Bouncing off the Satellites
By Mark Janovec

We have all seen them — those faint, star-like objects that silently glide across the night sky, only to slowly dissolve into the darkness. Ever since October 1957, with the launch of Sputnik 1, the sky has seen an ever-increasing number of man-made satellites placed in earth orbit. While many amateur astronomers tend to view satellites as commonplace — perhaps even a nuisance — one can learn to enjoy observing these objects, given a little knowledge of what one is looking at.

Getting Started

Observing at least some of the satellites requires nothing more than your naked eye. While many satellites are simply too faint to view with the naked eye, many others are bright enough to be seen without any visual aids. However, since satellites do not have their own light sources, they are generally only visible to observers when sunlight reflects off their surfaces and the observer’s location is dark enough to see these faint reflections. Satellites are best seen in the evening hours after sunset and in the early morning hours before sunrise. Satellites generally are not visible in the middle of the night because the Sun is too far below the horizon to illuminate them above your observing location.

Most satellites will appear to be a faint, star-like object that glides across the night sky. The apparent speed of the satellite will vary based on its altitude, with satellites in lower orbits appearing to move much faster. At a given point, the satellite will begin to fade away from view, often well before it drops below the horizon. This occurs as the satellite moves into the earth’s shadow or the reflective surfaces of the satellite are no longer in an orientation to reflect sunlight.
back to your viewing location. It is possible that one will even see certain satellites that appear to pulsate at regular intervals, which indicates that the satellite (or an object like a rocket booster) is tumbling in space, most likely because it is dead and no longer under control. Each time the satellite tumbles, sunlight bounces off a reflecting surface and can be seen by observers. An even more dramatic event is a satellite flare — but more on that later.

While it is possible to observe satellites on almost any clear night, satellite observing takes on a greater sense of reward if you know what you are looking at. The website Heavens Above (www.heavens-above.com) offers one of the best user-friendly (and free) resources available for satellite observers. The website allows observers to enter their observing location and obtain a forecast for visible satellite passes. Users can search for specific satellites they wish to observe or can query for satellites that will be visible at certain magnitudes of brightness. Observers also have the option of looking up satellite passes after an observing session is over. If you see a satellite while observing, make note of its approximate pathway, point of disappearance, and the time you saw it disappear (since you will often miss the time it first appeared). A quick search on the Heavens Above website will likely help you pinpoint which satellite you observed. Additionally, numerous computer software packages, such as Starry Night, also contain databases for satellites which can help you get started.

The International Space Station

By far the largest and most impressive satellite you can observe is the International Space Station (ISS). On-orbit construction of the ISS has been taking place since 1998. As the ISS has grown in size over time, the magnitude of the station has gotten noticeably brighter for ground observers. In particular, the addition of several large solar panels on the ISS has dramatically increased the station’s brightness to the point where it can sometimes be observed in the daytime. The recent addition of the tranquility module on shuttle mission STS-130 in February 2010 has completed the external construction of the ISS. Therefore, the station is now the brightest it will ever appear to observers.

The Heavens Above website will help you plan for observing the ISS. Also, NASA has a web page (http://spaceflight1.nasa.gov/realdata/sightings) to aid in observing spacecraft. Visibility of the ISS will depend on the position of its orbit during those key hours after sunset and before sunrise. When it is visible, more than one pass of the ISS can sometimes be observed on a given night or morning, since the station orbits the earth approximately every 90 minutes. The best times to observe the ISS are when it is mak-

Russian Soyuz/Progress spacecraft.
ing a pass that is nearly directly overhead of your observing location. Not only are these passes the longest-lasting — sometimes 5 minutes or longer — but they are also the brightest passes. If you are attending an outdoor gathering or party that stretches into the evening hours, check to see if the ISS is making a visible overhead pass that night and share this amazing sight with others.

ISS observing can also be coupled with observing other manned spacecraft, such as the Space Shuttle and Russian Soyuz/Progress spacecraft. In particular, these spacecraft can often be seen flying in close formation with the ISS in the hours and days immediately before docking and undocking with the station. Viewing these spacecraft adds an extra level of enjoyment and challenge to viewing the ISS. If the shuttle has just launched, check to see if it will be visible before it docks with the ISS.

An even greater challenge undertaken by some observers is to photograph the ISS using their telescopes. Tom Gwilym of Seattle, Washington, photographs the ISS using his Meade LX200 and an inexpensive Philips Vesta Pro web camera. Tom’s efforts are documented on his website (http://eastsideastro.org/observatory/spacecraft.html), where he also provides information and tips on photographing the ISS. Most of his guiding is done by hand; he simply aims to capture a few goods frames of the ISS each pass. This technique can be employed by nearly anyone with an inexpensive web camera and a telescope, even a Dobsonian-mounted scope.

**Satellites Flares**

Some satellites are constructed with a unique geometry that causes reflected sunlight to dramatically increase the apparent brightness of the satellite when oriented at optimal angles to an observer. These flares occur fairly quickly but can result in very bright and impressive events. Certain flares can even be seen in the daytime hours. The most famous set of satellites that regularly flare are those from the Iridium Satellite Corporation, which make up a constellation of satellites designed for voice and data transmission for satellite phones. The solar panels of these satellites, when oriented at a certain angle to the Sun, will result in the satellite increasing in brightness from roughly magnitude 6 (like a faint star) to a magnitude up to -9. The only objects in the sky that are typically brighter than an Iridium flare are the full Moon and the Sun.

To observe Iridium flares, it is essential to use the Heavens Above website or computer software that can give you predicted times for flares. Since only one flare might be visible on any given night, planning ahead is essential. Approximate location, time and magnitude of each flare will be provided. Knowing where and when to look is necessary in order to catch as much of the flare as possible, since the duration of the brightest portion of the flare may only be a few seconds. On the off-chance that you observe a satellite flare without advance preparation, you can visit Heavens Above within 48 hours to confirm whether the flare you saw was indeed one of the Iridium satellites.

**Challenge Yourself**

Once you’ve viewed the ISS and a few Iridium flares, start looking for other targets that can challenge you. Research other potential targets you can view, such as a tumbling satellite or booster. If you travel to the southern states, perhaps attempt to view the Hubble Space Telescope, whose orbital inclination doesn’t take it over Minnesota’s skies. Or try to capture the rare sight of a satellite occultation with the Moon or any celestial body. Perhaps the rarest sight of all is observing a satellite re-entry. While they are difficult to predict in advance, some observers have been lucky enough to capture these rare events.

Although satellite observing can never replace observing the natural wonders of our universe, it can provide a fun diversion while you wait for the skies to darken and your telescope to cool down. Consider adding satellites to your next observing session. 🌝

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*Images:*
- **Iridium flare and Comet 17P/Holmes slightly above the tree branch. Photo November 27, 2007, by Mila Zinkova.**
- **The International Space Station as photographed by the space shuttle crew from the STS-131 mission. Photo courtesy of NASA.**
- **Iridium satellite, constructed entirely from spares and donated to a museum by Motorola.**
Astronomy Day 2010
By Dave Falkner

All week I looked at the clear, blue, sunny skies during the day and beautiful, starry nights and thought, “Is it so much to ask for skies like this on Saturday, Astronomy Day?” But the weather forecasts remained consistent that Saturday would be cloudy with showers throughout the day and evening and lingering into Sunday.

When I woke up on Saturday I heard the rain on the roof and thought about all the things I could control but the weather was only fate. I drove through the rain out to the Onan observatory, arriving about 10:00 a.m., so I had plenty of time to get the observatory mopped up, swept and set up for our noon opening. I was pleasantly surprised to find that there were only two small puddles in the observatory, easily taken care of with a few paper towels. I swept the floor, and by the time I finished Ben Huset had arrived to help uncover the telescopes, set up tables, and complete the other tasks associated with a public event. Bob Benson showed up about ten minutes to noon with the MAS merchandise, and we got that set up and opened the doors to the hoard of people clamoring to join us for Astronomy Day. Well, O.K., there were two visitors.

Dave Venne arrived and set up his demonstration on astrophotography using a web cam. Unfortunately he had to choose a terrestrial object since the sky was overcast. Nevertheless, he explained how his setup captured images and processed them using freeware programs, which I found quite interesting. With inexpensive equipment that nearly any amateur could afford, he was able to capture very good images.

At one o’clock Steve Emert gave his talk to a half-dozen folks on the history of Astronomy Day as well as a description of the four observing sites operated by MAS. Parke Kunkle followed Steve with two talks. His first was an entertaining, interactive presentation on how astronomers determine what stars are made of. He handed out slides with diffraction grating film and had the audience look at different light sources to see the emission spectra. There was a nice discussion on the difference between an emission spectrum and an absorption spectrum.

Parke had a five-minute intermission between his talks which grew to a 30-minute break when the clouds parted for a while and the Sun broke through. We rolled back the roof so we could use the Coronado filtered telescopes. There were no sunspots, but we were able to see some prominences on the limb of the Sun. For about a half-hour we were excited to actually do some observing.

After the intermission we rolled the roof on again so we could see the projection on the screen, and Parke did a presentation on the North Star, its importance in history, and how there have been several North Stars over thousands of years due to the Earth’s precession.

Sally Brummel from the Minnesota Planetarium Society was next. I sensed that we were in for a treat when she set up her high-end Alienware laptop computer. I have a son who does computer animation and gaming, so I knew Alienware computers are a favorite for gamers with their fast processors and graphics cards with lots of memory and capability of handling large graphics files with ease. Sally is the education outreach coordinator for the MPS and uses her laptop and Unview planetarium software to run the Exploradome, a portable planetarium used primarily at schools for showing children the night sky. The Unview planetarium software is also capable of projecting on a flat surface, and this is what Sally did. Her presentation was excellent, taking us on a tour of the solar system, the Milky Way and beyond. It had amazing graphics using NASA data and pictures from the various probes that have toured our solar system.

Following Sally’s presentation there was a supper break, and in the early evening we started up again. A boy scout troop was camping in the park, and the dozen or so boys and their leaders joined us for Bob Kerr’s presentation on the night sky. About that time we learned that there were also 150 girl scouts at the Baylor Park Community Center who were working on getting their Astronomy badge. If it had been a clear night we could have easily accommodated them, but with overcast skies and limited seating in the observatory we had to come up with “Plan B” quickly. The girls were divided into three groups by grade. While Bob Kerr was giving his presentation in the observatory, Steve Emert, Bob Benson and I started with one of the groups on the plaza doing a question and answer session based on their requirements page. It lasted about a half hour but we answered all the questions.

We decided that the only way we could address all the girls was to have some of them attend Ron Schmit’s talk at 8:30 and then take the 35mm slide projector and portable screen down to the community center and do another presentation there. We held the prize drawing prior to this last presentation, giving away MAS lanyards, cof-
fee cups, T-shirts and a ball cap, a planisphere, several books and two telescopes. Steve Emert gave the last presentation with the slides. We followed that with a brief Q&A session. By the end of the evening all the girls had met their badge requirements.

Ash and Ron began cleaning up the observatory after what turned out to be a very active evening despite the weather. We finally locked up around 11:30 p.m., feeling that this was a successful Astronomy Day after all. Photographs by Ben Huset and Father Brown.

2010 Messier Marathon Report
By Bill Kocken, observing chairman

The 2010 Messier Marathon was one of the best-attended marathons we’ve ever had. There were 19 registered observers and a number of guests who did not sign in. The observing field at Cherry Grove was a busy place.

This year’s Messier Marathon was the one that tried to get away. In the end we persevered and “got ’er done.” The Marathon was scheduled for March 12 or 13 or the following weekend of the 19th or 20th. The first obstacle was snow. The weekend of March 12 and 13 saw the observing field covered with snow and beneath that was a layer of ice dating back to the last ice age, oops, I mean the Christmas ice storm. The driveway was also completely blocked by a berm of icy, crusty crud left by the snowplows. The backup plan was to hold the MM at Onan. We held it at Onan in 2009, and while the sightlines are not as good and the light pollution is worse, it was a viable option. All the fuss and hand-wringing was for nothing because it was cloudy that weekend.

As the next weekend approached, the weather warmed and the snow melted, but another issue got in the way. The lock on the door to the warming house was inoperable. Vic Heiner and Steve Emert discovered that we couldn’t get in. We could either have the party at Onan again or do without the warming house. Friday the 19th was cloudy, but things finally came in line for Saturday. Vic and Steve managed to get the old door out and install a new one. The Clear Sky Chart predicted that the skies would clear out by 9:00 p.m. Perfect!

I arrived late in the afternoon as Steve and Vic were finishing up the door. (By the way, the door has a digital lock; no keys required. If you want access to the CG warming house, contact Vic Heiner about getting a code.) Unfortunately, the clouds were lingering as the Sun set and I discovered that I’d forgotten the Messier Marathon log sheets. I want to thank Wayne Boline for driving all the way back to Canon Falls to make copies from my master sheet. You saved the day.

So what about the observing? The clouds lingered longer than predicted and by darkness the sky was only about 50% clear. I don’t think anyone observed the difficult early-evening objects of M74, M77 or M33. Due to clouds, M79 in Lepus, south of Orion, was also not seen. The clouds didn’t completely clear out until about 11:00 p.m. For the rest of the night, the observing field was a hub of Messier-observing activity. We had the usual assortment of Dobes and a smattering of refractors and SCTs. We had one or two people doing imaging. Some participants were experienced observers and some were eager novices. Some people left early and others stayed until dawn.
Toward morning there were four hardy souls left and the skies deteriorated somewhat. The southern-most Messier objects, M6 and M7 in Scorpius, were nabbed by three of us using a technique called “ground hopping.” The technique works best with binoculars and by using someone’s car to lean on. You consult your charts and guess where the targets might lie in relationship to the very few visible stars and to terrestrial objects. The final route to M6 was something like, “Start at that tall tree, go right and down to the street sign. Then go up 1/2 binocular fields and to the right a little. That fuzzy patch is M7. Go up and to the right and you’ll see M6.” Trust me, it all made sense at 4:50 a.m.

Due to the placement of the light shields, my scope couldn’t see to the southeast, so I borrowed a loaner scope and set up in front of the observatory to get the globes at the bottom of Sagittarius. Ken Hugill observed them with the 24” Starmaster and by more or less sitting on the ground. Clouds on the horizon and the impending dawn prevented most of us from seeing the early morning objects like M72, M73, M15, M75, M2 and M30.

Here are the results:

- Winner – Advanced Observer Category – Jeff Burrows – 100 objects. Since Jeff won the award last year, the prize was awarded to Ken Hugill – 99 objects.
- Winner – Novice Observer Category – Byron Day – 25 objects

**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 constitutionally established at 2½ 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 May 8, 2010:


**MAS Board Minutes — March/April 2010**

by Dave Falkner, acting secretary

With the Casby Observatory finishing up and star parties set to begin, the board addressed some of the operational details associated with the observatory and its location. Some concerns expressed by the Belwin Conservancy led to a requirement for all MAS members who wish to attend star parties at the Casby Observatory to attend orientation sessions on the Belwin Conservancy as well as observatory and telescope orientation for those who wish to use the 10” TMB telescope located there. The board also discussed at length the lack of access to restroom facilities, some possible solutions, and Belwin’s proposal for access to the restrooms in the Belwin Center located near the observatory. Further discussion between MAS and Belwin is needed with regard to the restroom access. The board will also draft an operational agreement with Belwin to clarify the day-to-day obligations for both parties, detail the operational responsibilities and liabilities for both parties, and address any other issues to ensure a smooth partnership moving forward.

The board agreed to purchase two 15-second advertisements on TPT public television just prior to the airing of the two parts of the Nova program “Hunting the Edge of Space.” Final plans for the Astronomy Day celebration to be held April 24 at the Onan Observatory were reviewed and approved. The board agreed that after Astronomy Day increased focus on the upcoming Camping with the Stars is needed.

The status of the website redesign was discussed and Tom Dantonola was contacted regarding the schedule. Tom will attend the May board meeting to demo the new site.
Joseph J. Casby Observatory Dedication
by Merle Hiltner

The dedication of the new Joseph J. Casby Observatory will be held at the Belwin Conservancy on June 12. Usually access to the site is limited to MAS members who have attended the Belwin orientation and their guests. For this event we will be inviting MAS members and non-members wishing to learn more about MAS and its facilities as well as Belwin Conservancy members.

The observatory was made possible by the generosity of Sylvia Casby, MAS member Kurt Casby’s mother. The entire MAS wishes to thank Mrs. Casby, who donated the funds to proceed with the construction of the observatory in honor of her late husband, Joseph.

Throughout the fall and winter of 2009-2010, construction continued on the observatory with the help and dedication of MAS members and non-members alike. This spring, MAS will open the Joseph J. Casby Observatory within the Belwin Conservancy. The observatory site overlooks open prairie and has spectacular views from the east to northwest. The observatory houses one of the largest refracting telescopes in the state, a 10” TMB f/9 refractor. This professional-quality telescope and mount is accompanied by a TMB 130 f/7 guide scope. Both are housed within a 16.5 foot Ash-Dome observatory. The motorized dome is a first for MAS and provides the appropriate home for such a high-quality instrument. The scope, mount and accessories are donations from our anonymous benefactor, whom we cannot thank enough for a truly incredible instrument.

Directions to the Casby Observatory and Belwin Conservancy can be found on page 10 in this issue. Once in Belwin, drive past the lower parking lot and the Belwin office on the hill, take a left through the gate and follow the single-lane road to the parking area near the Belwin Center. Parking at the observatory is limited. For those who wish to bring their own scope, you will be able to unload and load your scope near the observatory. There is also limited parking at the parking lot in the wooded area near the observatory or at the cul-de-sac.

If you would like to attend the dedication, please review Belwin visitation rules and star party guidelines (links on the MAS homepage at www.mnastro.org).

Prominent Milestones:
- Initial Belwin meeting and site selection: 5/23/2008
- Informed of donation from Mrs. Casby: 6/18/2009
- Groundbreaking: 10/22/2009
- Foundation complete: 10/28/2009
- Pier poured: 11/3/2009
- Ash-Dome picked up: 11/9/2009
- Slab poured: 11/17/2009
- Dome ring wall installed: 12/5/2009
- Dome skirt assembly: 12/12/2009-12/13/2009
- Dome assembly: 12/17/2009
- Dome shutter installation: 1/9/2010-1/10/2010
- Siding installation: 1/16/2010-1/17/2010
- Pier and mount installation: 2/13/2010
- Electrical installed: 3/2/2010
- Scope installation and first light: 3/7/2010
- Initial scope training: 3/14/2010
- First star party: 4/17/2010
- Observatory dedication: 6/12/2010
Having lived in Minnesota for a number of years, I was thoroughly familiar with the expected snowfall during the winter. On more than one occasion, deep snow had prevented my observing. Now it was time to consider building an observatory. I knew that, if the observatory was to be used during the winter months, it had to be conveniently accessible. Although several locations on our three-acre property offered less sky obstruction, I finally decided to construct the observatory as a third bay to our existing two-car garage. Since the garage was attached to the house, it would provide enclosed access to the observatory at any time.

As a result of experience with the straight tube design of my 8" refractor, detailed in an earlier installment, I opted for a domed observatory rather than a roll-off roof. The dome would provide better protection for the telescope, mainly from wind effects, and it would also provide some shielding from the metropolitan sky glow to my west. Based on experience while helping a couple of friends build smaller versions of domed observatories, I also decided to use a commercial dome rather than fabricating one of my own design. In the end, I chose Ash Dome™ as the supplier.

Finalizing the plans after discarding alternatives, I discussed the proposed construction with several of my neighbors. Fortunately, they all thought the idea was cool, and none raised any objection when I applied for my building permit. The county engineer had some experience with domed observatories, since the University of Minnesota has an infrared facility in the northern part of the county, about 25 miles away. As long as I was using a commercial dome with adequate snow-loading capability, he approved the plans.

Based on a 12'/2-foot diameter Ash Dome, the final design had a raised observing floor to get the telescope high enough to clear the peak of the garage roof. The dome covered the rear half of the structure, and normal roofing to match the existing pitch and color covered the front half. A secondary advantage of the raised observing floor is that it allows the hood of a standard car to fit under the floor so the garage bay could house an automobile, if so desired.

Construction began in the fall of 1984. Building codes required frost footings to be 42" deep to prevent heaving. My concrete contractor did more than simply raise an eyebrow when I specified the footing for the pier to be four feet square and six feet deep! Of course, I was concerned about more than just frost heaving: I wanted sufficient mass to damp vibrations from the nearby roads. We had a corner lot and both roads were gravel at the time. Besides, concrete was cheap.

The 3'/2-cubic-yard footing is completely underfoot. From the top of the footing to the level of the observing floor, there is a concrete column two feet square—almost another cubic yard for the six-foot height. Finally, from the observing floor level the pier extends another eight feet using concrete chimney blocks. Chimney blocks are 16" square and completely hollow inside. The eight-foot column is filled with dry sand for additional vibration damping. When the concrete pad of the garage floor was poured and the observing floor was built, both were isolated from the concrete pier and footing. With this construction I have never had a vibration problem, even when observing at magnifications of 350x or more.

The garage bay shell is standard frame construction. The observing room is 13 feet square with corner beams to support the dome ring. Ash Dome recommended a built-up ring, at least eight inches high, to support the dome base plate. Their plan showed standard frame construction with 2x4 struts spaced every 16 inches around the ring. As an alternative, the county engineer specified solid timber construction for the ring. My contractor had a mill yard cut the ring from laminated 2x6 and 6x6 timbers. This ring was the most expensive single part of the construction, other than the dome itself, but it has proved very durable over the years.

When the construction was finished in early December, the circular dome opening was covered with canvas and plastic to keep snow out of the structure until the dome arrived. Since Ash Dome is located in a Chicago suburb, I rented a trailer and drove down one weekend to pick it up. Ash Dome completely fabricates the dome in its facility and then disassembles it for shipment. By picking it up myself, I saved the shipping charges and was able to discuss the assembly with Ash Dome technicians. “Everything fits. You don’t have to cut or drill new holes,” they emphasized. They also assured me that two people could assemble the dome in a day.

Once the dome was unloaded into the empty garage bay, I waited for one of Minnesota’s traditional January thaws when temperatures get above freezing. On a Saturday in 40° weather, I carefully installed and leveled the base ring. Rather than a water level, I used a glycol level to maintain the ring position. I was impressed with the care that my contractor had used when he installed the ring, since I needed very few shims to level the base ring atop the fabricated support ring. After placing the dome support wheels on the base ring, I quit for the day.

Sunday was another 40° day, but snow was forecast for the evening. Figuring I had the hard part done with the base ring, and remembering the assurance of the technicians, I started to assemble the dome itself with Stephanie’s help. That’s when we discovered her tendency to vertigo. She could not get up on the roof or the inside scaffolding to help slide the metal gories together. At
least she was able to hand me the gores so I was not constantly climbing up and down for the next piece. Several of the neighbors stopped by from time to time to watch the dome take shape and to give Stephanie a break by shuttling pieces up to me.

Assembly proceeded smoothly as piece after piece slid into place. When they assembled the dome in the factory, the technicians numbered each piece in the order it was to be assembled. This greatly aided our reassembly. Our major problem came late in the day when it was time to install the shutter. Each of the two pieces was too heavy for either of us to lift. Fortunately, one of our neighbors was available to help, and we got everything closed up just as a few snowflakes began to fly.

With the dome enclosed, I was able to install the electric motors that turn the dome and raise/lower the shutter at my leisure over the following week. I had already wired the observing room for lights and electrical outlets. Initial tests showed that the dome rotated and the shutter moved as planned. Now I was anxious to install the telescope.

I had ordered an equatorial mount from Starliner Company, a supplier of commercial telescopes to the amateur market. After I talked to the company president and explained what I was doing, he recommended the mounting they provide with their 12 1/2-inch reflecting telescopes. This mounting has two-inch steel shafts, and both axes have electric drive systems. Since I already had the mechanical tubing pedestal from earlier mounting efforts, he offered to make the mounting base match the dimensions of the tubing so I could cut a piece and set it into concrete at the top of the pier. This arrangement worked very well, and the ability to rotate the entire mounting inside the tubing made polar alignment relatively easy.

With the scaffolding still in place, I set the equatorial mount onto the pier. Then I dismantled the scaffolding and reassembled the telescope that had been in storage. After fastening the scope to the mounting, I waited for the next clear night. And waited. Most Minnesota winter nights are clear, since all of the water vapor is on the ground in the form of snow, but it was almost another week before I was able to claim first light.

On February 22, 1985, I opened the shutter and rotated the dome to the north. After a preliminary eyeball alignment on Polaris, I turned the dome back to the southwest and pointed the telescope toward the Pleiades. Even at low power (85x), only about half of the cluster fit the field of view at one time, but it was glorious! I had finally fulfilled a dream of some 20-odd years to have an observatory of my own.

Over the next few months, I finished the interior of the observatory and added a few shelves for future equipment. The nice thing about a square observing room beneath a dome is that the corners are available for storage without materials getting in the observer’s way. This was an added benefit that I had not even considered during the early design phases. But not all of my time was spent with construction. I took full advantage of clear nights for observing, too.

Several evenings spent on improving polar alignment paid off handsomely over the years. The original clock drive that came with the mounting proved to be marginal with its 4" worm gear. It was replaced with a Byers drive having a 10" worm and an Optical™ variable-frequency controller for altering the tracking rate. With this configuration I was able to locate and track at high magnifications without difficulty. Slewing to a new position was still a manual operation.

A number of friends kept asking what I would name the observatory. I thought of several possibilities, but none of them seemed right. A number of years later, while visiting the welcome center on Mauna Kea in Hawaii, I came across the original Hawaiian/Polynesian name for the Pleiades star cluster: Makali‘i. Instead of the “Seven Sisters” of western mythology, Makali‘i means “little eyes.” I thought that was doubly fitting, since the Pleiades had provided first light. Given the size telescopes I was likely to use in the observatory, I adopted the name.

The refractor and the convenience of the observatory served well for many years. Finally, about 1995, the heat dome of the metropolitan area moved out past my location. Skies were still nicely transparent, but the steadiness was gone. Whereas I had typically observed planets at 275 and 350 magnification, now I was lucky to find a night that would tolerate 200x. I had just concluded my term as president of the Astronomical League (described elsewhere), and I was eager to get back to observing instead of administrative astronomy. I was so disappointed that I almost gave up observational astronomy.

During the summer of 1997, I had the opportunity to observe with one of the new computerized GoTo telescopes. While it was intriguing, I wondered about spending the money if I was not going to continue observing. The League had two relatively new observing programs, Herschel (deep sky) objects and double stars. Double stars were a natural fit for the refractor, and I was curious to see what the instrument could do on some of the faint fuzzies of the deep sky, so I embarked upon the two observing programs. It was well that I did because I rediscovered the spark of observing.

As expected, double stars were easy, even with rather poor seeing conditions. The stars chosen for the program were not particularly difficult to split, and many of the pairs had highly
contrasting colors. Not having used the refractor very much for nebulae and galaxies, I was pleasantly surprised at its performance in that arena. The slow f/13 aperture ratio was not in the f/5 range that is typically used for such objects.

Without computer control or digital setting circles, I found all the objects I observed with the refractor either by direct pointing or by star hopping. The latter practice requires that a path be plotted from some easily located star to the object of interest, and then the observer hops from one star along the path to another until the target is located. The aforementioned spark occurred one evening the following spring when I was searching for distant galaxies in the Leo-Virgo-Coma Berenices region. Here, galaxies appear so close together in the sky that I was literally galaxy hopping from one to the next. It was quite an experience as one dim island universe after another swam into view. I knew then that I could not give up observing.

Within ten months of starting, I was able to complete observing all 100 double stars and all 400 Herschel objects to qualify for the respective League observing certificates. I also decided at that time to invest in one of the new computerized telescopes. I selected at 10'' Meade LX-200 Schmidt-Cassegrain to replace the venerable refractor. The refractor was officially retired on June 1, 1999, and replaced by the new instrument. I have been happily using it ever since.

Except for years when I was League president, or traveling extensively for work, I have averaged close to 350 hours per year observing since I finished the observatory. Within minutes of deciding to observe, I can have the dome open and be at the eyepiece. This is a real convenience when I get up in the middle of the night to record an occultation or other transitory event. Now that I am retired from 3M, I have spent even more time observing. If the weather will just cooperate, astronomy really is a joy.

Epilogue

Since I wrote this article, we found a new area with near-pristine skies. Several MAS members are familiar with Mike and Lynn Rice’s New Mexico Skies B&B with an array of observatories housing a variety of telescopes. (See, for example, Dave Siskind’s article in the April 2009 issue of Gemini.) I may detail the trials of the move in a future article, but suffice it to say that we sold the Minnesota house and observatory last winter and have moved to New Mexico. Our new home and Makali’i South has been established about a quarter mile east of the Rices, on the same mountain ridge. If any of you come down to the Rice’s B&B, stop in and see us, too!

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

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, 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 J. 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 USÂ 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/right 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 2010 Star Party Schedule

<table>
<thead>
<tr>
<th>Friday Date</th>
<th>Twilight at:</th>
<th>Moon Rise</th>
<th>Moon Set</th>
<th>Moon % Illuminated</th>
<th>Onan Public Night (Sat.)</th>
<th>Cherry Grove</th>
<th>LLCC</th>
<th>Onan Star Party</th>
<th>Metcalf/ Belwin</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jun 04</td>
<td>11:44 p.m.</td>
<td>01:26 a.m.</td>
<td>12:59 p.m.</td>
<td>47%</td>
<td>June 05</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>Jun 11</td>
<td>11:56 p.m.</td>
<td>05:08 a.m.</td>
<td>08:52 p.m.</td>
<td>0%</td>
<td>June 19</td>
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<td></td>
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<tr>
<td>Jun 18</td>
<td>12:02 a.m.</td>
<td>12:50 p.m.</td>
<td>12:56 a.m.</td>
<td>51%</td>
<td>July 03</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>Jun 25</td>
<td>12:03 a.m.</td>
<td>08:48 p.m.</td>
<td>05:25 a.m.</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Jul 02</td>
<td>11:57 p.m.</td>
<td>11:49 p.m.</td>
<td>12:54 p.m.</td>
<td>63%</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Jul 09</td>
<td>11:47 p.m.</td>
<td>03:54 a.m.</td>
<td>07:35 p.m.</td>
<td>3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jul 16</td>
<td>11:34 p.m.</td>
<td>01:10 p.m.</td>
<td>11:24 p.m.</td>
<td>37%</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Jul 23</td>
<td>11:19 p.m.</td>
<td>07:29 p.m.</td>
<td>04:18 a.m.</td>
<td>97%</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jul 30</td>
<td>11:02 p.m.</td>
<td>10:14 p.m.</td>
<td>11:46 a.m.</td>
<td>96%</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Aug 06</td>
<td>10:46 p.m.</td>
<td>02:41 a.m.</td>
<td>06:14 p.m.</td>
<td>12%</td>
<td>August 14</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Aug 13</td>
<td>10:28 p.m.</td>
<td>10:52 a.m.</td>
<td>09:52 p.m.</td>
<td>23%</td>
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<td>Aug 20</td>
<td>10:11 p.m.</td>
<td>06:06 p.m.</td>
<td>03:15 a.m.</td>
<td>89%</td>
<td>August 28</td>
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<td>Aug 27</td>
<td>09:54 p.m.</td>
<td>08:40 p.m.</td>
<td>10:41 a.m.</td>
<td>89%</td>
<td>September 04</td>
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<td>X</td>
<td>X</td>
<td>X</td>
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<td>Sep 03</td>
<td>09:37 p.m.</td>
<td>01:33 a.m.</td>
<td>04:51 p.m.</td>
<td>24%</td>
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<td>Sep 10</td>
<td>09:21 p.m.</td>
<td>11:06 a.m.</td>
<td>08:20 p.m.</td>
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<td>02:12 a.m.</td>
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<td>September 18</td>
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<tr>
<td>Sep 24</td>
<td>08:49 p.m.</td>
<td>07:07 p.m.</td>
<td>09:39 a.m.</td>
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<tr>
<td>Oct 01</td>
<td>08:34 p.m.</td>
<td>12:31 a.m.</td>
<td>03:28 p.m.</td>
<td>38%</td>
<td>October 02</td>
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<td>Oct 08</td>
<td>08:20 p.m.</td>
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<td>06:47 p.m.</td>
<td>3%</td>
<td>October 16</td>
<td>X</td>
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<tr>
<td>Oct 15</td>
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<td>03:09 p.m.</td>
<td>01:07 a.m.</td>
<td>63%</td>
<td>October 30</td>
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<td>X</td>
<td>X</td>
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<td>08:35 a.m.</td>
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<td>November 13</td>
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<td>Nov 05</td>
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<td>04:16 p.m.</td>
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<td>Nov 12</td>
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<td>10:59 p.m.</td>
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<td>Nov 19</td>
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<tr>
<td>Dec 03</td>
<td>06:16 p.m.</td>
<td>06:37 a.m.</td>
<td>02:49 p.m.</td>
<td>3%</td>
<td></td>
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</tbody>
</table>

This schedule is subject to change. You can also check the MAS online calendar at www.mnastro.org for a complete schedule of all MAS events. Onan, Cherry Grove and Metcalf 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. In 2010 Daylight Saving Time begins March 14 and ends on Nov 7.

### Third Annual Camping with the Stars

by Merle Hiltner

The Minnesota Astronomical Society would like to invite you to attend our third annual “Camping with the Stars” weekend. Join us at Onan Observatory in Baylor Regional Park for a weekend of camping and astronomical fun. Events begin on Friday, July 16, and run through Sunday afternoon, July 18. On Saturday a number of speakers will give talks on astronomy, door and raffle prizes will be given away, and there will be tours of the night sky and of course stargazing (weather permitting). Call the Carver County Park Office at 952-466-5250 to reserve your spot and for registration information.

Registration $73.00.
- Group camp setting in ball field near Onan + MAS event: Registration $51.00.
- Extra person per campsite: $5/each for weekend.
- Daily admission (not camping) to MAS event: $10.00/person/day

All registration fees are for up to four people and include two nights of camping, vehicle permit, wristband for MAS activities and door prizes drawing entries.

Registered campers are automatically entered in the door prizes drawing. Raffle tickets will be available for purchase. Prizes will include at least two telescopes, an MP3 player, MAS merchandise, and an assortment of astronomy books and videos. For a complete list of prizes, go to the CWTS webpage at www.mnastro.org/camp-withstars.

Registration Fees for 2010 Camping with the Stars Event
- Utility campsite in family campground + MAS event: Registration $85.00.
- Primitive campsite in family campground + MAS event:

- Camping with the Stars 7/16-18
- Northern Nights Starfest at LLCC
Your MAS membership expires at the beginning of the month shown on your Gemini mailing label. Send your payments to the MAS Membership Coordinator at: Minnesota Astronomical Society, Attn: Membership Coordinator, P.O. Box 14931, Minneapolis, MN 55414. Make checks payable to MAS or you can pay by PayPal on the MAS web page. The current annual membership dues and subscription fees are: $24 for regular memberships ($56.95 including Sky and Telescope subscription discounted to the annual member subscription rate of $32.95), $60 for patron memberships ($92.95 including Sky and Telescope subscription) and $12 for student memberships ($44.95 including Sky and Telescope subscription).

To Renew Your Sky and Telescope Subscription

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.

If you wish, you can 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.

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.