby Observatory

Head east from St. Paul along Hwy. 94. Exit at Manning Avenue (exit #253). Turn south (right turn) and then almost immediately turn left onto the frontage road (Hudson Road S). Continue east on the frontage road about 3.4 miles until Stagecoach Trail South, then turn right onto Stagecoach Trail and go east about 2 miles until reaching Belwin Conservancy on your left at 1553 Stagecoach Trail South. From the Belwin driveway entrance, y travel about 500 feet and turn left at the gate. Travel about 1/4 mile through the woods until you emerge at the parking area near the classroom building and the Joseph Casby Observatory.

Long Lake Conservation Center

From Western Twin cities

Take I-94 west to Rogers/MN 101. Go north/right on MN 101 through Elk River, where MN 101 becomes USA 169. Continue north on US 169 approximately 90 miles to Aitkin. At stoplight in Aitkin, turn east/right onto US 169/MN 210 and go out of town eight miles. Then turn east/right, following MN 210 toward Duluth. Proceed seven miles. A large green highway sign marks the turn off 210 to Long Lake Conservation Center. Turn north/left on County Rd. 5. After three miles, turn east/right on gravel County Rd. 88. It is approximately one mile to the LLCC gate. Follow signs to parking and unloading areas.

From Eastern Twin cities

Go north on I-35 to Finlayson/Exit 195. Turn west/left and go one mile to County Rd. 61 and MN 18. At stop sign turn right/north and go two miles. Follow MN 18 west/left and continue 19 miles to MN 65. Turn north/right on MN 65 and proceed 30 miles to McGregor. Intersect with MN 210 and follow 210 west/left (through McGregor) for seven miles. A large green highway sign marks the turn off MN 210 to Long Lake Conservation Center. Turn north/right on County Rd. 5. After three miles, turn east/right on gravel County Rd. 88. It is approximately one mile to the LLCC gate. Follow signs to parking and unloading areas.

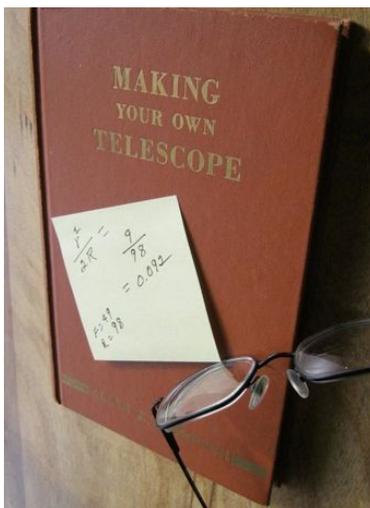
A Beginner's Story

by Ray Amundson

This is the story of my first telescope. It is about trying to convert what was available to what could be used for astronomy. The reason was my own restlessness.

I was about eight years old when I received the book *Stars* by Zim and Baker from my aunt for Christmas. It had big words and maps that neither I nor my third-grade teacher could decipher. I saved the book and still have it. To this book I added more which I found in the magazine rack at the local drug store. I also found books on rocks, rockets, etc.

In high school I came across Gamov's book 1,2,3, Infinity. Here was relativity and the Lorentz Transformation. I thought I could understand that, so I was different from the other kids. I asked Mom and Dad for a telescope for my birthday. They gave me one and were very pleased. It was a 3x, five-pound gun sight from a World War 1 tank.



I transformed the gun sight into a six-inch f/8 reflector telescope with a mirror kit that I ground during my senior year. Larry Rogers from E & W Optical Co. on E. Hennepin Ave. gave a talk to our science club, so I knew that making my own telescope was possible. Mr. Anderson, my high school physics teacher, found room in the janitorial closet for me to grind in. First light was successful, but then came college, the army, a job, marriage, and more jobs. Finally, in 1993, after standing in the corner for a long time, the telescope got another look. The mirror was recoated, delayed, lost, sent to London, found, installed, centered and stabilized. To my shock, a 1/2 inch eyepiece yielded only a blur, so the telescope was retired.

A few years later I made another telescope, a 12.5-inch reflector, which I have enjoyed. Thanks to my parents for standing by me and to my wife for all the encouragement offered. Without that, none of this would have happened. 🐱

Minnesota Astronomical Society 2012 Star Party Schedule

Friday Date	Sunset:	Twilight at:	Completely dark from:	Completely dark to:	Moon % Illuminated	Onan Public Night (Sat.)	Cherry Grove	LLCC Weekend	Notes
Mar 08	18:08	19:48	19:48	04:56	8%	Mar 09	X	X	Messier Marathon at both CG and Onan on Friday, with Saturday as alternate.
Mar 15	19:18	20:58	23:48	05:42	19%	Mar 16	X	X	
Mar 29	19:36	21:20	21:20	22:49	99%	Mar 30			
Apr 05	19:46	21:32	21:32	04:38	18%	Apr 06	X	*	
Apr 12	19:55	21:44	22:34	04:39	8%		X	X	
Apr 19	20:04	21:57	03:23	04:23	67%	Apr 20			Astronomy Day
May 03	20:22	22:26	22:26	03:10	31%	May 04	X	*	
May 10	20:31	22:41	22:41	03:34	1%		X	X	Virgo Venture at CG
May 17	20:40	22:57	01:51	03:19	51%	May 18			
May 31	20:54	23:26	23:26	01:42	45%	Jun 01			
Jun 07	21:00	23:38	23:38	02:43	0%		X	X	
Jun 14	21:04	23:46	00:21	02:38	35%	Jun 15			
Jun 28	21:06	23:48	23:48	00:13	71%	Jun 29			
Jul 05	21:05	23:41	23:41	02:52	4%		X	X	July 4-6 at LLCC - 3 nights
Jul 12	21:01	23:30	23:30	03:04	22%	Jul 12-14	X	X	Camping with the Stars, at Onan, July 12-14.
Jul 26	20:48	23:03	never	never	75%	Jun 27			
Aug 02	20:39	22:47	22:47	03:05	12%		X	X	
Aug 09	20:29	22:31	22:31	04:03	11%	Aug 10	X		
Aug 23	20:06	21:58	never	never	87%	Aug 24			
Sep 06	19:40	21:25	21:25	04:55	3%	Sep 07	X	X	Northern Nights Starfest #5: Sep 4-8
Sep 13	19:26	21:09	01:07	05:06	67%	Sep 14			
Sep 27	18:59	20:39	20:39	00:38	40%	Sep 28	X	*	
Oct 04	18:45	20:25	20:25	05:36	0%		X	X	Fall Mini-Messier Marathon at CG and LLCC
Oct 11	18:32	20:11	00:08	05:45	53%	Oct 10			Fall Astronomy Day
Oct 25	18:08	19:48	19:48	23:24	57%	Oct 26			
Nov 01	17:57	19:38	19:38	06:12	2%		X	X	
Nov 08	16:48	18:30	22:10	05:21	39%	Nov 09			
Nov 29	16:29	18:16	18:16	04:37	27%	Nov 30			Special Event - Comet ISON
Dec 06	16:26	18:14	21:08	05:52	24%	Dec 07			Special Event - Comet ISON
Dec 20	16:28	18:18	18:18	20:00	87%	Dec 21			Special Event - Comet ISON

LLCC nights indicated with an "*" instead of an "X". We will be sharing the facility with other groups. Not all of the lights will be extinguished.

This schedule is subject to change. Please check the MAS online calendar at www.mnastro.org for a complete schedule of all MAS events. Cherry Grove Star Parties are held on Friday nights, with Saturday reserved as the backup night if Friday is cloudy. LLCC Star parties are held on both Friday and Saturday night. Onan Public nights are held on Saturday nights only.

The **Casby Observatory at Belwin** is available to MAS members who have completed the Belwin Orientation and training to use at any time. We will not have scheduled star parties at Casby. To reserve the observatory for yourself, please post your request on the Casby Observatory Keyholders discussion forum.

The **Metcalf Observing Site** is available to MAS members at any time. We do not have organized, scheduled star parties at Metcalf. Feel free to head out there whenever you wish.

The **Onan Observatory** holds regularly scheduled Pubic nights. You are welcome and encouraged to bring your own observing equipment to these events. All other nights the observatory is available for trained members use. To reserve the observatory, go to the Onan reservation calendar at <http://www.mnastro.org/onankey/reservations/reserve.php> Before heading out, Please check the Onan reservation calendar to verify if there is a outreach event scheduled.

In 2013 daylight saving time begins March 10 and ends on Nov 3.



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How to pay your dues

February 2013 Volume 38 Number 1

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To Renew Your *Sky and Telescope* Subscription

New subscriptions to *Sky and Telescope* at the MAS member discount must be sent to the MAS for group membership subscription processing. Send new subscriptions with your MAS membership to the attention of the Membership Coordinator at the MAS at the Post Office box address shown on the back cover of the *Gemini* newsletter.

You may mail your subsequent subscription renewal with payment directly to *S&T* or renew via phone with Sky Publishing at 1-800-253-0245. This method is especially beneficial to those who wait until your subscription is about to expire before renewing *S&T*. If you wish, you may still submit your *S&T* subscription renewal to the MAS when you renew your membership in the MAS and we will enter your renewal on your behalf just as we always have done.

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