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In the pages of the Gemini

Taking the Plunge -or- Getting Started in ATMing

Michael T. Burr

When I was about 11 years old, the idea of owning my own telescope seized me and held on like a python gripping a piglet. I had no money to buy a telescope, so I went to the library and checked out every book on astronomy. Lo and behold, among them were books on grinding a mirror and building an 8" f/6 Newtonian reflector telescope.

I read these books with rapt interest, but when it actually came time to begin doing something, I ran into two major hurdles. First, I didn't have any money, so the supplies to build a 'scope were almost as far beyond my reach as a commercial telescope was. But this first hurdle could have been overcome with hard work and strategic pleading before my parents, so the second hurdle was really the important one. Namely, I found myself overwhelmed and intimidated by the apparent complexity and difficulty of the task.

Indeed, this hurdle was so high that it took me almost 25 years to overcome it. OK, I didn't spend 25 years struggling with it. I was really busy getting an education, pursuing a career, getting married and raising a family. But the idea of grinding a mirror was planted in my head when I was 11 years old, and it didn't sprout until I was 35 years old – after I already had owned four telescopes of different sizes and designs.

On my 36th birthday, I took pictures of my completed 8" f/6 Newtonian telescope on a Dobsonian mount. From initial mirror grinding to first light, it took me just over three months to finish it. But I will always think of this 'scope as the one that was 25 years in the making.

GETTING STARTED: THE HARD PART

As the old saying goes, the journey of 1,000 miles begins with the first step -- and that step can be the most difficult one. I personally found the threshold to get into amateur telescope making (ATM) to be very high, at least from a psychological point of view. (This is perhaps less true for those who would simply acquire a finished mirror and put together the parts of a telescope. While that activity is certainly telescope making, this article focuses on the project of making a primary mirror for a Newtonian telescope, because that is the threshold that both attracts and obstructs many ATMers.)

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Now Showing

Compiled by Ron Schmit

Eisenhower Observatory:
Come view the night sky through a powerful telescope on top of the Eisenhower Community Center in Hopkins, MN. Viewing time varies throughout the month and is open to the general public. There is no charge, although a $2.00 donation is requested. Space is limited, so call Diane for reservations: 612-988-4077.

University of Minnesota:
Observing from the telescope on top of the Physics building, East Bank. Open to the general public. Fridays during the school year: 612-626-0034 for more info.

College of St. Catherine's, St. Paul
The Observatory at the College of St. Catherine houses a 14" Celestron computer driven telescope as well as a number of smaller solar and wide field telescopes for group viewing. The Observatory will not be open to the public until further notice because of installation of air conditioning vents on the roof. The observatory will be moved and reopen. Phone: (651) 690-6023. Leave e-mail questions about astronomy at askastro@stkate.edu The public nights at the Observatory are run by the Student Observatory Assistants of the College of St. Catherine, Mary Wallraff and Rose Stenglein. http://www.stkate.edu/physics/observatory.html

Carleton College, Northfield
Goodsell Observatory is located at 93° 7' W and 44° 29' N, on the campus of Carleton College in Northfield, Minnesota. In Goodsell's main dome, there is a 16.2 inch John Brashear refractor and in the smaller dome there is an 8 1/4 inch Alvan Clark and Sons refractor. Both are over a hundred years old. Goodsell also has some modern telescopes. http://physics.carleton.edu/Astro/welcome.html

Open houses are held the first Friday of every month. Everyone is invited to come look through the observatory's two historic telescopes. Remember to dress appropriately as the telescope domes are neither heated nor cooled. The open house will be canceled in the event of cloudy skies. For more information contact Jesse at 646 5719 or via email: jball@carleton.edu.

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The steps involved in making your own mirror for a Newtonian telescope are numerous and they can seem counterintuitive and complicated. Simplified, the seven major steps are:

1. Getting Started: Namely, this is resolving to do it and then actually getting off the couch.
2. Getting Stuff: Deciding what to build and then assembling the supplies and equipment you need to begin.
3. The Grind: Using grit and a grinding tool to create a smooth, concave surface in your mirror blank.
4. Making a Lap: Creating a tool for polishing and figuring.
5. Polishing: Using a polishing tool, polishing agent and brute force to turn a frosted surface into a transparent one.
6. Testing & Figuring: Reading the curve and prescribing polishing strokes that bring you closer to your goal.

Obviously this list of steps is truncated heavily, but these are the major steps on which the amateur optician must focus.

For the record, I will state right now that mirror making is not as complicated as all the literature and obsessive discussions might suggest. Grinding is actually really easy. Polishing isn't that difficult either, and, ... I'll go out on a limb here, ... neither is figuring. Learning about these things can be difficult, but once you know how, doing them is dirt-simple.

It helps, of course, to have someone show you the ropes. But it's not necessary. I've never had a mentor close by who could stand at my shoulder and tell me what I was doing right or wrong. Like many people, I relied on books, magazine articles and the flood of information that exists on the World Wide Web. But this flood alone can exacerbate the problem.

ATMers tend to be an anally retentive lot (not all of them, but many of them are), and the information available tends to frighten rather than inspire the first-time glass-pusher. Most tutorials and books make it look harder than it is.

So with that in mind, here is my first piece of advice: Just Do It. Stop thinking about it. Stop researching thermal expansion properties and tool-construction methods. Stop combing the ATM List archives for arguments about pitch hardness or bearing surface materials and move forward! Resolve to do it, and then order some mirror-grinding supplies.

GETTING STUFF

"Hold on there!" you say. "What supplies should I order? And from whom?"

Those are good questions that can be answered many different ways. I will answer them the way they make sense for me. In fact, I will write the answer as if I'm sending a message back in time to myself.

Dear MTB in June 2002:

How's the family? They're all great, I know. But keep an eye the littlest one; he's going to roll down the stairs a few times before he learns to walk.

Now onto the telescope thing. Let me give you a bit of advice. Start with a 10" f/5. Try to get the kit from Dan Cassaro, but if you can't, try ASM Products in Canada. They have great prices too, and those Black Vitrified Ceramic (BVC) blanks look like they'd be interesting to work with.

I'm telling you to start with a 10" f/5 for two main reasons. First, I know you're thinking, "I don't want a small Dob, I want a _big_ Dob, so why would I start with anything under 16 inches?" You already know the answer to that -- 16" will be a lot of glass to push around, and the figuring will be a real challenge. I'm not saying never make a 16", but definitely start with something smaller.

The exercise of figuring a 10" f/5 will be excellent experience that you can take to your bigger projects. And it will be _better_ experience than building a smaller mirror, or one with a slower focal ratio, but it shouldn't be so much more difficult that it will frustrate the crap out of you.

That brings us to the second reason. When it's done, you will want to put this mirror to use, and 10" has a lot more light grasp than an 8". Believe me, you are going to feel enormous pride in the results of your effort. Make it a 10" rather than an 8", because it's going to reward you better for those efforts.

(If you come across a smaller piece of glass to start on earlier, fine. But I think the combination of a slightly bigger piece of glass and a slightly steeper curve will provide invaluable experience that will save you time and effort in the long run.)

That's all for now. Work hard, hug the wife and kids for me, and for god's sake get your money out of the stock market while you still can! But put it back in late September 2002.

Best Regards,
MTB in October 2002

In this letter, I am assuming the only option is a kit with a blank that has a curve already generated into it – thus a 10" f/5 blank. Curve-generation services are so economical it makes no sense to hog-out the curve yourself, unless you are die-hard traditionalist. If so, have fun. I prefer to leave hogging to hogs.

Also, this letter was written with my particular goals and purposes in mind. From the beginning, I knew that I wanted

to build a big telescope, no smaller than 16" in aperture. But I also knew that starting with a 16" mirror-grinding project would probably be an overwhelming task.

You might be saying, "That's me too!" or you might be saying, "I just want the experience of building my own scope; I'll probably never build a big gun." If so, that's fine. You should still consider making a 10" f/5, because it can be built almost as compact as the traditional 8" f/6, and it will show you a lot more.

Obviously this is just my opinion. There's nothing wrong with starting smaller, and there's really nothing wrong with starting bigger either. But smaller will give you less to brag about, and bigger will give you more to cry about.

THE GRIND

Don't let anyone tell you that mirror grinding is difficult work. It is not. It is relatively time consuming, and it takes some attention to detail – especially with regards to cleanup. But don't drive yourself crazy. Basically if you alternate doing tool-on-top (TOT) and mirror-on-top (MOT), and use a "W" stroke that seems to cover the surface of the lower disc pretty evenly, ... you can't really go wrong.

So easy a child can do it, ...the mirror grinding process is much simpler than one might imagine. Nature, in this one instance, is very forgiving (and children are amazingly patient. Here Mitchell works the glass to humor his dad.).)

But I'm getting ahead of myself. First you need a tool, and since you are starting with a curve-generated blank (I hope), then the best answer is to make a tile tool – which is basically little floor tiles stuck or embedded to a firm foundation disk. There are several sources on the Web for instructions on making a tile tool with a foundation of dental stone, plaster of paris, concrete, wood or metal. They all have their peculiarities. Just pick one and go with it. (Probably not plaster of paris, but use your judgment.)

However, since each material has its own characteristics and requirements, be careful about combining methods between tool types. For example, some methods call for using salad oil or petroleum jelly on the mirror before putting tiles and mud onto it. That's fine unless you're going to wrap the tool in packing tape after it's cured like David Harbour suggests in his "Winburn Hex Tile Tool" instructions. Packing tape won't stick to cement that has petroleum jelly on it, and it's basically impossible to remove.

But I digress. The point here is to pick one of these methods and then move forward. Always move forward. Don't dwell too much on the pros and cons of every little thing. Everybody has an opinion, and nobody is 100 percent correct. If you find a method that seems reasonable to you, give it a shot. You will learn what works and you will adapt it to your needs. Move forward.

(I won't belabor the point by spelling out how to make tile tools, since these methods are explained in detail elsewhere. But for what it's worth, I use concrete without sand, because it is more forgiving than dental plaster (i.e., it has a longer working time), it is much cheaper, and it's easy to find. My method is a variation on David Harbour's recipe mentioned above. I seal the back and sides of the tool with polyurethane, not packing tape. But I'm still trying to perfect my methods, so I won't try to proselytize them to you.)

Once you have your tile tool and your curve-generated blank in hand, and you've decided where your workspace will be, you can get started grinding. (Again, I won't specify techniques that are explained adequately elsewhere.) Keep two things in mind: 1) This is easier than you might think, so don't over-think it; and 2) Be careful not to let the edge of the mirror ever touch down anywhere, especially on the tool, or you will get chips and dings. You don't want that.

But even if chips happen, it's not the end of the world. This is a long project, and you will make mistakes, run into problems and encounter delays along the way. That's OK. You are learning. When you do, take a deep breath, shrug your shoulders and move forward. Don't listen to false prophets of doom. If you get chips, some people will tell you the chips will destroy your figure. Others will tell you that your glass is worthless with chips in it. Don't listen to them. Just bevel the edge of the mirror and keep going.

Aside from the edge-chipping issue (and in general the problem many people have of ramming their mirrors into sink faucet's and things like that), I believe the biggest bugaboo of the first-time grinder is being overly fastidious. I'm not suggesting that we should be sloppy, but we don't need to obsess about every little thing. Don't spend too much time worrying over things like pits and scratches. As long as

they aren't too heinous, they will come out in the end.

The same is basically true for the Sharpie test. (Again, look elsewhere for the technique.) This test is most useful at the fine-grinding stages, to make sure you're getting a nice sphere and maintaining your curve. If you don't monitor your curve, it will travel to lands unknown, and you may not like where it ends up. But again, if you alternate MOT and TOT, it can't really go that far, so don't worry too much.

On this point, it is worth considering that TOT works more slowly at changing the curve than MOT does. The center of the mirror makes up less glass than the outside, and with TOT you are working the outside more than the center. So doing MOT/TOT in perfect 50/50 proportions will shorten your radius of curvature, not maintain it. To maintain the curve, you will probably need something closer to 70 percent TOT. But again, don't worry too much about this. If you can, be a little flexible on the focal length that you're seeking. If it comes out a few inches off, so what? Just do a few extra TOT wets now and then to keep it in the ballpark, and keep going.

One of the many fun parts of ATMing is making tile tools for grinding mirrors. Almost any plaster or concrete-like substance will work for a tool foundation. Here the author is using cement to cast a sub-diameter foundation for grinding a pair of 10" mirrors.)

A final note on grinding:

I have a theory. If a first-time telescope maker (with a curve-generated blank) had never heard of the Sharpie test and did not know to look for pits, and if he did a descending number of wets through the grits, starting from 25 wets at 120 grit and ending up at about 8 wets with 9 micron, ... and if he used a reasonable W stroke and did 70 percent TOT, he would wind up within reason of where he needed to be when it was time to begin polishing. And furthermore he would get there a lot quicker than the poor guy (like me) who worried over every pit and kept careful track of every wet. This is just a theory, but I believe it is true.

The mantra of the ATM List applies here: "Grind more and worry less." And the mantra of the home-brewer is also instructive: "Relax, don't worry, … have a homebrew."

THE NEXT HURDLE: MAKING A LAP

Next to simply getting started, making a pitch lap is perhaps the greatest hurdle an ATMer faces. This is because of all the hyperbole about pitch being messy, smelly and difficult to work with. Indeed it is an adventure the first time, and probably one of the few things about ATMing that actually makes John Dobson get testy (watch his video and you'll see what I mean). But like most things, it's not as hard as people make it out to be.

There are several methods for pitch-lap making, and there are people on all sides who violently oppose the methods they don't use. I would note that John Dobson's method is today considered to be one of the more treacherous, especially for someone just doing one lap. If you want to know why, search the ATM List archives.

As for me, I am a cheater. I use a custom-made lap mold that was created by a local friend of mine. No, he doesn't sell them commercially, although perhaps he should. Anyway, my point here is that I am not really qualified to give much advice in making lap molds, because I am able to cheat with a special and wonderful lap mold, and I will continue cheating as long as I can.

If I didn't have a lap mold like this, I probably would buy one of the new-generation of molds from "Perfect Pitch" lap molds, or I would use a method similar to the one illustrated by John Upton on this page: http://www.atm-workshop.com/pitch-lap.html

POLISHING

Polishing is hard work. I like it for that reason, and I hate it for the same reason. I like the exercise, but the work gets tedious and tiring, and you work muscles you didn't know you had. This can be exhausting and painful.

You need to put in a lot of effort to get good contact, and you need good contact to polish well. So get some music you like to listen to, roll up your sleeves, and move forward, ... slowly, night after night, until your mirror passes the sunspot test.

What is the sunspot test? I'll tell you, ... but first, let me say that this is probably the cruelest piece of advice I'm going to give you. The sunspot test is ruthless and unforgiving of an incomplete polish. Once you do the sunspot test, you will hate me forever because it will convince you of the need to polish until you pass the test. And you need a vigorous, thorough polish to pass the sunspot test.

But if your mirror passes the sunspot test across its entire

face, I'm willing to bet that you will have a far nicer mirror surface (in terms of overall reflectivity) than most hand-polished mirrors ever are. So if you don't care about having a good polish, stay away from the sunspot test. Consider yourself warned.

Here is a description of it, shamelessly lifted from Richard Schwartz's Star Fleet Engineering website (http://www.megspace.com/science/sfe/):

"The Sunspot Test: with a large magnifying glass, focus the sun onto the surface of your mirror. An unpolished surface will show a bright spot at the focal point. A polished surface will not. Be sure to check all zones of the mirror from center to edge. Use a known good optical surface for comparison. If you cannot do this test because you live in Seattle, proceed to the laser test.

"The Laser Test: in a dark room, shine a laser pointer on the surface of your mirror. You will see a red spot, of course. But as polishing progresses, the intensity of this spot will diminish. Be sure to check all zones from center to edge. If the edge fails to polish out, you may have to go back to fine grinding."

By the way, Richard Schwartz is a truly Great Light in the ATM field. Look his site over carefully and consider his comments on the ATM List and the ATM Free Yahoo! group. (But watch out when exposing yourself to Great Lights, as you can get scorched in the process.)

Conclusion to this article will be in the next Gemini, don't miss it!

Michael Burr is a freelance writer and ATMer in central Minnesota. We expecvt him to become a "Great Light" himself as he builds his ATM skills. He coordinates the MAS ATM Special Interest Group (www.mnastro.org/SIGs/atmsig.htm). Contact him at mtburr@msn.com.

Observer's Report

Doug Brown

Here's a quick update on list observing going in the MAS.

Greg Haubrich reports on the Messier group:

Mark Werner Has reported over 70 Messier Objects Logged. Will be turning in log shortly.

Dave Venne Has reportedly logged well over 70 objects. Waiting for 110? Dave has developed a neat program for logging Messier Objects that he has available for free to MAS members.

Cort Sylvester Has logged well over 70 Messier Objects. Mentioned that he will be turning in his observing log soon.

John Marchetti Has logged 109 Messier Objects. Waiting for final one to make 110.

Tim Parson 110 Messier Objects Logged. Log being organized prior to submission. Plans on submitting log soon. Also only has 20 objects left on Herschel II (will Tim be the first ever Observer in the MAS to get the Herschel II Observing Club Certificate?!)

Greg Haubrich Has received Binocular Messier Certificate, and has had Herschel 400 Observing log approved. Working on Lunar, Double Star Club, and Herschel II observing lists.

Megan Eagen Has submitted Observing Log for 72 Messier Objects (with drawings!). Log approved by me and letter sent to Astronomical League for Certificate Award! Congratulations Megan!

Tom Youngblood Has well over 50 Messier objects Logged. Tom has also been tutoring Beginner's SIG Members on observing the Messier Objects as part of Tom's Metcalf Hosting Role. Thanks Tom!

Remember Observers: you can submit your log with just 70 Messier Objects for a "Regular" Messier Club Certificate. This can easily be upgraded for the "Honorary" Messier Club Certificate once all 110 Messier Objects are logged. I would recommend going this route as it helps encourage new observers by getting twice the visibility for Messier Certificates Awards at the monthly meetings!

Please submit Astronomical League Observing Program Observing Logs to the MAS Awards Coordinator:

Greg Haubrich:
greg.haubrich@medtronic.com, 763-421-4736,

or snail mail:

11190 Hillsboro Ave. N.,
Champlin, MN 55316.

I will gladly accept paper COPIES or electronic copies of your observing logs following a monthly MAS Meeting, snail-mail, or email. I can read Excel, Word, Text, or PDF electronic versions of your log files. I would recommend submitting copies of your log (not the original) as the unthinkable can occasionally happen in spite our best efforts.

Buying a B.A.D. for the MAS

MIchael T. Burr

"*My first target was M82. Remember that first scene in Star Wars, where Princess Leia's ship comes overhead, firing laser shots behind it? A few seconds later, a massive Imperial Destroyer enters the scene. Finding M82 was a lot like that. I kept finding these annoying little galaxies that I'd never seen before. They were littering the field. Then, suddenly, M82 comes careening by like the Titanic. I gasped."*

This excerpt from Ed Ting's review of a 36-inch Obsession (www.scopereviews.com) summarizes the appeal of a truly large-aperture telescope. Such an instrument can transform faint fuzzies into bright objects with stunning detail.

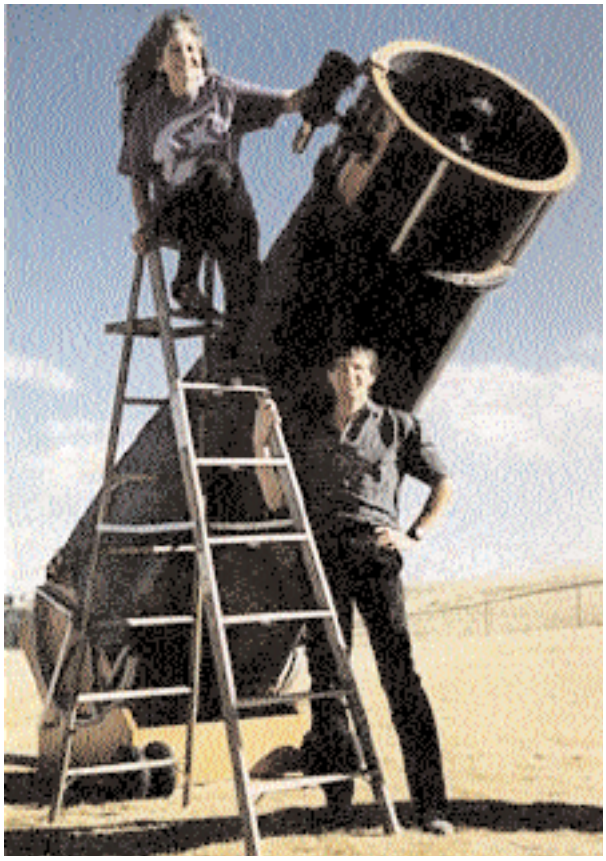
Most observers, unfortunately, must resign themselves to the fact that a large-aperture telescope does not fit into their lives for practical reasons. But all the reasons that prevent individuals from owning large-aperture telescopes make it completely logical for a group like the Minnesota Astronomical Society (MAS) to acquire and maintain such an instrument. For example:

Cost: A 30"-class truss-tube Dobsonian costs about $15,000. Very few individuals can invest funds of that magnitude in a telescope. Acting as a group, however, the MAS can raise such resources.

Location: Light pollution hinders all telescopes, but big Dobs in particular are most effective under dark-sky conditions. Few individuals live under dark skies. The MAS Cherry Grove site, however, is available to all members and could provide an excellent home for a large-aperture telescope.

Bulk: The physical size of a large-aperture telescope makes it difficult for an individual to transport and assemble one in the field. Such an instrument is best housed permanently (or semi-permanently) to limit issues involving transportation, setup and teardown. Few individuals own such a location, but the MAS Cherry Grove site is available for this use.

Moreover, for the logistical and site reasons mentioned above, members of MAS would be likely to use a club-owned telescope as much or more than they would use their own big-aperture Dob (BAD). Therefore, an MAS BAD would be a truly fantastic deal for the club's members.



Obsession 30" f/4.5
Sometimes, you want it all!

The MAS BAD Task Force was created in October 2002. We have set our sights on a truss-tube Dobsonian in the 30-inch class, and have begun raising funds to acquire it. At this writing, $1,100 has been raised, and we are working on ideas for broader fundraising efforts.

To make contributions, please complete the B.A.D. Fund contribution form and mail it to the address on the form, along with a check for the donation amount, payable to "Minnesota Astronomical Society." Also, please notify Deane Clark, BAD-Fund Contribution Coordinator, drclarkjr@mn.rr.com / (612) 922-9638.

The MAS has a unique opportunity to acquire an instrument that will treat its members to views of the cosmos that most would never see otherwise. But this will not happen without your help. Raising $15,000 is certainly achievable, but it will require the participation of every member – contributing hundreds of dollars each, or mere pocket change. We need every dime we can get.

Thanks for your help!

Michael T. Burr
BAD SIG/Task Force Coordinator
763-263-1783 / mtburr@msn.com

Excerpt from Ed Ting's Review of a 24-inch Sky Designs Dobsonian:

"True story: My first time at the controls of this scope, I decided to go for M31 as my first object. To tell the truth, I wasn't impressed. It looked just like the view through my 6-inch, only brighter. I stepped down the ladder and said as much, to the next person in line.

"As I walked away in the darkness, I heard, 'Ed. Where are you? Come back!'

"It turns out I had found M32, the small companion galaxy. My sense of scale was completely off with this scope. Now, viewing M31 revealed a massive galaxy, with its dust lane careening through the field of view…

"I get a 'Holy Cow!' sensation whenever I use this telescope. This is a stunning deep-sky instrument. M51 and M104 look just like their photographs, dust lanes and all. The Orion Nebula will just about ruin your night vision. I've also seen the Horsehead with direct vision."

BAD Goals & Progress

The BAD Task Force has set its goals and begun pursuing them in a step-by-step way. The goals are:

1) To raise funds sufficient to acquire a large-aperture telescope that would be otherwise unobtainable to all but the most affluent amateur astronomer;
2) To obtain a fine-quality instrument that will provide views brighter and qualitatively superior to those available with most star-party hardware, and that will allow one or two reasonably competent users, working alone, to operate it successfully with relative ease;

3) To make this instrument available to the MAS membership and guests at an appropriate site/facility.

The primary conduit for the task force's activities is the newly formed Big Dob Special Interest Group (www.mnastro.org/SIGs/bigdob.htm). SIG members have researched what we should acquire and where we should locate it. We've tentatively set our sights on a 30-inch Dob, and we expect to locate it at the Cherry Grove site. Initially it will probably be an open-air instrument – i.e., we'll store it in a shelter onsite, and to use it we will wheel it onto the lawn. (A 30-inch 'scope would be too big for the Cherry Grove observatory.)

Finally, we have begun raising funds. As of this writing we have raised $1,100. That is a long way from $15,000, but it represents amazing progress in just one week of fundraising. Additionally, task force member Michael Koppelman has taken it upon himself to raise funds via a T-shirt selling enterprise, and other ideas are being developed.

CONTRIBUTE TO THE MAS BIG-APERTURE DOB FUND

The MAS BAD Task Force is raising funds to acquire a large-aperture (30"+) telescope. Our goal is to raise $15,000. In about one year, if we have not yet collected enough to purchase a telescope, the BAD Task force will make the decision whether to make one last valiant effort at fundraising, reduce the cost, or to redistribute the collected funds according to the wishes of individual contributors.

When you fill out and send in this form, please indicate how you would like your donation handled if a Big Dob is not purchased. Also, please notify Deane Clark (drclarkjr@mn.rr.com / 612-922-9638) about your pledge, and contact him with questions.

Mail the completed form, along with your donation made payable to "Minnesota Astronomical Society" to:

BAD Fund
c/o Deane Clark
5636 Vincent Avenue South
Minneapolis MN 55410

Thank you for your generosity!

BIG DOB CONTRIBUTION FORM

NAME_____

STREET_____APT._____

CITY_____STATE_____ZIP_____

PHONE #_____

E-MAIL_____

CONTRIBUTION AMOUNT $_____

PLEASE CHECK ONE:

_____ I would like my contribution returned to me if the MAS does not use it to purchase a very large Dobsonian telescope or accessories/shelter for it.

_____ My contribution may be placed in the MAS General Fund if not used to purchase a very large Dobsonian telescope or accessories/shelter for it. No promises can be made about what it will be spent on if placed in the General Fund.

PLEASE NOTE - Your selection above may impact your taxes if you choose to use this donation as a tax deduction. In particular, if your donation is returned to you, it may require filing a revised tax return if you used the donation as a deduction. The M.A.S. assumes no responsibility for any tax implications of your donation.

MAS member inspires donation

An anonymous donation has been made to MAS in recognition of Dave Olmstead's devotion to the hobby in particular, to MAS in general, and to those of its members who are mechanically challenged.

Dave's been an active and dedicated MAS member, currently serving as vice president, and an inspiration to the people who meet him!

MAS Member Photo Page

Matt Russell, Steve Leikind, Bob Seabold

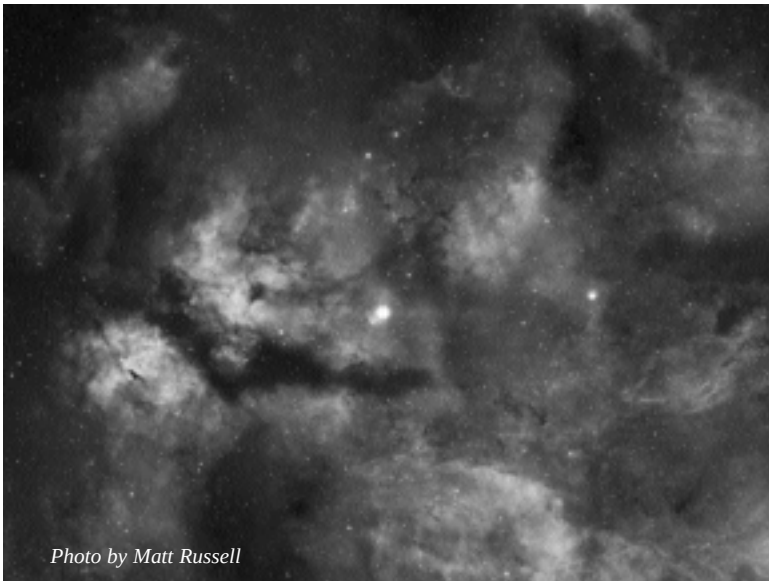


Photo by Matt Russell

Gamma Cygnus (NGC 6910) 8-image mosaic I did. It is a total of 16 hours worth of exposure time through a Hydrogen-alpha filter. Imaged with a SBIG ST-10XME and a Takahashi FSQ-106 4" refractor.

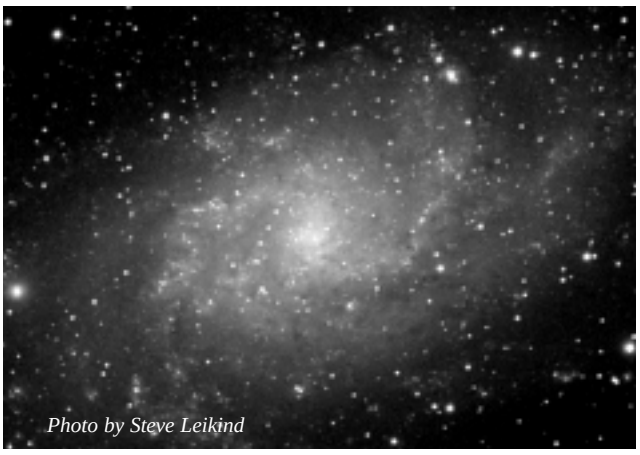


Photo by Steve Leikind

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Here is a 90 minute CCD image of m33 taken with a Takahashi 4" f/5 APO refractor and SBIG ST8E CCD camera. It was taken on October 3, 2002 near Kenton Oklahoma. It is a composite of 18 five minute images.

Photo by Steve Leikind

The M27 images was taken on September 3, 2002

Leonid 2

These photos were shot from a farm in Argyle, Iowa, the forecast was for clear skies in extreme southeastern Iowa. I was using three cameras on a tracking mount and exposures were approximately 1 to 3 minutes..Leonid2 was Provia 400 using a 28mm lens. I shot 204 images however many were extremely overexposed. Approximately 25 had meteors in the frame, however, most were quite faint. This was my first try at shooting meteors and I made many mistakes but in doing so learned quite a bit.

T-Shrit Design

Michael Koppelman

2002 Star Parties

Star parties are held on Friday if weather permits, otherwise on Saturday. Call (651) 649-4861 after 6:00 p.m. on a star party date to hear whether it will be held.

Metcalf

Metcalf is the grassy parking lot of Metcalf Nature Center, about 20 miles east of St. Paul along highway 94. About 6 miles E of the 694/494 crossing is county road 15 (Manning Ave.). Turn right, then left onto the frontage road and continue east, crossing over county road 71. Turn right (south) onto Indian Trail; follow it 1.1 miles to an chicken-wire gate on the right, (marked by three blue reflectors), opening onto a dirt driveway, which is the entrance to Metcalf.

Baylor Regional Park

Baylor Regional Park is roughly 25 miles W of the SW corner of 494. Head west on highway 5, through x, to Young America. Turn right onto county road 33 and follow it about 2 miles to the park, a right turn. The observing site is through the gate and roughly 100 yards beyond. Card-carrying MAS members may observe at Baylor at any time; call the park keepers in advance at 448-6082.

When visiting Baylor Regional Park, MAS members are requested to NOT park on the grassy areas next to the observatory (or any other grassy areas for that matter). This is a matter of being considerate to the park, its caretakers, and other visitors, so PLEASE PARK in the PARKING AREA.

Annual Park Permits (optional, not required for observing) can be purchased by sending a check to Carver County Parks, 10775 County Road 33, Norwood Young America, MN 55397. The cost for the Annual Permit is $16. Permits are also available at the Park Office at Baylor Park, the Carver County Government Center located at 600 4th St. in Chaska, through the honor box systems and gate houses when staffed at both Baylor and Lake Minnewashta Regional Parks. Lake Minnewashta Regional Park is located in Chanhassen off of Hwy. 41 between Hwy. 5 and Hwy 7 .

Cherry Grove

Cherry Grove is about 20 miles south of Cannon Falls. Head south on Hwy 52. Around 6 miles south of Cannon Falls, take a right onto Goodhue County 1 and follow it around 16 miles, where it ends in a T with Dodge County A. The observatory and warming house are at your right, nestled in the corner of the T.

Date	Location	Sunset	Twilight
March 8 or 9	Baylor	19:50	20:01
March 15 or 16	Cherry Grove	18:21	20:01
March 22 or 23	Metcalf	18:30	3:20
April 5 or 6	Baylor	18:48	20:31
April 12 or 13	Cherry Grove	18:57	20:43
April 19 or 20	Metcalf	19:05	2:07
May 3 or 4	Baylor	19:23	21:22
May 10 or 11	Cherry Grove	20:31	22:35
May 17or 18	Metcalf	20:39	1:51
May 31 or June 1	Baylor	20:53	23:16
June 7 or 8	Cherry Grove	20:59	23:26
June 14 or 15	Metcalf	21:03	0:30
July 5 or 6	Baylor	21:04	23:30
July 12 or 13	Cherry Grove	21:01	23:22
July 19 or 20	Metcalf	20:55	2:18
August 2 or 3	Baylor	20:40	22:43
August 9 or 10	Cherry Grove	20:30	22:28
August 16 or 17	Metcalf	20:20	1:00
August 30 or 31	Baylor	19:56	21:41
September 6 or 7	Cherry Grove	19:43	21:26
September 13 or 14	Metcalf	19:30	23:39
September 27or 28	Baylor	19:03	20:41
October 4or 5	Cherry Grove	18:50	20:28
October 11or 12	Metcalf	18:38	22:23
October 25 or 26	Baylor	18:14	19:52
November 1 or 2	Cherry Grove	17:04	18:43
November 8 or 9	Metcalf	16:55	20:06
November 29 or 30	Baylor	16:37	18:21
December 6 or 7	Cherry Grove	16:35	18:50
December 13 or 14	Metcalf	16:35	2:28

Dusk at Onan

How to pay your dues

Your MAS membership expires at the beginning of the month shown on your Gemini mailing label and your membership card. Send your payments to the MAS treasurer (Chuck Jorgensen) at 1615 E. River Parkway Minneapolis, MN 55414-3627. Make checks payable to MAS. The current annual membership dues and subscription fees are:

Regular membership	$20.00
Patron membership	$50.00
Student membership	$10.00
Subscription to Gemini for members of other astronomy clubs	$4.50
Subscription to Gemini for other persons	$9.00

To Renew Your Sky and Telescope Subscription

If you get *Sky and Telescope* at the club's discounted rate, you must renew your subscription through the club. When you get a renewal notice from S&T, send the notice along with a check for the amount indicated on the notice (currently $29.95) to the MAS Treasurer (Chuck Jorgensen) at 1615 E. River Parkway Minneapolis, MN 55414-3627). Make checks payable to MAS. If desired, you may renew your MAS membership at the same time, and write one check to cover both payments.

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.

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