



# Capitol Skies

The newsletter of the Madison Astronomical Society

October/November 2003

## Moon Over Monona Terrace – Friday, October 3rd

A really great MAS event is at hand. Moon Over Monona Terrace, an evening of lunar observing for the public has become a standout affair for our public outreach efforts and a really fun time as well. This is a great opportunity for MAS to show the public a little of what we do, to entertain their curiosity and encourage folks of all ages to get involved in astronomy.

Public turnout at previous Monona Terrace events has been terrific. The Monona Terrace Community and Convention Center promotes the event in their "public events" brochure which gets mailed to over 25,000 recipients as well as handed out daily at Monona Terrace. They also have the event announced in the media. In addition, MAS posts announcements in the public libraries, schools, and on public bulletin boards. So, it is absolutely essential that many members participate to insure that this year's gathering will be as successful as the prior occasions. Instruments large and small—binoculars, refractors, Newtonians, Schmidts, Dobsonians—equipment of all shapes and sizes will be needed, showing people that an involvement in astronomy can be at any scale. Members not bringing equipment will be needed as well to answer questions, take care of hand-out material and generally assist. In the past, Moon Over Monona Terrace has been a happy, enjoyable outing in one of Madison's most spectacular

## From the President's Desktop

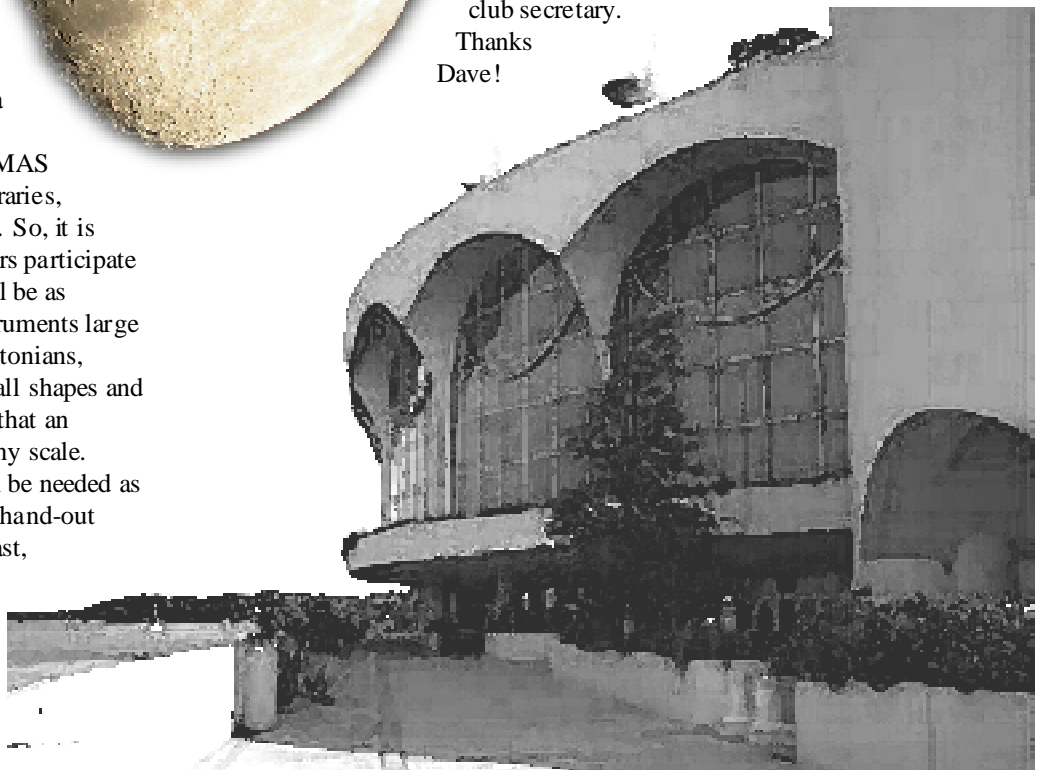
by Neil Robinson

Greetings fellow MAS'ers, the Mars opposition event at the Washburne Observatory was attended by several MAS members and hundreds of members of the public. The participation of MAS was very valuable since on some evenings, the line to view through the 15" instrument in the Washburne facility exceeded the observing time allotted and many people would not have seen Mars through any telescope at all if we had not been present.

The next opportunity to facilitate public stargazing is on October 3rd at the Moon Over Monona Terrace event. I encourage all MAS members who are able to attend to bring along any equipment you feel would be appropriate and help us to showcase amateur astronomy to the community. There will be a weather check and decision at 4:00 pm on the 3rd so if there is any doubt about the conditions, call me or Tim Ellestad for verification. Rain/cloud date is Saturday October 4th.

A hearty welcome aboard to Dave Odell, who has volunteered to be the club secretary.

Thanks  
Dave!



*Continued on page 2*

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Madison Astronomical Society members are active in sharing the pleasures of astronomy with the public, acting as a resource for students and teachers, and exchanging information at Society meetings which occur monthly. The Society continues to pursue its original goal to "promote the science of astronomy and to educate the public in the wonders of the universe."

For more information about the Society, please contact one of the officers listed above.

MAS thanks

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Visit MAS on the web at:

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settings. This year should be the same.

We may begin setting up as early as 5:30 PM. Members bringing equipment may use the loading dock located on the northeast end of the building. The drive-up entrance to the loading dock is at the traffic lights on John Nolan Drive just to the northeast of the Monona Terrace parking ramp tunnel. When turning off John Nolan Drive at the traffic light intersection make an immediate hard right turn. The dock will be in plain sight. Members may use the large cargo carts in the dock area to transport their equipment to the rooftop via the service elevator which is also located right in the dock area.

The event has been promoted to begin at 7:30 PM although the public usually begins to wander in early. This year the scheduled conclusion time was announced as 9:00 PM based on the tapering off of last years crowd. However, by the time the last stragglers have left and the last MAS members have packed and left it will probably be 10:00 PM.

If Monona Terrace has no other traffic for the loading dock that evening (fairly likely) members bringing equipment will probably be allowed to park in the loading dock area in an orderly fashion. If not, equipment will have to be delivered and vehicles will have to be parked elsewhere until departure. If this is the case, the MAS has authorized a \$2 dollar parking stipend be given to each



MAS member Rod Helt in action during last year's Moon over Monona Terrace.

member bringing equipment. Paid parking is available in the Monona Terrace lot or on the streets or in the public ramp a block away.

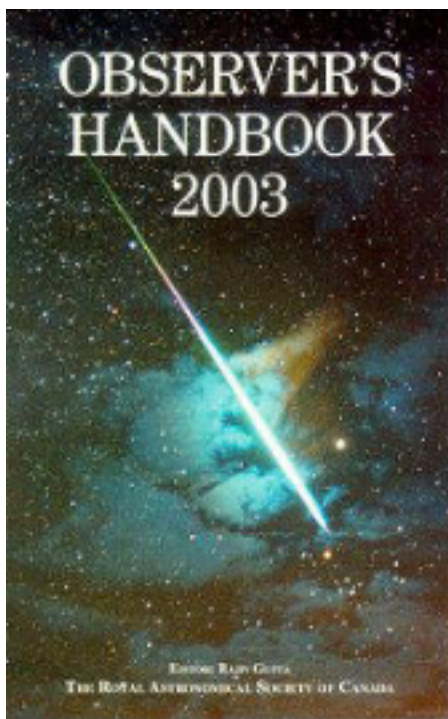
If weather is inclement, a go/no-go decision will be made at 4:00 PM by MAS President, pilot, and weatherman extraordinaire Neil Robinson. The weather decision can be checked by calling the Monona Terrace events number 261-4042, Neil Robinson at 238-4429, or Tim Ellestad at 233-3305. Should the event be canceled due to clouds or high winds (the Monona Terrace rooftop can get really, really windy) the following evening, Saturday October 4th has been announced as the weather date. The same weather announcement procedure will be used.

Everyone come to Moon Over Monona Terrace! It's a wonderful time

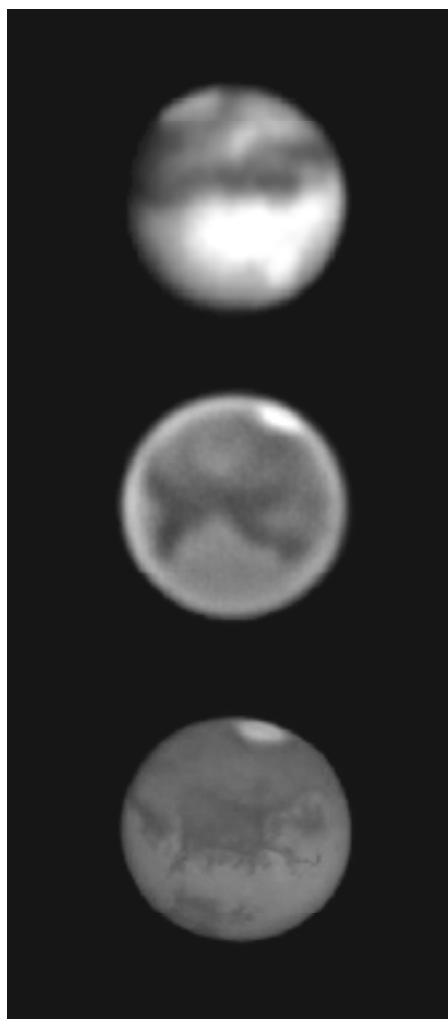
## Telescope and Binocular Fair

Jim Lattis and Space Place will conduct its annual Telescope and Binocular Fair on October 28th from 6:30 to 9:00 pm at Space Place, 1605 S. Park St. This is an opportunity for members of the public to come out and see a variety of astronomical equipment, from binoculars and small telescopes to higher-end equipment, talk to experts, and do some outside observing if weather permits.

MAS members are encouraged to come to the event, either with or without their own equipment. Your expertise and willingness to talk with the public will be invaluable.



Neil Robinson will be taking orders for the RASC Observer's Handbooks for 2004 at the Oct 10th meeting and ordering the books from Royal Astronomical Society of Canada in time (hopefully) for distribution at the Nov 14th meeting. If you would like to order a book, please bring \$15 to the October meeting.



## A collection of Mars images

The historic opposition of August 2003 may be past, but Mars watchers' memories of this event won't fade so quickly. Here is a selection of pictures taken by some MAS members this past summer. Don't be discouraged by Mars' shrinking size and diminishing magnitude. Though it's receding from Earth now, it will remain large enough to observe detail in most telescopes well into October.

South is up in all images

*Top: Douglas Russell, August 9, 2003, C11 and Starlight Express CCD camera, average of 40 exposures.*

*Center: John Rummel, September 5, 2003, C8 and Nikon Coolpix 4500, 10 images stacked and processed.*

*Bottom: Mark Hanson, August 27, 2003, 12" LX200 and Nikon 5000, 46 images stacked and processed. Mark's amazing image shows the benefits of fine optics and superior skill in image processing.*

## Calendar of Events

- |             |   |
|-------------|---|
| October 3   | Moon over Monona Terrace (rain date October 4th). See cover article for info.   |
| October 10  | MAS monthly meeting. 7:00 pm board meeting, 7:30 main presentation: TBA. Space Place, 1605 S. Park St.  |
| October 15  | MMSD Planetarium Public Show. Memorial High School, corner of Mineral Point and Gammon. 6:30 Family Program: Solar System Sleuths, 7:45 Adult/HS Program: Exploring the moon, preview of the lunar eclipse in November. |
| October 28  | Telescope and Binocular Fair, 6:30 to 9:00 pm, Space Place, 1605 S. Park St. See article on previous page.  |
| November 8  | Total Lunar Eclipse: Partial eclipse in progress at moon rise (4:38 pm), umbral phase begins shortly thereafter.  |
| November 14 | MAS monthly meeting. 7:00 pm board meeting, 7:30 main presentation: TBA. Space Place, 1605 S. Park St.  |
| November 19 | MMSD Planetarium Public Show. Memorial High School, corner of Mineral Point and Gammon. 6:30 and 7:45, Skywatching, explore the current night sky, identifying constellations and planets.                              |

# My Quest for the Satellites of Mars

by Eric W. Theide

As I approach the middle of my fifties, I have come to realize that in my first 35 years as an astronomical observer, many interesting things were left unseen, and I probably don't have another 35 years left to try to see them. Having read Roger Sinnott's article "The Hunt for the Hurling Moons" (*Sky and Telescope*, Aug. 2003, p. 102), I decided that the small, elusive objects Phobos and Deimos belonged on my to-do list, especially with such a close perihelion opposition of Mars drawing near.

Phobos and Deimos are irregularly shaped bodies, about which little is known. They are both in the approximate form of squat watermelons whose long axes point perpetually toward Mars. They are not large: the long axis of Phobos is about 27 km. (17 miles), of Deimos about 15 km. (9 miles). No spacecraft, despite Russian attempts, has ever successfully landed on either of them. Phobos has been imaged more or less completely by Russian and American spacecraft, but Deimos has only been partially imaged. Their origins are still a mystery: superficially they would appear to be captured outer main belt asteroids, but their circular orbits in Mars' equatorial plane argue against this. They also seem to have very strange, nearly charcoal-black surfaces.

Sinnott's article stressed the need for a piece of equipment called an occulting bar that can be used to hide brilliant Mars from direct view in order to facilitate the search for the much fainter satellites. I proceeded to make one, which soon became two. As I have a very ample supply of junk (just ask my wife Angela, bless her heart!), I was able to throw one together for a 20-mm eyepiece, followed by the more difficult task of building a much more miniature one for a 10-mm eyepiece (see article on following page). These two could be used on all the telescopes I could conceivably have access to, without the need for a Barlow lens or any other optics that could absorb

or scatter light. The reduction of scattered light is a most pressing issue. The satellites of Mars are bright enough that they could be seen with a small telescope were it not for their proximity to Mars (which outshines them by a factor of several hundred thousand) and their consequent immersion in the light scattered around the planet by the Earth's atmosphere, the telescope optics, and the observer's eye.

The availability of telescopes to use is always a limiting factor, but I am perhaps more fortunate than most, as it turns out. My two largest telescopes are an 8-inch Celestron with a Halley-era corrector plate (i.e. poorly polished and a potential light-scatterer) and a 6-inch f/10 Newtonian with excellent optics but a four-vane spider supporting the secondary which would certainly scatter a lot of light in some directions. I also thought of our 16-inch Cassegrain (and its spider) and our 12-inch SCTs at YRS.

The most preferred instrument of all, though, was one I knew well from having used it extensively in the 60's and 70's. This is the 15.6-inch Alvan Clark refractor at Washburn Observatory on the UW-Madison campus. What better 'scope to try with than one that is essentially a 6/10 scale copy of the 26-inch refractor used by Asaph Hall to discover the objects of my quest in 1877?

I no longer have the ready access to this instrument that I once had, but Dr. Jim Lattis was kind enough to invite Wynn Wacker and I to accompany him there in the wee hours of Aug. 2. A little before 8:30UT, with Mars just past the meridian, I had the planet behind the occulting bar of the 20-mm eyepiece (310X). I found Deimos (2.5 hours before its western elongation) in less than 15 seconds. I also tried an 18-mm eyepiece without an occulting bar, and put Mars just outside the field. Deimos could be easily seen this way as well. I wanted to try the latter approach because that was the method Hall used to discover Deimos in the first place. I made only a half-

hearted search for Phobos, as I knew that it would be very near the planet and probably invisible, which turned out to be the case. But at least I had accomplished half my goal.

I concluded that it would be awhile before I got to Washburn again, or to YRS, so I decided to make a try with my own equipment, in my own urban backyard. Not the best setup for the job, to be sure, but highly accessible.

My 8-inch Celestron is mounted in a small roll-off roof observatory, where I use it mainly to make frequent observations of a variable star that is of interest to me. As such it had seen many years of exposure to the elements. I had never cleaned the corrector plate before, but decided it was time to do that (too bad I couldn't repolish it properly as well). I also recollimated the 'scope and arranged to be able to view straight through with the 10-mm eyepiece and occulting bar (200X). Then I dusted off my drive corrector so I could use it to position (and reposition) Mars accurately behind the occulting bar.

On August 16, I made my first serious attempt with this instrument, as I knew both satellites would be near their western elongations at 8:15UT. Sadly, I was unable to see either one. When analyzing the possible reasons for failure, I came up with the following: hazy sky, bright moonlight (which was also shining on the corrector plate), and light scattered by a radio antenna wire that was in my line of sight at that time.

Having taken down the antenna, I decided to try again on August 18, even though neither satellite was optimally placed. This was one of the least hazy nights I had seen so far in a very muggy August, and Earth's moon had shrunk somewhat and moved further east. I also took the precaution of opening the observatory roof up less than usual, so I could position a piece of cardboard on it to prevent any moonlight from falling

directly on the corrector plate. All this appears to have paid off. At 8:10UT, I got an occasional glimpse of a faint speck ENE of Mars, which I assume was Deimos 2.5 hours past eastern elongation. I must emphasize the great difficulty of this observation. I could at best get only an occasional glimpse of Deimos by averted vision, probably during moments of good seeing. After a short while, when Mars had dropped a little lower west of the meridian and our moon had risen a little higher in the east, I was unable to see the elusive speck at all any more. I was indeed encouraged, but I concluded that with an 8-inch 'scope (at least one with the problems mine has) and viewing from an urban environment, this observation was at the extreme limit of feasibility. How surprised I would be ten days later!

I tried again unsuccessfully on the following two nights, first with the 6-inch Newtonian (great optics, but probably too small), and the 8-inch SCT (probably too hazy). At this point I decided to slow down and smell the roses, as it were. For a few nights I happily watched Mars

with the 6-inch Newtonian and marveled at the amount of detail visible on it. The hurtling moons would have to wait awhile. The next success would not come until the wee hours of August 25.

Jim Lattis had told me that Washburn Observatory would be open for public Mars viewing every clear night from Aug. 24 to Aug. 30. Having had much experience there, I volunteered to help out. Though the day of the first viewing was very hot and muggy with a chance of thunderstorms, luckily the clouds and rain held off until the predawn hours.

Despite the oppressive heat, we had a good turnout on that Sunday night. I had not participated in a public event for awhile, and I had forgotten how much fun it is to talk to enthusiastic, curious people who often know quite a bit already and are eager to learn more. By

1AM Aug. 25 we had shown the last public view for the night. I knew that Deimos had reached western elongation less than two hours earlier. The sky was hazy but reasonably clear except for a few scattered clouds, and with Mars nearing the meridian, the seeing was fairly good. Most importantly, Phobos was approaching western elongation.

With no small anticipation, I deployed the 20-mm eyepiece and occulting bar. The instant Mars was behind the bar, Deimos sprang into view, near the point where I had seen it about three weeks earlier, but now much easier to see. Phobos required somewhat more effort. I

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got my first glimpse of it soon, but to see it repeatedly I had to position Mars just inside the west edge of the bar and move it back and forth a little. The resulting motion of Phobos then drew my attention to it. In the best moments I could see both Phobos and Deimos strung out in a line to the WSW of the hidden Mars. What a beautiful sight that was. Success at last!

**W**hen the initial excitement gave way to a more introspective calm, I arrived at a sobering conclusion: Phobos is a nasty little thing to try to see, even with a very well-made long-focus refractor of nearly 16 inches aperture. It's no small wonder that I failed to see it with my smaller telescopes. I could plainly see that even with the Washburn refractor, Phobos is close enough to Mars

that it must be viewed against a bright background, despite the use of an occulting bar. The background sky surrounding Deimos seemed almost black by comparison. Though Gerald Kuiper determined with his heroic photoelectric photometry in 1956 that Phobos is actually 3 times brighter than Deimos, the brightness of the background against which it must be viewed makes it appear instead to be about one-third as bright.

Not knowing if and when I might have the opportunity again to use better equipment, I returned to using my own. The weather during opposition week was vexatiously unpredictable, with clouds coming and going in a way that made it hard to plan anything. On the evening of Aug. 27 there was a thunderstorm, but when that ended we were left with the most transparent night of the whole month, and possibly the whole summer. At 7:40UT Aug. 28 I spotted Deimos, about 0.5 hours before eastern elongation. I was surprised by how bright it was in an 8-inch 'scope. Though I still had to avert my vision, I could follow it continuously, which I did for 40 minutes until it was about 15 minutes past

eastern elongation, at which point Mars was occulted by a tree. That Deimos can be seen under good conditions from an urban backyard with a less-than-perfect 8-inch 'scope was now an established fact. I failed again to see Phobos, though, which by now did not particularly surprise me.

I was able to see Deimos favorably placed twice more with the 8-inch 'scope, on Sept. 2 and Sept. 4. However, it was by then much fainter and more difficult than only a few days earlier, though somewhat easier to see than it had been on Aug. 18. Phobos I saw one more time, around its eastern elongation at 4:30 UT Sept. 7, with the Washburn Observatory refractor. It was by then a very difficult

*Continued on page 6*

object, which took Wynn and I quite a while to locate. Unfortunately, Deimos was too close to Mars to be seen at that time.

As a result of these observations, and other reports from oppositions back to 1877, I have concluded that the Martian moons have very peculiar surfaces. The rapidity with which their brightness rises just before and falls just after opposition suggests that their outer layers are much more unusual than those of the moon or most asteroids. I am hoping to see Deimos another time or two, with instruments larger than my own, to gather a little more data as the phase angle continues to increase. If any of you out there attempted any observations of these interesting and weird little bodies, please convey to me the particulars of your observations at erixm9507@aol.com or 256-9213. Every little data bit helps, and negative results can be as important as positive ones.

**T**he next opposition of Mars in November of 2005 will not be as close as this one was, but due to the geometry the satellites of Mars will spend more time at even smaller phase angles than they did during this

one. Because of this, they will probably be visible again in small telescopes despite the greater distance. I encourage anyone to try for them again then, and tell me the results. At that time, if all goes well, I hope to be using the Washburn refractor fitted with a large iris diaphragm of my own construction to obtain visual extinction photometry on them.

I strongly suspect that the surfaces of these moons will turn out to have more unusual properties than being merely dark and powdery. If they are indeed captured asteroids, they must have been captured early enough in Mars' history for their surfaces to have been extensively modified as a result of their orbiting in the nebulosity that eventually became the Mars we see today.

My experiences with these bizarre objects made me wonder more than a little about how different things might have been if Phobos had been the outer satellite and Deimos the inner one. One suspects that Mars would not have remained moonless long enough to command the dogged persistence of Asaph Hall in 1877. The Red Planet would probably have had a moon much earlier, possibly as soon as the discerning and purposeful eye of William Herschel

could be applied to it, in 1783. If the scattered light from his speculum bronze mirrors had proven overwhelming, Phobos most likely would have succumbed to the efforts and fine refractors of Struve at Pulkova, Bond at Harvard, or D'Arrest at Copenhagen. Of Deimos, we can only speculate. Faint and lost in the glare of Mars, Deimos would have languished unseen much longer than its brighter (and in our scheme, better placed) companion. One can never know whether Asaph Hall would have had the motivation and perseverance to search for and discover a faint inner satellite when Mars had been won from the ranks of the moonless so long before. Possibly Deimos would have had to wait for the acute vision and boundless determination of E. E. Barnard at Lick or Yerkes, sometime between 1890 and 1910. Lastly, there is the very real possibility that the tiny and forlorn chunk of whatever-it-may-be, not much bigger than a small city, that we call Deimos, would not have come to reveal itself to human vision until frail craft with bold names like Mariner and Viking bore down on Mars from across the void separating it from its bright morning star.

## From the Observatory Director

by Tim Ellestad

### YRS Orientation For Observing Members

**A**ny MAS members who have observing memberships but haven't had the orientation session with the Observatory Director, please call as soon as possible. I apologize for any oversight in getting anyone underway with the use of our equipment and facility.

Orientation sessions are scheduled at mutual convenience as per telephone contact. I try to start the process when there is about an hour and a half of daylight left before the first stars appear. This gives us enough time to familiarize

you with things best understood when seen—locks and combinations, shutters and roll-offs, scope controls, etc. As the first stars become visible we go through the basic operation of the LX200 and the session is complete. Obviously we try to coordinate schedules with the weather man as well.

Please call me, Tim Ellestad, your friendly Observatory Director, 608 233-3305, at your earliest convenience.

### Autumn at YRS

**A**nother year is rolling around and Fall is almost upon us. While for some this foretells the less enjoyable weather that will likely

follow, it also can provide some wonderful observing opportunities with moderate temperatures and clear skies. One of the best rewards that Autumn gives to astronomers is that nightfall comes at a civilized and convenient hour. So take advantage of the seasonal conditions and enjoy some Fall observation at YRS.

While you're at it, consider traveling to YRS before dark. Our observatory sits high atop the rolling landscape of southern Wisconsin, quite beautiful always and particularly resplendent in Autumn colors. This daylight observing is rewarding too. YRS is a beautiful place, in light or darkness.

It's good for the soul.

# On the Construction of Occulting Bars

by Eric W. Thiede

I constructed two occulting bars, for use with eyepieces of 10 and 20 millimeters focal length, from materials on hand. The assemblies slide into the eyepieces and have a moveable inner support for the bar itself to permit bringing the bar into precise focus in the field of view.

The main part consists of a short length of 3/4-inch PCV water pipe which has been wrapped with enough layers of 1-inch masking tape to get a snug but moveable fit in the interior of the eyepiece. The inner support of the 20-mm bar is made from a container that once held a disposable medical syringe (those miserable years as a medical technologist finally paid off). This too is wrapped with enough tape to give a snug but sliding fit. The inner support of the 10-mm bar (pictured below) was made from the cap of a defunct felt-tip pen, inserted into a piece of rubber tubing large enough to give the required snug but sliding fit. These two items were chosen because they both taper in such a way as to accommodate the incoming cone of light from the telescope objective, and are also small enough at their narrow ends to enter the field stop of the eyepiece. This is necessary to allow my myopic eyes to have the bar in focus.

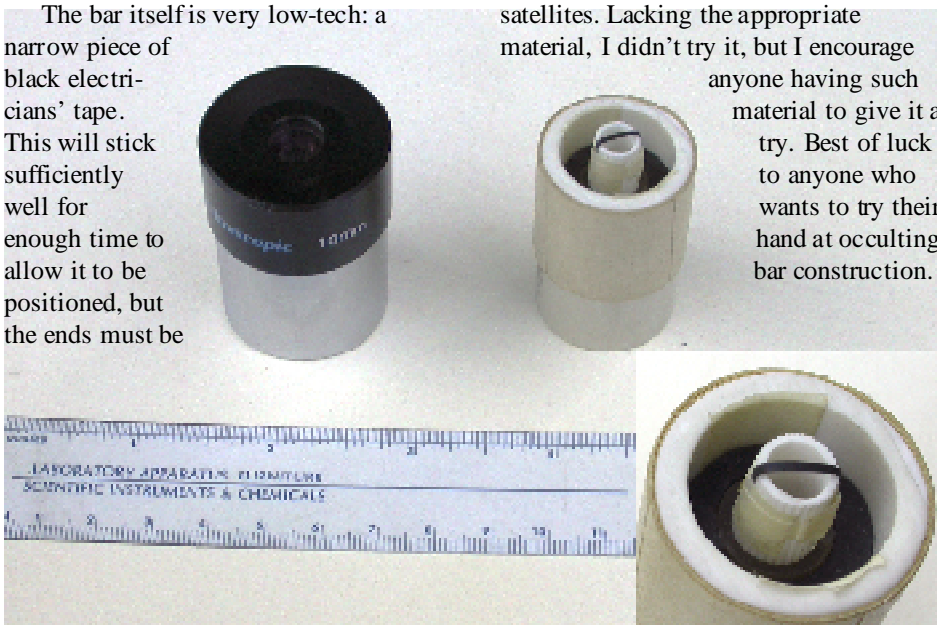
The bar itself is very low-tech: a narrow piece of black electricians' tape. This will stick sufficiently well for enough time to allow it to be positioned, but the ends must be

held down ultimately with small pieces of masking tape. Even those can come loose with time, particularly in the case of the 10-mm bar. A pain, but not bad for things thrown together in an afternoon from junk lying around.

The width of the bar should be about 2 to 3 times the diameter of Mars' image. The 10-mm bar proved wide enough, but I had to widen the 20-mm bar. It hid Mars well enough, but large refractors like the one at Washburn Observatory have a secondary spectrum of unfocused red and blue light that surrounds the image of bright objects, and the original bar was not wide enough to hide both the planet and the secondary spectrum. This unfocused light is noticeable but not annoying for normal observing, but once the bright object is occulted, it appears obnoxiously bright.

I am sure that there are many other possible arrangements for occulting bars, depending on ingenuity and junk-box contents. In his article, Sinnott mentions the alternative method of using dark filter material through which the planet can still be seen, sufficiently faintly. This would enable one to be able to tell exactly where the planet is, something not possible with an opaque bar and potentially helpful in trying to locate the satellites. Lacking the appropriate material, I didn't try it, but I encourage

anyone having such material to give it a try. Best of luck to anyone who wants to try their hand at occulting bar construction.



# Thanks and A Request From Your Treasurer

by Mary Ellestad

MAS warmly welcomes the following new members: William Gardner, Kevin Ireland, Courtney Sharp, Elise Gorchels, Jeff Bonte, Dennis Roscoe, Tom & Judi Jacobs, Mary Schaper, Margaret Kefer, and Stephen Bracker.

I have already received quite a few of your dues and subscription payments. Thanks very much to everyone who has paid up. This really helps me a lot with getting the club subscriptions renewed before you get too many notices and before any expire. Since the renewals are sent in all at once, if you haven't paid yet please do so by Saturday, October 4th. I will have to drop any subscriptions not paid by then because it isn't fair to hold up those that have been paid for.

I also would like to take this opportunity to thank lifetime member Doris Koster for her donation to MAS and Neil Robinson & Tanya Cunningham for renewing at the higher Patron level. More good news—Dave Odell, who just joined MAS this past January, has agreed to be our Secretary and recorded his first minutes for MAS at our last meeting. And while I'm thanking people, have you noticed that John Rummel continues to publish this newsletter even after trying to retire more than once? If you get a chance, please let him know that he's doing a great job.

Thanks again everyone—I truly appreciate your contributions to MAS.



*Capitol Skies*  
 2810 Mason Street  
 Madison, WI 53705

**First Class**

*MAS would like to thank:*

**PRINT-TECH**

*and Tim Stanton for printing  
 the newsletter and*

**IDC**

*for hosting our web presence*

This resource list is made up of people who have special interests which they are willing, even eager, to share with others in the Society. Many members, not listed, also are interested in particular aspects of astronomy and have considerable expertise in viewing and imaging the skies. Members are encouraged to come to the monthly meetings, not only to get to know the other members, but to discuss and enjoy their special or general interests in various aspects of astronomy. This is a Society of beginners and experienced amateurs. From time to time we have seasoned professionals attending. The meetings are a good time to meet these people as well. See you there.

**Resource People and Special Interests**

- Newsletter Editor: desperately seeking one
- LX200 Observatory: Dick Greiner 233-6882 (ragreiner@mailbag.com)
- Photo Editor: Tim Ellestad 233-3305 (ellestad@mailbag.com)
- Webmaster: Dan Strome 241-3775 (dan.strome@mpcug.com)
- Variable Stars: Dave Weier 241-1444 (daveweier@att.net)
- CCD Imaging: Dick Greiner 233-6882 (ragreiner@mailbag.com)
- Jupiter Observations: Wynn Wacker 274-1829 (wkw@mailbag.com)
- Deep Sky Observing: Tom Brissette 833-4225 (tom.brissette@midplains.net)
- Minor Planet Search: Greg Sellek 848-6301 (orion98@charter.net)

<b>MAS Membership Form</b>	
<b>Name:</b>	_____
<b>Address:</b>	_____
<b>City/State/Zip:</b>	_____
<b>Phone:</b>	_____
<b>Email:</b>	_____
Please circle membership type: <i>Enclose check and make payable to the Madison Astronomical Society. Mail to MAS Attention: Mary Ellestad, 2810 Mason Street Madison, WI 53705</i>	
Student (\$5.00)	<input type="checkbox"/>
Regular (\$25.00)	<input type="checkbox"/>
Observing (\$60.00)	<input type="checkbox"/>