Gemini

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In the pages of the Gemini

Stories Wanted: *Gemini* needs your story of how you first became interested in astronomy, what you have done over the years, what equipment you have used, what star parties you have attended in other states, and how you have encouraged others, especially young people, to get involved in this fascinating hobby. Submit your story to: brownreveugene66@gmail.com

E-mail Update: If your e-mail address has changed in the past year, chances are that the address MAS has for you is not current. We need to be able to communicate with all of our members on a timely basis. Please submit new e-mail addresses to Bob Brose at bob@qbjnet.com

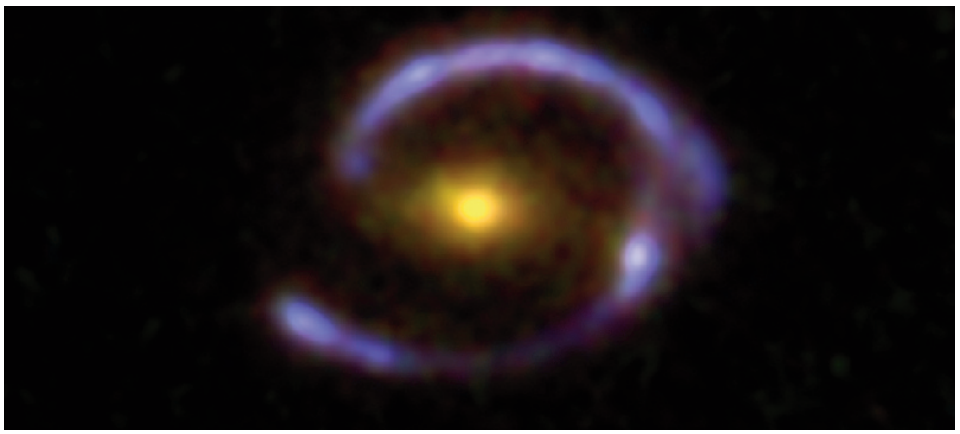
The Cosmic Eye

By Dave Tosteson

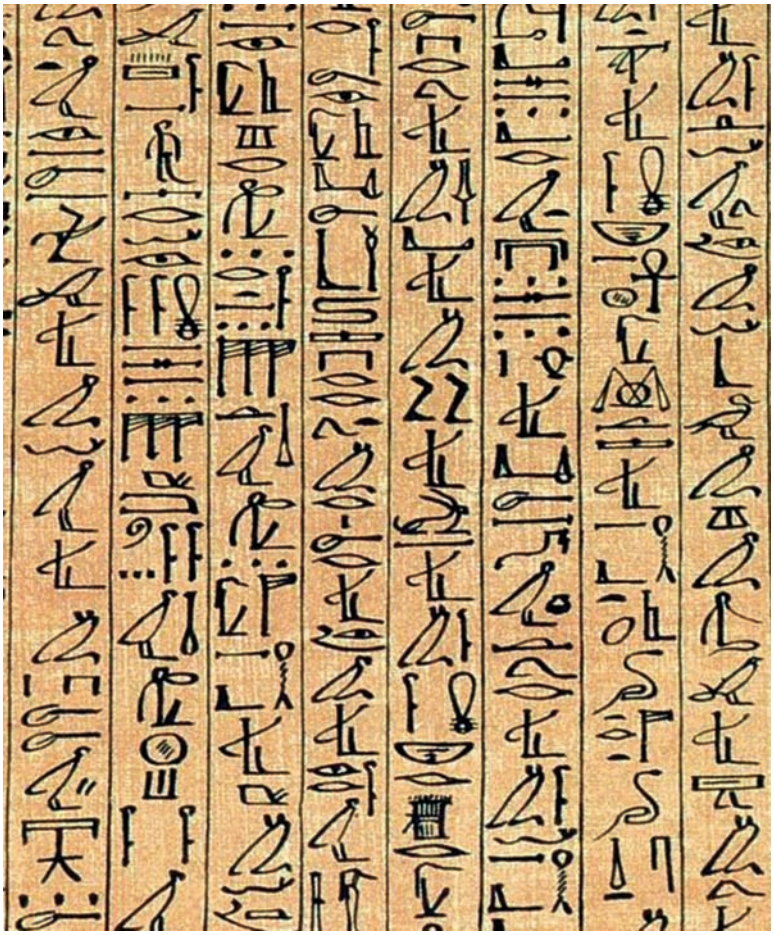
The traveling exhibit of Tutankhamun, Egypt's rediscovered young monarch who changed his name to reflect his religious preference, resided at the Science Museum of Minnesota for several months last fall. I spent several fascinating hours examining its detailed dioramas and absorbing artifacts. King Tut's story is provocative, partly from his early demise at age nineteen, but also because he was purposely forgotten by his people. Intentionally left off the list of buried kings by his father's attempt to consolidate the Egyptian pantheon by introducing monotheism, his reign was also relatively undistinguished because of its brevity. Initial flurries of grave-robbing attempts were defeated, and the location of his ornate tomb was eventually forgotten. It was thus left intact for over three thousand years, and its discovery by Howard Carter in the early twentieth century unveiled hundreds of priceless artifacts, along with the intact mummy encased in several layers of gilded structure. When I attended our club's annual dark-site star party several days later, it seemed serendipitous that I was searching for a celestial hidden treasure of my own that is named for another Egyptian deity: the sky god, Horus.

The Cosmic Eye, or LBG J213512.73-010143, is a gravitationally lensed galaxy located in Aquarius, just 30' southeast of the globular cluster M2. At magnitude 20.3 and redshift 3.07, it is 11 billion light years away and one of the faintest and most distant non-stellar targets visible in large amateur telescopes. I had been attempting to view a galaxy at a redshift of one for some time and had not yet been successful, so the magnifying effect of not one but two intervening bodies suggested that this infrared, actively star-forming galaxy be placed on my observational horizon. This galaxy was discovered during a search for bright lensed galaxies in X-ray emitting clusters in 2006 by Dr. Ian Smail of England's Durham University and was reported in the January 1, 2007, Astrophysical Journal. Magnified by a foreground galaxy at a redshift 0.73 (designated G1 in that paper), the yellowish object seen in the Hubble Space Telescope image that centers the "eye," the lensed galaxy forms two non-concentric arcs with a size of only 3 arcseconds.

The intervening galaxy cluster MACS J2135.2-0102, nearer to us at redshift 0.325, also affects the lensed galaxy, but mostly by shearing it. They thus form a type of double lens: a compound natural astronomical telescope assisting our own manmade devices and easing its discovery. The extended nature of the lensed



The Cosmic Eye



An example of Egyptian Hieroglyphs

galaxy allows more accurate geometric analysis than would a point source, such as a quasar, according to a 2007 model by Dye and others of the dark matter halo and elliptical baryonic central component. Without the lensing, the background galaxy would appear close to 24th magnitude, as the magnifying factor is about 28; that is, over three and a half magnitudes.

Egyptian mythology is complex, evolving as it did over three thousand years. Tutankhamun's father, Akhenaten, attempted to consolidate the multiple gods of Egypt's pantheon into one god, Amun. His son was named after this new deity, but Tutankhamun changed his name back to represent Egypt's former god, Aten, after ascending to the throne. His people did not respect that change following his death, contributing to his relegation to obscurity. The Egyptian sky deity, Horus, was one of their first, if not the first, known national deities. Horus did extra time as their god of war and protection and was portrayed as a falcon. His hunting eye was represented by a design of seven hieroglyphs, and the spiral-galaxy-like figure of Hubble's lensed galaxy discussed above resembles this "Eye of Horus," making its assignation appropriate as the hunter becomes the hunted and our own keen eye seeks this cosmic prey.

The Minnesota Astronomical Society uses land located two hours north of the Twin Cities, at the Long Lake Conservation Center near McGregor. In a cooperative agreement, there is space to store and use large telescopes at a dark site in exchange for hosting a number of public events during the year. For the last few years in August we have had a three- or four-day star party arranged by MAS member John Marchetti, featuring speakers from the University of Minnesota and other local colleges. Opportunities exist to pursue nature activities in the beautiful central Minnesota lake region. The sky quality at the site is excellent, with readings of 21.5 mag/square arcsecond. Humidity and the "state bird," the mosquito, can be issues, but the evening of August 25, 2011, was special. For several hours the seeing was near perfect and the field became quiet, both from a lack of insects and that special buzz of excitement as we unpacked our challenge objects: the ones awaiting that confluence of conditions allowing equipment to be pushed to the limit. Our society owns a 30" f/4.5 Obsession, and I proposed to Bill Kochen that we use it to try for the Cosmic Eye. We obtained the field right away, as there is a bright 10th magnitude star just 1' to the southwest, with a fainter 15th magnitude star lying 30" to the south-southeast. Using the POSS 2 (R) and the Sloan Digital Sky Survey (SDSS) images for navigation, we quickly found the exact spot to search for our distant prey.

In near-perfect conditions of seeing and transparency, the dark skies and excellent equipment made this very faint, lensed galaxy visible within a few seconds. Employing a 6mm Ethos and averted vision, my eye met its cosmic counterpart four or five times in 30 seconds. The overall impression was of a faint, round smudge a few arcseconds across,

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MAS Officers

with the central lensing galaxy not differentiated from the surrounding arcs; they appeared conjoined as one confluent mass. I classified it as faint, but not extremely difficult; a bit surprising, given its magnitude. (I had failed to see it at the 2011 Texas Star Party with my 32" scope in poor seeing conditions.) My impression was confirmed when five other observers at LLCC came to the eyepiece, each seeing it several times in less than a minute. I estimated that it could be seen 40-50 percent of the time. Three galaxies, from 18.5-19.0 magnitude, could be seen in the surrounding MACS cluster within a minute or so, and I suspect that several more could have been teased out, given extra time. When I contacted Dr. Smail, the discoverer of the object, he was surprised that it could be seen without a CCD.

Glorious conjunctions exist within the universe, and the factors that align and allow us to see for ourselves these amazing structures are reasons to celebrate its complexity and beauty.

Coordinates: 21h 35m 12.73s, -01d 01m 42.9s (2000.0)

References: ApJ 654, L33-L36, January 1, 2007,
Smail, et al.; arXiv.0705.1720 v1, [astro-pH], May 11, 2007, Dye et al.;
Science Daily, September 9, 2008.

The Eye of Horus

The Nearest Star: Our Local Stellar Laboratory

By Bill Arden

Introduction

Sometimes, astronomers consider the Sun to be a bit of a nuisance. If it weren't for the Sun, we could be out observing all the time. Imagine getting up on Saturday morning and thinking, "I've got two whole days of darkness to do the Messier Marathon!" You'd have to bundle up, of course, but we're from Minnesota. We're used to that.

In this article I'm going to ask you to take a slightly different view of the Sun. Think of it as a laboratory in which we can watch the processes that make all stars work. As you read the article, remember that what we learn watching this "beautiful beast" can be applied to all the stars we love, however different and distant. I'm not trying to make you a convert to solar astronomy (although you'll have to admit that aperture fever usually isn't a problem), but I would like to raise your appreciation of our source of light and heat as an astronomical object.

Sunspots and the solar cycle

The solar cycle was observed long before there was any real understanding of the physical processes underlying the variation. The story begins with sunspots. Large sunspots, and groups of them, can be seen with the naked eye when the Sun is partially obscured by smoke, clouds or haze, especially near sunrise or sunset. Prehistoric humans probably observed them. The earliest actual records of astronomical events can often be found in the Far East, and the first recorded observations of sunspots come from China about 2,000 years ago.

Sunspots were noted by Galileo and others in the early 17th century. Along with the discoveries of the moons of Jupiter and the phases of Venus, these observations of an imperfect Sun provided further (and sometimes unpopular) evidence that the classical view of the universe needed reexamination. Early observations were cut short after about 30 years, when the spots disappeared for 70 years or so around 1645 in what is now called the Maunder Minimum. This Grand Minimum was not the first; modern techniques such as isotope measurements in ice cores and carbon dating can be used as proxies for sunspot measurements from earlier epochs, and these measurements indicate the presence of such minima over thousands of years. There is no reason to expect that the Maunder Minimum will be the last Grand Minimum.

During that first 30 years, though, the early observers discovered and measured the axis and period of solar rotation and the dependence of that rotation on solar latitude, paving the way for later work on the fluid nature of the Sun and differential rotation—the fact that the equatorial region of the Sun rotates faster than the poles. They also established, and published, techniques for accurate observation of the Sun that make it clear that they were quite capable of detecting and measuring a phenomenon like the Maunder Minimum. So they didn't miss the sunspots; the spots weren't there.

After the return of sunspots around 1715, a further century of observation finally led to Schwabe's noting in 1844 a periodicity in their number. He reported a cycle whose period he measured at approximately ten years. It is the name of Rudolf

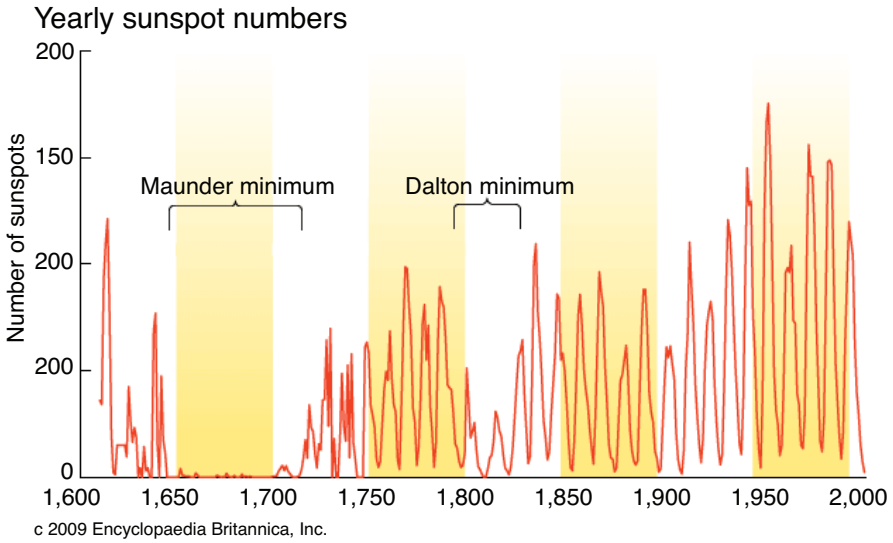

Figure 1. The solar cycle. Note that the cycle varies in amplitude, length and the shape of the peaks. The last complete cycle is cycle 23; we are now a couple of years into cycle 24.

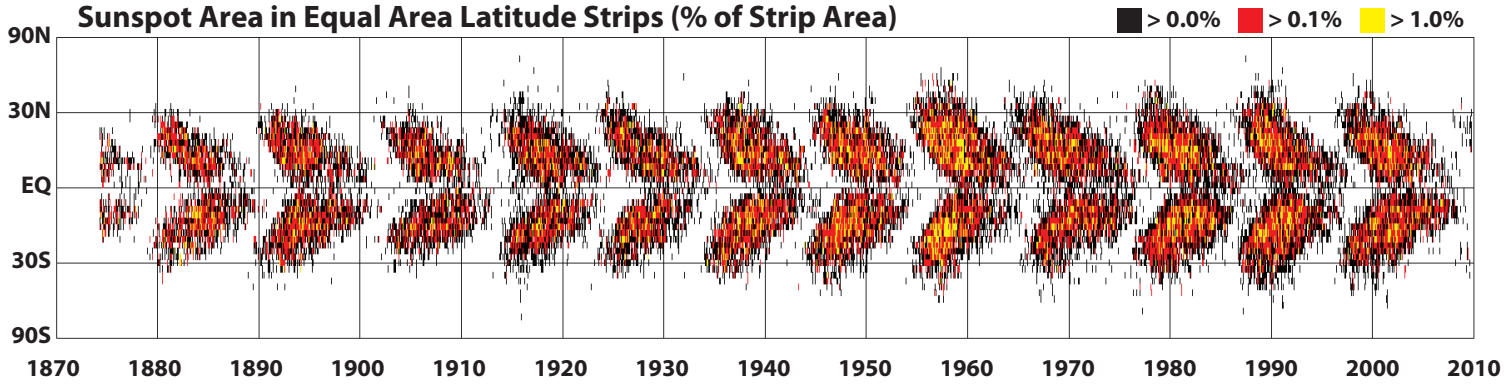

Figure 2. Butterfly diagram. Time is the horizontal axis, latitude the vertical axis.

Wolf, however, that is associated with the definitive measure of sunspot activity. Wolf's measurements enabled him to establish the widely accepted standard of solar cycle measurement, the Wolf relative sunspot number. These numbers have been collected daily since 1849, although Wolf reconstructed the time series back to the earliest measurements in 1749. We thus have a rich and continuous history of sunspot observations (Figure 1) that gives an invaluable time series of data against which all efforts to predict the solar cycle are tested.

The absence of a convincing physical model of solar activity didn't keep observers from formulating laws describing its behavior. Some of these laws include:

- Spörer's law. Sunspots appear at higher latitudes (in the range of 20° to 30°) at the start of each cycle, and this range both broadens and moves closer to the equator as the cycle progresses.
- Maunder's butterfly diagram. This diagram, iconic in the study of the solar cycle, illustrates Spörer's law. At the start of a solar cycle (the time of minimum activity), the few sunspots that appear are at higher latitudes (poleward of about 30°). As the solar cycle progresses toward solar maximum, sunspots are increasingly more common, and they emerge progressively closer to the equator. After solar maximum, the number of sunspots decreases but the trend toward the equator is unchanged. When plotted, this behavior results in a butterfly diagram. See Figure 2.
- Hale's and Joy's law. The polarities in bipolar sunspots are always ordered. The preceding (or leading) spot of a pair has one polarity in the southern hemisphere and the opposite polarity in the northern hemisphere; the following spots have opposite polarity to their leaders (Figure 3). The ordering reverses between solar cycles. There is an association with the butterfly diagram: Bipolar groups originate at higher latitudes at the start of a solar cycle and have the opposite order of polarities from the last cycle's bipolar groups. Joy's law states that the leading spot in a bipolar group is closer to the solar equator.

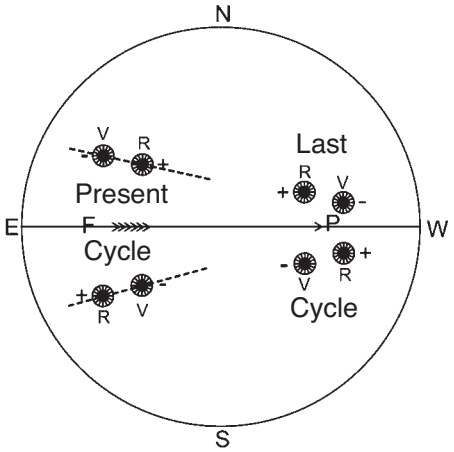

Figure 3. Hale's Law (see text)

Hale is deservedly famous for his 1909 discovery that sunspots are related to intensified magnetic fields. The breakthrough of connecting sunspots with magnetic activity enabled theorists to begin more fundamental analysis of the underlying physics. In addition, this discovery revealed that the total cycle is 22 years and consists not only of the 11-year cyclic variation in the number of sunspots but also a reversal of their polarity. Like technical analysis in the stock market, observation of the sunspot cycle over centuries resulted in rules of thumb derived from mountains of data. A deeper understanding of the processes behind the cycle, however, came only in the last half of the twentieth century with the theory of the solar dynamo.

The solar dynamo

The association between magnetism and celestial bodies began in the early 1600s, when Sir William Gilbert proposed that a magnetic compass functions because the Earth itself acts as a gigantic magnet. Hale's 1908 discovery that sunspots display magnetic fields that are orders of magnitude larger than the Sun's mean field (a few gauss) led Larmor to ask, in 1919, "How could …the Sun become a magnet?" The search was on for a magnetic interpretation of the centuries of sunspot data. Work by Parker, Babcock and Leighton in the 1950s and 1960s led to a basic model that explained many of the observed phenomena. The current consensus is that this model, a hydrodynamic dynamo, is the source of the Sun's magnetic activity. The problem is to construct a dynamo model that incorporates the known observations of the Sun to explain the laws outlined in the previous section—those of Hale, Joy, Maunder, Spörer et al. To summarize briefly, the model must explain:

- The 11-year sunspot cycle and the 22-year cycle that includes reversal of the dipolar magnetic field after each 11-year cycle.
- The fact that, at least in the early part of each cycle, the leading sunspot in a pair has the same polarity as the pole in the same hemisphere; the following spot has the opposite polarity and the polarity of spot pairs is antisymmetric across the equator.
- The fact that, during the cycle, the polar fields of the sun switch polarity.
- The tilt, which increases with time, of the line between

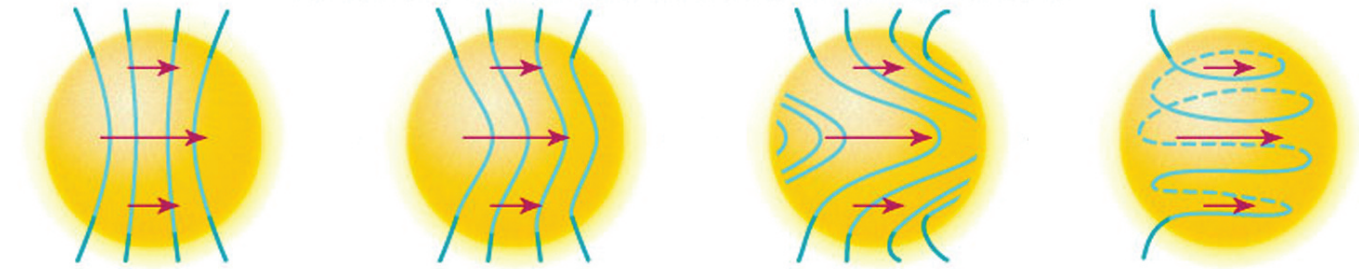

Figure 4. The Babcock model – Toroidal field lines develop from an originally poloidal field. The red arrows indicate that the rate of rotation is higher at the equator.

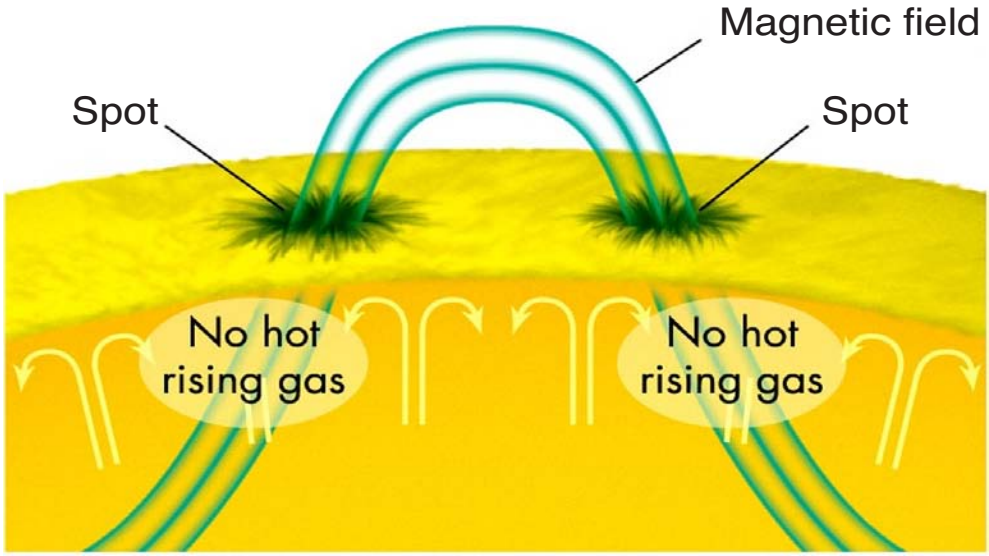

Figure 5. Sunspots form by the penetration of magnetic flux through the surface of the Sun.

leading and following spots of a pair

Here is a qualitative description of the solar dynamo model: Begin with the Sun in a state with a dipole magnetic field (the overall field looks like that of a bar magnet), with no dependence on solar longitude and aligned roughly with the Sun's rotational axis (a "poloidal" field). We'll start with the case where the north pole of the dipole is aligned with the north pole of the Sun.

Babcock's model employs the Sun's known differential rotation and the fact that, in a plasma, magnetic field lines are frozen into the plasma—as the plasma moves, it drags the field lines along with it. Since the equatorial region of the Sun rotates faster than the poles, the originally north-south field lines become deformed, wrapping around the Sun near the equator and gradually becoming oriented more and more along lines of latitude instead of longitude—a toroidal field. Babcock showed that after about three years, the magnetic field at low latitudes would be wrapped about five times around the Sun, intensifying the field as it did so. Figure 4 is a schematic illustration of the development of toroidal field from poloidal field lines. As the field lines are wound tighter and tighter, the lines of magnetic flux are stretched and, ultimately, form kinks in them. (You might imagine a twisting a rubber band; at a certain point, the band moves from being smoothly wound to becoming kinked.) These kinked regions are of lower density than the surrounding gas, so their buoyancy causes them to rise to the surface. When a loop of flux finally penetrates the surface, it does so at two points; at those points, convection of the gas in the area is suppressed and the area is cooler. The result is a pair of darker (cooler) spots (Figure 5).

Figures 4 & 5 show that even this very simple model explains parts of Hale's sunspot polarity law: Pairs of sunspots will have a leading spot with the same polarity as the field in its hemisphere and a following spot of opposite polarity. The polarity of sunspot pairs will be opposite on opposite sides of the equator. Look closer, though, and you'll see that this model doesn't pass some of the other tests. We need a more sophisticated approach. What about Joy's law, for instance? The tilt of the line connecting leading and following spots requires further evolution of the model. Observation shows that, as a pair of sunspots evolves, the leading spot moves toward the equator while the following spot moves toward the pole. This requires a new idea.

Rotation of the convection zone of the Sun creates Coriolis effects in the gas; in the Earth's atmosphere, this is one of the causes of hurricanes and cyclones. This twists the rising flux loop, making it more parallel to a meridian. Instead of being purely latitudinal in direction, there is now a longitudinal component in the field and the pair is tilted. During the 1980s, improved observational methods detected a flow of material at the surface, from the equator toward the poles, at a rate of approximately ten meters/second. The addition of this conveyor belt, or meridional flow, to the dynamo model enables us to reproduce the Sun's observed behavior with even more accuracy.

This construct also leads to an explanation of another aspect of the solar cycle—the reversal of the Sun's magnetic polarity after each 11-year cycle. Consider the situation early in a solar cycle, when the following spot in a sunspot pair is of opposite polarity to the pole in its hemisphere. As the axis of the pair tilts, the leading spot moves closer to the equator, canceling the field from spots on the other side of the equator. The following spot moves toward the pole. Over time, there are two results: The field transforms from a primarily toroidal field back to a poloidal field, and the polarity of the polar field is reversed from the original form. Real sunspots are messier than this, of course, but the theory works in any case.

With these developments, we finally had a basic working model of the Sun's fluid behavior. Next time, we'll look at some of the visible effects that result, including more on sunspots.

Continued in April Gemini.

Cherry Grove: Past, Present and Future

by Steve Emert

I was originally hoping that this article would be an in-depth retrospective of the early history of the Cherry Grove observing site. Unfortunately, the wealth of information I hoped to find in old MAS board notes from the 1990s was much skimpier than I expected. I have been able to piece together quite a bit of history, although I'd like to ask the long-term members to jot down their recollections of the early days so we can fill in more of the blanks.

1992 - 16 Inch Newtonian on English Equatorial - Side View

For a long time since the society's inception (first as the Twin City Astronomy Club, later incorporated as the Minnesota Astronomical Society), the only permanent observing site MAS had was Metcalf observing field. In the late 1980s and through the 1990s, the society spent considerable effort both in the creation of Onan Observatory and in the purchase and development of the Cherry Grove Observatory and observing field.

Cherry Grove title was obtained from Goodhue County on September 9, 1992. It appears that the cost was a whopping $1.65 filing fee plus the cost of dry fill to create the driveway, estimated at $1,500. The land had been foreclosed upon for unpaid taxes by the previous owner, who forfeited the property. It wasn't an expensive plot of land; in June of 1997, Goodhue County reported that the estimated market value of the 0.71 acres of CGO property was $3,500. Even that was a considerable increase from the market value of $1,400 reported on another property tax statement in 1993.

Why is it called "Cherry Grove"? That's a simple one. The property is located in Cherry Grove Township in Goodhue County. It seemed an appropriate-enough name.

1992 - Proud installer of 16 Inch Newtonian

I haven't found records to validate the story, but I have been told by several members that the CGO observatory building and warming house were obtained from the 3M Astronomy Club when it disbanded in the early 1990s. The buildings had been located at Tartan Park east of St. Paul and were moved by trailer to Cherry Grove. I assume this occurred between September and December of 1992, based on the property purchase date and the pictures accompanying this article, which were taken in December of 1992. The observatory building is a bit taller than the warming house, and that caused a problem. The story is that one of the bridges along the road was just a little too low for the observatory. Unfortunately, no one noticed until it hit the bridge and the roof was damaged as a result.

The buildings were originally stained dark brown, and the observatory was constructed a little differently than you see it today. The door was at ground level, with steps inside the building. Once inside, the observer flopped a part of the floor down to cover the steps. The floor was so high because it hid part of the structure of an English equatorial mount that held a large homemade 16" Newtonian telescope. This scope was originally built using a cardboard Sonotube and was equipped with dual-axis drive motors. The telescope presented a few problems throughout its lifetime at CGO. Turning and slewing it was difficult. In 1998 or 1999, the CGO core group that maintained the site reported that the cardboard tube wasn't adequately stiff and needed replacement with an aluminum tube. Also, they said the mirror needed refiguring. The cardboard tube was replaced with an aluminum one in 2000 or 2001 and the mirror was refigured about that same time.

BAD Shed circa 2005. Note trees on east and north sides

The mirror continued to challenge us through the 1990s into the 2000s. From the first time I used that scope, I found collimation challenging. The mirror had a center hole like a SCT's mirror, even though it was a Newtonian. Try center spotting it to use a Cheshire sight tube or a laser collimator... ain't gonna happen! Star testing was the best way to collimate the scope. I actually got pretty good at doing that, working with Vic Heiner, the CGO site manager. Around 2004 or 2005, the CGO committee found that the mirror needed re-aluminizing. We took it to a MAS member who owned a mirror coater; it came back nice and shiny and was put back in the scope. A few months later, Vic came down to do some observing with it. He looked down the tube at the mirror in preparation to checking collimation and got a shock. Something didn't look right. It took a minute or so to realize that he wasn't seeing the aluminum front surface of the mirror but the ground-glass back of the mirror. The aluminum had flaked off the mirror. Obviously, we took it back out and had it recoated.

CGO observing field from the east before bulldozing parking area in 2006

In 2008, Father Brown graciously donated a Meade 14" LX200 GPS to MAS. With all the continuing issues we had experienced with the old Newtonian, the CGO committee decided to use this newer computerized LX200 to replace the troublesome Newtonian. The Newtonian was dismantled that year and the aluminum of the mount was taken to a recycler. Ken Hugill reconfigured the scope as a Dob, and for a while it lived at Long Lake Conservation Center.

During the last half of 2008, we experimented with a steel pier for the LX200 mounted to the wooden structure under the floor that held the old Newtonian's mount. We found that the wood just wasn't sufficiently stiff to hold the LX200, and in the spring and summer of 2009 we held a couple of work parties to dig the hole for a good, solid concrete pier. The concrete pier was poured on July 11, 2009. We mounted the LX200 later that summer, and it has been available

CGO LX200 on tripod in 2008 before installing pier

for MAS member use since that time.

In addition to work on the observatory and its telescope, there have been a lot of improvements to the property over the years. Back in the 1990s, we relied upon members to mow the field, using several mowers owned by MAS and stored onsite. Because we depended on volunteers, it wasn't mowed frequently and often was mowed only the afternoon before a star party. I remember at one of my first CGO star parties that the observing field was like a fresh-cut hay field with long grass lying all over the place. Since then we have realized the value of regular mowing and now allocate money in the budget for a neighbor's teenagers to mow the lawn regularly and spray the weeds that grow in the parking lot. This makes a huge difference in the quality of our observing field.

In 1999 the CGO core group began discussing the building of a storage shed to house the mowers. That plan eventually ended up as the three-foot-deep lean-to across the north side of the observatory and at first was used to house the mowers. It is now used for the portable light-shield tarps. Speaking of light shields, even back then local light pollution from cars going by was a concern. Some members suggested a fence to block the lights from cars coming from the east and turning north. That was a stellar idea (pun intended). The current CGO committee came up with the same idea around 2006 and built the current light fence during August and September of 2007. Coupled with the portable light-shield tarps, we now have a pretty effective system in place against most passing car headlights.

An interesting item that I found in my research is that in 1999 the Minnesota Department of Agriculture somehow thought that MAS was farming the CGO land and sent a stern warning letter that the organization has not been certified by the commissioner to do so. Fortunately, a brief phone call from the MAS secretary clarified the situation before MAS was fined.

CGO pier pour - cement mixer July 11 2009

You may have guessed from my comments about lawn mowing that throughout the 1990s, Cherry Grove was maintained on a pretty lean budget, and you would have guessed correctly. For example, the budget for CGO in 1996 was $120 for electricity and $110 for everything else. There were some fairly major improvements in the 1990s, however. For example, Bob Schmidt's VP notes from August of 1996 indicate that money

Cherry Grove Star Party 7-29-2011

was approved to fit the warming house with vinyl siding and to do some work on the windows.

The current CGO committee is committed to making everyone's observing experience at Cherry Grove the best it can be. Throughout the 2000s, we have made significant improvements to the equipment, the buildings, and most especially to the grounds. Early in the 2000s, several members of MAS formed the Big Dob committee in order to fund and purchase a large truss-tube Dobsonian scope. Believe it or not, at that time the only large scopes that MAS owned were the 16" Larson Cassegrain scope at Onan and the 16" Newtonian at CGO. That committee eventually ended up purchasing the BAD, which stands for Big A... (ahem… Aperture) Dobsonian, the 24" Starmaster truss-Dob now at CGO. We purchased it from a person in Washington State, and Dick Jacobson brought it home in his VW Passat station wagon. For the first year or two that MAS owned the BAD, it was stored disassembled in the lean-to storage shed attached to the north side of the observatory and needed to be assembled before each use. In 2005, we built the BAD shed to house the assembled scope so it can be easily wheeled out for observing. We also installed the ServoCAT drive and Argo Navis DSC system in the scope. It all runs off a power supply which is plugged into the outlet at the front of the BAD shed. This year we intend to bury a conduit and place an outlet at the end of the concrete pad to eliminate the tripping hazard.

If you came to CGO before 2006, you would have noticed that the observing field was a lot smaller and shaggier than it is today. The east side of the property had a big dirt and brush pile, and the lawn on the east side was never mowed. People parked either on the road or on the observing field itself. In the summer of 2006, the CGO committee had the east side of the property bulldozed flat and gravel added to make the parking area we enjoy today.

Cherry Grove Star Party observers waiting for dark 7-29-2011

East side of observatory repaired Sept 2010

About that same time, we began to get serious about clearing out excess brush and embarking upon our program of horizon modification. In 2006 and 2007, we cleared out the area of the northwest corner of the property and seeded it. Before that, the area to the west and the north of the BAD shed was filled with brush and trees and was virtually inaccessible. Now it's opened up as an observing area more protected from local light pollution from passing cars and can even be used for setting up a tent for overnight camping. Around that same time, we took out the trees surrounding the BAD shed and cleared the area for the new storage shed which was constructed in the summer of 2008 to replace the little old shed that was torn down in 2009. We obtained permission from the neighbor to the south and began cutting down the scrub trees on the other side of the road that had grown up and that hinder our views of the southern horizon. We hope this year to continue to cut more of those taller trees to the south in order to further improve our southern horizon.

New storage shed, July 2008

Of course, additional maintenance to the buildings has been needed over the years. Around 2005 or so, we replaced the old fiberglass roof on the observatory with a new steel one. The wood siding had also deteriorated, so the south wall was repaired and the siding replaced in 2008; the east wall was repaired and its siding replaced in 2010. The roof of the warming house was replaced in the summer of 2010 as well. We found that we had to replace the old wooden warming-house door with a new steel door in 2010, which is when we also went from a key lock to the current combination-lock system; this makes it easier to give members access to the buildings on the site.

By now you are probably thinking to yourself that this article has only been about the grounds and buildings. What about observing? Well, the first official Messier Marathon at Cherry Grove was held in March of 1999. Since then we have held the spring Messier Marathon at CGO every year and have been following it with the Virgo Venture (an evening dedicated to locating the Virgo Cluster of Galaxies) a month later. In addition to the regular star parties, Cherry Grove also hosts the 4M, the MAS Mini Messier Marathon each fall, as another chance to see the majority of the Messier objects before going into hibernation for the winter.

North side of BAD shed 2006 before clearing out brush

Cherry Grove is the only observing field that MAS owns outright. With its decently-dark skies (not as dark as our northern LLCC dark sky site but darker than Onan and much darker than Casby or Metcalf), coupled with reasonable travel times (45 to 90 minutes from virtually anywhere in the Twin Cities), and the ability for members to visit the site any time they wish without restriction, CGO is a great site for beginning to intermediate observers and even advanced observers who don't want to travel for an overnight observing session.

Observatory siding replacement and wall repair - July 2008

We are looking at finally dismantling and replacing the observatory building. Although we have done many repairs over the past few years, it remains a very old building with all the issues associated with its design and age. We estimate that between its time at the 3M club along with its history at CGO, the building is between 40 and 50 years old.

For the future, we want to make CGO an even more attractive site to observe and to image. We are planning to replace the observatory next year with a new roll-off-roof model, expanding its footprint from the current 12x12 foot to either 12x14 (if we continue with one pier) or 12x18 (if we expand to two piers). What are your thoughts in regard to the size and construction of the new observatory? We'd like to hear from you. What would you like to see at CGO, and what would make your observing experience more enjoyable while there?

Cherry Grove today

MAS Board Minutes

by Roxanne Kuerschner, secretary

November

Event Review: Dave talked to the Rochester Astronomical Club and to the Hopkins Chamber of Commerce. Merle filed the paperwork for the CWTS raffle. **Election Status:** Everything is in order; the election is ready to go. **Jack Harrison Talk:** Bob will take care of coordinating this. **Tax Status:** The 2010 taxes have been filed. The Minnesota annual report has been filed. We are still talking about the 2007 taxes. Once 2007 is resolved, we are done. **Onan Monitoring:** The decision was made to go with a new security company to monitor Onan. Cherry Grove Observatory: It was discussed to maybe monitor Cherry Grove. The new observatory will be started this spring. Insurance Discussion: The board is still looking for a better price. We will research non-profit insurance companies. **Guy Ottwell Almanac:** Dave will check with membership to gauge interest in ordering these. **Forum Administration:** Due to confusion on how to get members the correct forum accessibility, we need to contact the proper people to get this fixed ASAP. The Onan keyholder site is especially problematic. **GiveMN:** Merle signed us up for it. It is for non-profits. The intention was to do the match, but they wanted 48 hours for approval, so we missed the match. There is a 3% fee to donate. **Action Items:** Merle is updating the Onan page; he had us look at ideas for pages. He would like to take care of the Astronomical League volunteers for those who are out at Onan a lot. Next agenda: get the telescopes all looking at the same thing.

December

Welcome: MAS president Dave Falkner welcomed the new members and thanked the outgoing members. **Harrison Schmidt Talk:** We are still waiting to hear the status of this. Dave will contact Peter Pittman to follow up. **Tax Issues:** All past tax issues have been resolved. **Onan Monitoring:** The payment will go to the company and the switch will be scheduled. **Cherry Grove:** Merle will polish up the plans and give them to Vic. **Insurance:** We are still looking for a better company to represent us. Russ Durkee and Dave Olmstead are heading up the research. **Guy Ottwell Almanacs:** MAS will order 12 calendars and 10 almanacs. The club will purchase them and resell to members at the January general meeting. **Forum Administration:** We are still trying to update the Onan page. Dave will contact Tom Dantona and Mike Kibat to see what needs to be done. The entire hierarchy of the forums needs to be revamped. A suggestion was made to have an IT committee to oversee this; more discussion is needed before a final decision is made. The website is the primary face of the society, and it is worth funding to get a good product. **MESTA Conference:** Dave and others will go and present to the Minnesota Earth Science Teachers Association in February. Any members with scopes and willing to help are welcome. **Earth Sun Day:** Dave is working on weekly telephone calls to get this organized. Onan will have an event during the early part of the transit, as we will see only three hours of it. **Joint Star Party:** A joint star party with the Rochester Astronomical Club will be scheduled. **Meeting Space:** It was discussed to move to a larger space. **Next Meeting:** The focus of the next meeting will be budget.

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 $60 annually for a patron membership. The $36 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 18, 2011.

Scott Anderson
William Arden
Pat Arndt
Rajib Bahar
Steve Baranski
Greg Baril
Bradley Beisel
Scott Billeadeau
Ken Bolvin
Rev. Eugene Brown
Jonathan Burkhardt
Jeff Burrows
Bill Bynum
Ken Carlson
Scot Carpenter
Kurt Casby
Deane Clark
Michael Conley
Mark Connolly
Mike Daniels
Alex Danzberger
Russell Durkee
Steve Emert
David Falkner
Joe Fisher
Jon Forsberg
Andrew Fraser
Amy Gammill
J. Mark Gilbert
William Glass
Donald Golofski
Steve Grabarkiewicz
Lawrence Gray
Noel Grover
Dale Hagert
Drew Hagquist
Kevin Harris
Greg Haubrich
Thomas Hawkinson
Michael Haydock
Jonathan Hayman
Victor Heiner
Merle Hiltner
Gary Hoaglund
Lauren Hoen
Michael Hornstein
Don & Anne Householder
Michael Jacobs
Dick Jacobson
Gale Jallen
Mark Job
Chelen Johnson
Julie Johnson
Daniel Kaminski
Ron Kasel
William & Danette King
Mark Klunder
Jim Knudsen
David Kocken
Parke Kunkle
Adam Kuzlak-Swanson
Michael and Deanna Lawrence
Louis Leichter
John Lindberg
Brad Linzie
Sridhar Mahendrakar
Duane Martin
Ron McLaughlin
Javier Medrano
Beverly Miller
Bob Minor
Douglas Oines
Corinthian Pagel
Alan Pals
Kirby Richter
Stephen Riendl
Jack Sandberg
Roy Sarver
James Schenz
Loren Schoenzeit
David Schultz
Brad Scott
Robert Seabold
Dan Siers Sr.
John Silvis
David Siskind
Eric Smestad
Drew Smith
Larry Steiner
Cortney Sylvester
Valts Treibergs
David Truchot
Carl Tubbs
Steve Ulrich
Bob Vangen
David Venne
Arthur Von Eschen
Paul Walker
Ann Walters
William Wood
Gene Yates
Neal Zimmerman

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 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.

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 16	06:25 PM	08:03 PM	08:03 PM	03:36 AM	23%	Mar 17	X	X	
Mar 23	06:35 PM	08:14 PM	08:14 PM	04:25 AM	4%	Mar 24	X	X	Messier Marathon at both CG and Onan on Friday, with Saturday as alternate. Also: Public Night on Saturday at Onan.
Mar 30	06:45 PM	08:26 PM	02:19 AM	04:09 AM	31%	Mar 31			
Apr 13	08:04 PM	09:51 PM	09:51 PM	03:10 AM	37%	Apr 14	X		
Apr 20	08:14 PM	10:05 PM	10:05 PM	04:18 AM	0%		X		Virgo Venture at CG
Apr 27	08:23 PM	10:20 PM	01:52 AM	04:01 AM	43%	Apr 28			Astronomy Day at Onan
May 11	08:42 PM	10:52 PM	10:52 PM	01:41 AM	52%	May 12	X		
May 18	08:50 PM	11:08 PM	11:08 PM	03:11 AM	1%		X	X	Joint star party with Rochester Astronomy Club at Cherry Grove on May 18, with May 19 as backup.
May 20						May 20			Special Event: Partial solar eclipse. 7PM Cancelled if cloudy.
May 25	08:58 PM	11:24 PM	12:26 AM	02:56 AM	29%	May 26		X	
Jun 05						Jun 05			Venus Transit Party at Onan. 4PM. All weather event. Details TBA
Jun 08	09:11 PM	11:52 PM	11:52 PM	12:10 AM	67%	Jun 09			
Jun 15	09:14 PM	12:01 AM	12:01 AM	02:28 AM	7%		X	X	
Jun 22	09:16 PM	12:03 AM	12:03 AM	02:28 AM	17%	Jun 23	X	X	
Jul 13	09:10 PM	11:39 PM	11:39 PM	01:47 AM	18%	Jul 14	X	X	
Jul 20	09:03 PM	11:24 PM	11:24 PM	03:16 AM	7%	July 20-22	X	X	Camping With the Stars at Onan. Details TBA
Jul 27	08:56 PM	11:08 PM	01:11 AM	03:32 AM	76%	Jul 28			
Aug 10	08:35 PM	10:35 PM	10:35 PM	12:25 AM	32%	Aug 11	X		
Aug 17	08:24 PM	10:17 PM	10:17 PM	04:18 AM	2%		X	X	Northern Nights Starfest 4: Aug15-18
Aug 24	08:11 PM	10:00 PM	12:01 AM	04:32 AM	63%	Aug 25		X	
Sep 07	07:44 PM	09:26 PM	09:26 PM	11:04 PM	48%	Sep 08	X		
Sep 14	07:30 PM	09:10 PM	09:10 PM	05:08 AM	0%		X	X	
Sep 21	07:16 PM	08:54 PM	10:55 PM	05:19 AM	49%	Sep 22		X	
Oct 05	06:49 PM	08:25 PM	08:25 PM	09:46 PM	65%	Oct 06			
Oct 12	06:35 PM	08:12 PM	08:12 PM	05:11 AM	4%		X		Fall Mini-Messier Marathon at CG
Oct 19	06:23 PM	07:59 PM	09:50 PM	05:58 AM	35%	Oct 20	X		Fall Astronomy Day at Onan
Nov 02	05:00 PM	06:39 PM	06:39 PM	07:31 PM	80%	Nov 03			
Nov 09	04:51 PM	06:30 PM	06:30 PM	02:59 AM	14%	Nov 10	X		
Nov 16	04:43 PM	06:24 PM	07:42 PM	05:34 AM	20%		X	X	

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 2012 daylight saving time begins March 11 and ends on Nov 4.

The Messier Marathon is a competition for MAS members and non-members to find as many of the Messier objects as they can in one night. Typically, those working on completing the list will be using their own telescopes and may not want to be disturbed. Since we will be holding a marathon at Onan this year, the main observatory will be open (weather permitting) to the general public. Please respect those members working on their lists by staying within the observatory and adhering to the Star Party Guidelines, especially by not using white-light flashlights. Thank you.

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How to pay your dues

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If you like, you may mail your renewal notice with payment directly to S&T or renew via phone with Sky Publishing at 1-800-253-0245. This new process will especially be of benefit to those of you who wait until your subscription is about to expire before renewing.

You will still need to send in your MAS membership renewal to the MAS Membership Coordinator at the MAS Post Office box address, or renew your membership via PayPal.

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New subscriptions to Sky and Telescope at the MAS member discount must still be sent to the MAS for group membership subscription processing. Send new subscriptions 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

To subscribe to the MAS e-mail list visit:
http://lists.mnastro.org/mnastro/listinfo/
and follow the subscription instructions.

There is a general list (MAS) as well as special interest group (SIG) lists. Archives of the lists are also available by visiting the listinfo page for a specific list.

The MAS list has about 40% of the membership on it.