# The View From Arunah

Arunah Hill Natural Science Center

Fall 2000 The Journal of the Arunah Hill Natural Science Center, Inc. Volume 31

## Inside this issue:

# The Editor's Desk

by Steve Pielock

Welcome to another issue of The View From Arunah. I would like to dedicate this issue to the memory of Joe Piorkowski; we were all shocked to hear that Joe unexpectedly passed away in late August. See the Astronomy News section for more details about Joe's passing.

Another member of the Arunah Hill organization will be on the move soon! The past editor of The View From Arunah, Chuck Musante, will be leaving UMass ECE Department to start work as a Chemical Vapor Deposition Process Development Engineer at IBM Corporation in Essex Junction, VT.

Now, on to Arunah Hill Days 2000! We had a mixed bag of weather at this year's event, but we were able to pull off some good observing on Friday and Saturday night after a memorable and spectacular thunder and lightening storm. This year's AH Days had a lot of spirit to it, people just had a lot of fun! The Astronomy Association Horseshoe Play-off went to The Aldrich club of Worcester, MA. We had a total of 134 guests to the event with about 60 of them camping for the weekend. The largest telescope there was the new Arunah Hill 24-inch reflector. Bob Douglas, Ed Faits and Gene Lauria figured the optics. The Dob mount was built by Bill Falcone. I am told that the telescope's next appearance will be at the Connecticut Star Party on September 29.

This year's Arunah Hill Days brought another new event that hopefully we won't need to repeat next year on the cloudy evenings. The event was "Really Bad Sci-Fi Theater Night". If any of you have any cheesy Sci-Fi movie requests for next year, let me know and I will try to find them! Another high point on Saturday was the kid's model rocketry. Kids from ages 7 to 70 were watching the rockets red glare! The Rocket launches built to a crescendo with the launch of "Ranger" Gary Cislak's Saturn moon rocket which gained a height of about 80 feet before it arched over and headed for the largest outcropping of bed rock on the hill, need I say more! We do have the video of the launch if anyone is interested!

There is still time to sign up for the Star Watch program, it will be held on the weekend of October 27. Don't forget to look at the Star Watch advertisement that came with this mailing.

**Correction from the Last Issue**

In the "Extra section, Late breaking news about the Dudley 12 inch refractor" article, we incorrectly stated that Allen French talked to the Dudley Board of Directors initially. It was actually his wife; Sue French that started the ball rolling. Sue was on the Board of Directors for the Dudley Observatory and planted the thought that Arunah Hill could make use of this fine telescope.

**How to Submit Material to *The View from Arunah***

***The View from Arunah*** welcomes material submitted by guest contributors. The strength of this publication is its writers and photographers, so we are always on the lookout for new contributors. If you have an idea that you think might make a good article, or if you are an astrophotographer who would like others to enjoy your work, then please consider contacting us. Our staff would be happy to provide any assistance that you might need to get your work published in *The View From Arunah*. To submit articles, photographs, or drawings, please send to them to: Steve Pielock, 132 Sand Gully Rd., So. Deerfield MA 01373

Materials submitted via electronic mail should be sent to "Pielock@acad.umass.edu". Comments and criticisms are always welcome. Letters to the Editor or any of the section editors are also welcome.

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# Astronomy Association News

by Steve Pielock

## Remembering Joe Piorkowski

by Steve Pielock

It is with deep sadness that I have to inform the amateur astronomy community that on the afternoon of August 21, Joe Piorkowski passed away unexpectedly.

Joe has been a member of the Amherst 5A's for 14 years and was one of the founding members of the Arunah Hill Natural Science Center. Joe's many contributions to the local astronomy community will live on for many years. Joe was a machinist by trade; in fact, many of the telescopes that we use at Arunah Hill and the 5A's were repaired and enhanced by his machining skill. My memories of Joe will always be the way he preferred to work quietly in the background, helping people with problems that they were having with their telescopes. Joe touched many lives. He was a regular at all of the Northeast conventions. Joe would also go on the many trips with Joe Zuraw and me to update the local clubs about the happenings at Arunah Hill.

Joe was a kind, quiet soul. In the 14 years that I knew him, I never heard him once raise his voice in anger or speak ill of anyone.

Joe leaves a son, Eric Piorkowski; a close friend, Dianne Lynch, with whom he lived; and a brother, Michael Piorkowski.

We'll miss you, Joe!

## Update: The Dudley Observatory Warner Swasey Telescope

By Joe Zuraw and Jim Zebrowski

On August 29th, Arunah Hill member Jim Zebrowski visited the warehouse in Schenectady, New York, where the 12" Pruyn (pronounced "prine") telescope is currently in storage.

As most readers are now aware, the Executive Committee of the Dudley Observatory reached an agreement early this year with Arunah Hill on a long-term basis. The telescope will see use as an educational instrument with limited access to the public and amateur astronomers.

**Turn Left at the Conestoga Wagon**

With the help of Nancy Langford, Susan French and George Wise of the Dudley Observatory, Jim searched through the extensive archives for information on the Pruyn and Fitz telescopes. From there, they traveled to the huge Museum of History of New York at Rotterdam warehouse seeking the telescope which had been stored there 15 years ago.

The first clue to the location of the telescope was the discovery of a cast iron base section to the mount. Measuring 5 feet by 4 feet at the base, and 5 feet tall, this massive casting indicates the true scale of this instrument. Surrounding the base casting were boxes containing the rest of the mount.

Jim was able to examine most of the components of the telescope, including the main tube assembly, which is in two pieces, the spotting scope, and the finder scope. Still in question is the nature of the drive. The age of the telescope would indicate a gravity clock drive, but subsequent upgrades may have resulted in an electric drive of some early vintage.

**Historical Tidbits**

The exact age of the telescope has now been determined. It was purchased before the decommissioning of the Dudley Observatory's 13" Fitz/Clark telescope, and moved into a new observatory dome at a different location. The purchase occurred in 1892 for a total of about $6,250.00.

Arunah Hill research had long thought that the Warner Swasey telescope had immediately replaced the Fitz/Clark. As it turns out, the Fitz/Clark continued to see use with the able assistance of the building janitor for quite some time.

Research that will result in a comprehensive article on this instrument is currently underway.

**Immediate Plans for the Future**

Excavation is under way for the new Telescope Restoration Building at Arunah Hill. This 30 foot by 40 foot building will be dedicated to restoring antique telescopes as they find their way to Arunah Hill's growing collection.

Completion of the building is expected in 2001 and plans will be made to transport the Pruyn telescope there for a careful restoration process.

In the meantime, Arunah Hill will undertake a fund-raising campaign to finance the new Rollaway Observatory building on the summit.

**Star Watch Training**

Would you like the keys to Arunah Hill and all it's telescopes? Then don't forget about Star Watch on the weekend of October 27. Please see the advertisement for more details about this training weekend.

# A Foucault Tester You Can Really Build from Current Hardware Store Parts and Very Basic Hand Tools

**Amateur Telescope Making**
by Ken Slater of the Springfield Telescope Makers

After a few years of work at the Stellafane mirror making demonstrations, and attending a few mirror making workshops, it became apparent to me that building a Foucault, or knife-edge, tester was almost as much of a deterrent to starting a mirror making project as the unfounded fear that "pushing glass" is hard. So when our then club president asked me to make a few loaner Foucault testers for our club, I set out with the goal of coming up with an easy-to-build design that used only parts and materials that would be very easy to obtain. The result is presented here, and shown in Figure 1, while the companion mirror test stand is shown in Figure 2. The complete plans are on the Stellafane web site (see box below).

Figure 1: The Foucault Tester described in this article, made from easily obtainable parts with only common hand tools.

**Goals**: Too often, testers shown in the currently available ATM books use materials that are no longer easily available or designs that are no longer state-of-the-art. The tester, and accompanying mirror test stand, were build entirely from parts obtained either at Home Depot or Radio Shack, both national chains in the United States.

There is one exception: I used a 1" imported "economy" dial indicator that must be mail ordered. It is optional, and one can use a calibrated knob instead, just like Berry [1] and Texereau [2] use in their testers. But I find the dial indicator much more convenient to use, and it is relatively inexpensive at about $10.

The design I selected is a **moving source slitless tester**, because it is easy to build and use. Older testers used bulky and hot light sources, starting with kerosene lamps in the early days and moving to large, hot electric lamps in the middle part of the 20th century.

Both of these sources were too large to mount on the moving stage, so they remained fixed to the base of older testers. Professionals started using moving source testers as fiber optic illuminators became available, but this is not an item most people have access to, or can afford.

Today, we have small, cool, bright Light Emitting Diodes (LEDs), that can be bought for $2.00 at Radio Shack. They can be battery powered, and a pair of D-cells will last for many mirrors. The small size allows the LED to be mounted right on the carriage close to the knife-edge. Often, people are skeptical that the LED will be able to provide sufficient illumination for testing. Once one sees a mirror on one of these testers, there is no longer any concern. I recently received this comment in a E-mail from someone who built one: "*It works great!!! I don't get my face scorched anymore from my old fixed source. I have to admit, I was a bit skeptical on the LED source, but the mirror glows a nice, easily seen lime green."*

Now that we have the ability to put the source near the knife-edge, we can take the next step forward and build a slitless tester. Earlier testers required either a well-formed pinhole or a narrow slit at the light source, and the slit of the source must be carefully made parallel to the knife edge used for testing. Slitless testers are "self-aligning"; the same knife-edge used for viewing also cuts the light source, so parallelism is automatically achieved. Since there is only a single edge, there is no fine slit to adjust. Remembering that mirrors reverse images left to right, the returned, reversed image of the knife-edge forms a "virtual slit" (More details about this in [3]).

Figure 2: The companion, adjustable Mirror Test Stand with a 6" Mirror. The attached steel rule makes Radius and Curvature easy for a single person.

**Construction Techniques**. The tester is build mainly from 3/4" plywood, sawn into basic rectangles and triangles. Since there are no critically sized cuts, careful work with a hand saw will do. Assembly of the wood pieces is with carpenter's glue and drywall screws. This "Glue & Screw" technique is well proven to produce strong, durable joints while keeping assembly procedures easy and straightforward. The choice of "self-tapping" drywall screws eliminates the need to pre-drill many pilot counter-sink holes, although on small pieces or where accurate positioning of the screw is required, a pilot hole is recommended.

Key items in any Foucault tester are the linear bearings that allow the tester to slide smoothly toward and away from the mirror. Any sticking or play will make the tester very hard to use. Finding easily obtainable material to make the bearings, and making the bearings easy to assemble, was a major challenge. Whenever I need inspiration in an ATM project, I head for the plumbing department, and wanter the aisles until inspiration hits me.

I chose 1/2" copper pipe as the main bearing rod, and van clamps (sometimes called bell clamps) to support it, both available in any hardware store that sells pipe (copper pipe is normally sold in 10' lengths, but Home Depot, as well as many other stores, sell 2' lengths, so you won't have to buy expensive, excess, material). This makes a rigid and easy to assemble bearing, that just requires cutting the soft copper pipe to length.

Teflon (tm) is the ideal material for the contact surfaces of the bearing, but has not been widely available in the retail world until recently. However, a new retail product, Magic Sliders (tm), is now widely available, as are "copycat" products at slightly reduced costs. Sold as easy-to-move furniture feet, they consist of self-adhesive pads with a Teflon contact surface. Fortunately for the ATM, Teflon can now be had at the local discount store, hardware store, or home center!

The trickiest part to cut in the whole project are the two V-blocks that hold the Teflon pads, as these are small, hard to hold parts that require an inside corner cut. As explained in the instructions on the web page, it is best to use a large, easier to hold strip of wood to cut the "V" in, and then make an easier cut to trim the block to length. These two small blocks also need to have pilot holes drilled for their screws, or they will most certainly split.

**Motion and Measurement**: The sliding head of the tester is held against a lead screw by a spring. The lead screw is a common carriage bolt. At 20 threads-per-inch, one turn moves the tester 0.0050 inches; one quarter turn 0.0125 inches. Thus you can see that even a moderate sized know on the bold till allow you control motion to 0.001 inch without much difficulty.

As mentioned above, I chose to buy an approximately $10.00 dial indicator to directly measure tester motion. The indicator has a 1-inch working range and directly reads to 0.001 inch. Make no mistake, at this price you get an Asian import instrument that would not stand up to hard use in a machine shop, and one would have to wonder about it's absolute accuracy. But for our use, which is light duty and relies on relative movement over a very restricted range, it works just fine, and is probably more accurate than the traditional amateur methods of scales on the lead screw dial or a scribed scale, and it is certainly more convenient to use.

If you don't wish to use a dial indicator, I encourage you to use calibrated dial on the lead screw - details are on the web site, along with a scale you can print out.

Dial indicators are not generally available at local retail stores; instead you must mail order them from machine tools or industrial suppliers. They seem to be on perpetual sale at MSC [4] for $8.99, or at Grizzly [5] for $12.95 (both sources will add small shipping and handling charges).

**Spherometer**: I use the same dial indicator in a piece of aluminum bar stock as a direct reading 2-point spherometer when rough grinding (See Figure 3). Of all the measuring techniques we use at the Stellafane mirror workshops, this tool has proven to be the most popular because it is so quick and simple to use. Simply drill a 3/8" hole in the center of a suitably long piece of 1 1/4" square bar stock, and drill a perpendicular hole for a set screw to hold the dial indicator shank in place. If you have a tap, you can thread the hold for a thumbscrew, or blunt the tip of a self-tapping sheet metal screw and use that.

Figure 3: A simple spherometer using the economy dial indicator and an aluminum bar 1 1/4" square and 14" long. Once zeroed, this setup can read the sagitta directly.

To use, you must first zero the indicator dial, by placing it on the best flat surface you can find - I use another piece of bar stock that is smooth and undamaged. Then, centering the indicator over your mirror and resting the bar on the mirror's edge, the dial indicator will read the depth of the sagitta directly (be sure to use the correct scale - the one that measures extension of the indicator).

Light Emitting Diodes: I have chosen to use a green LED, mainly because green is right in the center of the visual spectrum and the eye is most sensitive at this wavelength. But the color is not critical, and you can choose any color you wish. At 565nm wavelength, 350mcd brightness works well. Be sure to use a current limiting resistor; details of how to size this are on the web page. Also, slitless testers with extended sources need to be diffuse. Sanding the LED lens to make it frosty works well; if you have a tester with a small bulb, use frosted transparent tape as a diffuser. I specify D-Cells as a power source - they add some mass and stability to the tester and last a looooong time. My personal tester is running on a pair of AAA cells, and I can't remember the last time they needed replacement - LEDs are very efficient light sources! Use what you have, or what will fit in your space.

**Conclusion**: You can build a very effective foucault tester with easily available parts and basic hand tools. I built 3 of these in 1998 and purchased everything; cost of parts was about $70.00 each. My personal tester, a prototype of this design, built in 1997 with lots of help from my scrap bin and junk box, cost less than $30.00 in material.

If you have an existing mirror, building a tester, and learning to use it before you can start your first mirror making project, can be a good strategy. That's what I did, and being competent with a tester certainly helped me in my subsequent mirror making endeavors.

Having a good, functional tester can really enhance the mirror making experience, and the time and effort spent to build one that you will use for years is minimal. I hope this article gives you the urge to start building.

**REFERENCE & NOTES**:

[1] **BERRY, RICHARD**: BUILD YOUR OWN TELESCOPE 2nd EDITION, WILLMANN-BELL, 1984.

[2] **TEXEREAU, JEAN**: HOW TO MAKE A TELESCOPE 2ND EDITION, WILLMANN-BELL, 1984.

[3] **SUITER, DICK**: "ON SLITLESS TESTERS", TELESCOPE MAKING #22, SPRING 1984, PP 16-19.

[4] **MSC INDUSTRIAL SUPPLY**: 800/645-7270, HTTP://WWW.MSCDIRECT.COM, 1-INCH ECONOMY DIAL INDICATOR #76450071 $16.95 REGULAR PRICE, FREQUENTLY ON SALE FOR $8.99.

[5] **GRIZZLY INDUSTRIAL**: 800/523-4777, HTTP://WWW.GRIZLYINDUSTRIAL.COM, 0-1" CAPACITY DIAL INDICATOR #G1479 $12.95.

**TOOLS REQUIRED**:

Wood Saw (crosscut)
Hacksaw or Pipe Cutter
Hand Drill & Drill Bits
Soldering Iron & Solder
Screwdrivers, Ruler & Pencil
Wire Cutter/Stripper, Hammer

Complete plans with dimensions, wiring diagrams, additional photographs and information on the materials and parts used in this tester and stand are available at the Stellafane Web Site.

Click on **ATM** in the index frame at the bottom of the page to find **Tester Plans**. Click on **FEEDBACK** in the index frame at the bottome of the page to **Contact the Author**.

# The Visitor

**Barlow Bob's Corner**
by Bob Pielock

Once in a lifetime, visitors like Comet Hale-Bopp, Walter Scott Houston, and Michael, appear, returning enthusiasm to amateur astronomy. Several amateur astronomers bring a variety of telescopes to a summer weekly astronomy program here on Long Island. Each week, a different show is created from the changing sky. For a few weeks, the show is the Moon, followed by the planets, stars, galaxies, and nebulae.

One night, the show was Michael. Michael used the Telrad to point my scope to Albireo, the beautiful blue and yellow double "Cub Scout Star". After Albireo, he found several other objects. He also ran to the end of the line of people waiting to look through my telescope. When he returned to the front of the line, he used the Telrad again. When his turn was over, I asked him to let me know when a bright star appeared on the eastern horizon. He disappeared and reappeared when he had found one. I told him to point the telescope at the star. He climbed up on my LADDER-FOR-THE-VERTICALLY- CHALLENGED when you observe with a group.

The elf you help today could being the TV-101 at a later date. Support the vertically challenged: hire an elf! I made Michael my official "finder" that night; a job that has been filled by many other "Michael's" at other astronomy events. When someone came up to the telescope, he would point it at something to observe. However, those observing through my scope only saw Saturn that night! Michael sat in a chair while a person looked through the scope, realigned Saturn for the next person and sat down.. He did this for the remainder of the evening, and everyone thanked Michael for finding Saturn for them.

When the street lights were turned on at the end of the program, a woman approached me and introduced me as Michael's mother... She thanked me and the other amateur astronomers for allowing her son allowing her son to be an amateur astronomer for the night. She said that Michael had Attention Deficit Disorder and had never sat still like this before. I guess he was truly fascinated with the Telrad. That evening began as one giant leap for promoting amateur astronomy and ended as one small step for Michael.

# Sailing The Heavenly Sea

## The Observer's Notebook

by John Davis

Each year, the crisp, cool and (with luck) clear autumn nights, shorter twilights and earlier darkness usher in a whole new panorama of viewing opportunities with which to exercise our observing skills. With Sagittarius still lingering in the southwest, the fall constellations, less spectacular than their more brilliant summer counterparts nonetheless offer some remarkable deep sky objects which you'll not want to pass up.

In previous columns, we've already looked at several of these; some fairly challenging, such as the planetary NGC 246 in Cetus, and Barnard's Galaxy NGC 6822 in Sagittarius. This time, we'll be cruising through two constellations: Aquarius, The Water Bearer, and Capricornus, The Sea Goat. Both make up a portion of a dim and watery part of the sky sometimes known as The Heavenly Sea, also home to several fish, a dolphin, and a sea monster or whale. We'll concentrate on four objects, all relatively easy: two globular clusters and two planetary nebulas, each one with distinctive features, which give it a singular "personality".

Starting out down in Capricornus, we'll find what is perhaps because of its southerly declination, the only impossibility for Messier Marathoners here in the Northeast, the globular cluster M30. You can locate it by first identifying the large triangle of stars tracing the outline of the constellation. Just over 7 degrees SW of delta Cap., at the eastern corner of the triangle, are 34 (zeta) and 36 Cap., 3/4 degrees apart. This pair forms the short base of a 2 1/4 degree long isosceles triangle pointing SE, the tip of which is marked by a 6.5 magnitude star. A 1 1/2 degree hop due east of that star will put 5.2 magnitude 41 Cap in your finder, with M30 lying next to it 23' back W and glowing at magnitude 7.3. Charles Messier discovered it in August of 1764 and described it as a "nebula seen with difficulty...with no stars there". William Hershel, 19 years later in 1783, is credited with first resolving the cluster with his 40 foot reflector. M30 has generally been thought to lie about 40,000 light-years distant, although several reliable sources now give it a distance of 26,700 LY. Compared to other larger globular clusters, M30 is not particularly easy to resolve, but with an 8 to 10 inch scope, good clear steady conditions and sufficient magnification you should be able to resolve it nicely. It has a fairly dense concentration of stars in the very bright center and core with a Shapley-Sawyer classification of V (I being the most, and XII the least concentrated). The cluster has an elliptical pattern elongated 3' x 4' E-W, implying significant rotation. Its outer surrounding halo of stars stretches out to 12 arc minutes. The most striking feature you'll notice in the cluster is its odd, lopsided shape. The northern side has three distinct straight projections of stars radiating out from the core, while the southern side appears dull and flattened, with no star chains, giving this observer the impression of an oval ball sitting on top of a tripod. What do you see in this "oddball" globular cluster?

Back in the southern region of Aquarius is the most challenging object of our quartet, **NGC 7293**, a large planetary known as **The Helix (or Helical) Nebula**, quite difficult to spot because of its very low surface brightness. With an overall magnitude of about 7.0, its light is spread out over 14 arc minutes, making it not only the largest of the planetaries - nearly half the apparent size of the full moon -- but also the closest at between 400 and 450 LY. The best way to locate The Helix is to look slightly E of about half way between the well-known "Water Jar" asterism of Aquarius (just E. of 3rd magnitude alpha Aqr) and the bright 1st magnitude Fomalhaut in the Southern Fish to find 3rd magnitude delta Aquarii. Slide just 7 degrees SW from delta to 5th magnitude upsilon Aqr at the western tip of a 3 degree long flattened triangle of 5th magnitude stars. The Helix lies just 1 1/4 degrees W of upsilon. The darker and more transparent the sky, the better your chances are of seeing The Helix with a minimum of difficulty. Its best to start out with you lowest power in a scope or even binoculars. A rich field scope or giant binoculars should work well. In addition to using averted vision, another trick is to rock you equipment back and forth slightly. Doing this will generate enough motion so that the faint object becomes much more obvious as it dances back and forth in your field of view. With an 8 to 10 inch scope at low power, The Helix becomes a faint round glow, possibly showing a hint of its central hole. By using a narrowband filter, preferably the Oxygen III, the nebula becomes quite impressive; detail begins to appear and you should be able to discern the central hole. With good optics in moderate to larger apertures, you'll see several involved stars, including the 13.5 magnitude central star. You may even be able to detect a hint of the coiled helical structure while noting its variations in brightness. Give it a try! You should find it worth the effort.

A much easier target in Aquarius is **NGC 7009**, a planetary nebula just 25 x 30 arc seconds wide and about as different from The Helix as you can get! Its popularly known as the Saturn Nebula, named by Lord Rosse in 1850 when he observed it with his giant 72" reflector from his estate in Ireland. He saw that the planetary's bright oval disc has two extensions or ansae (handles) protruding on either side, reminiscent of Saturn. To find it locate 3rd magnitude alpha Aqr just W of the "Water Jar". Move 10 degrees WSW to 3rd magnitude beta Aqr, the 8 degrees SW of 4.5 magnitude nu Aqr. From nu, slide just 1 1/3 degrees due W and you'll have the bright 8th magnitude blue green disc of this remarkable planetary in your field. This gem is a favorite of Arunah Hill's founder, Joe Zuraw, who some years ago together with a few others of us, marveled at its vivid blue-green color on our very first night of observing down near "the barn" at Arunah Hill. With increasing aperture and magnification, you'll see more detail, though the trick is to see the somewhat difficult projecting "ansae" extending from the ends of the oval disk. You should begin to make them out in the hazy ends of the disk with a 10 inch telescope under good conditions. The 11th magnitude central star and the ansae become easier to glimpse, and even faint knobs at the ends of the ansae can be discerned in scopes of the 13 to 20 inch aperture range. The Saturn Nebula is some 2900 LY away. This one should definitely be on your fall observing list.

Our last stop in Aquarius on this watery sea tour takes us to **M2**, a glorious rich globular cluster which is too often overlooked, possibly in preference to its more popular neighbor M15, just 13 degrees away to its north in Pegasus (much the same as the dazzling M13 in Hercules upstages its bright and attractive neighbor M92). By looking 8 degrees W of alpha Aqr, and 5 degrees N of beta Aqr, you'll spot the tiny fuzz ball of M2 in your binoculars or finder scope forming the right angle of a right triangle with those two stars. Some 37,000 LY distant, and glowing at magnitude 6.3, it has been glimpsed with the naked eye under perfect conditions. M2 was actually first discovered in September 1746 by Jean-Dominique Maraldi while comet hunting, only to be "rediscovered" by Messier in September 1760 and entered into his famous catalog. Because of its distance and compact concentration of 1000,000+ stars (Shapley-Sawyer Class II), resolution of M2 into stars is difficult in small telescopes. A good 4 inch class at high power will bring out tiny faint stars around its edges; an 8 to 10 inch scope will resolve it well, but it takes 12 inches or better to resolve stars across the bright core of the disk. John Herschel described it as "a heap of fine sand". This cluster also has a slight oval shape (aligned N-S) to its overall extent of 12 arc minutes, indicative of rotation. Spectacular view of this rich and highly condensed cluster increase in proportion to aperture. 14 to 16 inch scopes show a hundred or more stars scattered across the disk with chains of stars radiating out into the halo in all directions, while in scopes 18 to 20 inches and up, the scene is overwelming. Some observers have noted "shadows" or dark lanes among the stars, especially one straight dark lane which cuts across the northeast corner of the halo and is visible in some photographs - something of a challenge you might try with a moderate or larger size scope.

A few weeks ago, at "The Conjunction" star party in Northfield, MA, several of us enjoyed excellent views of our four objects featured here: M2, M30, The Helix, and the Saturn Nebula, in Chris Harkin's beautiful home-crafted 12.5 inch F4.8 dobsonian reflector. Sue and Alan French's superb 8" refractor, as well as Phil Harrington's 18" "dob" also provided some memorable sights.

To take full advantage of our observing the autumn skies this fall, you'll want to seek out a dark sky location like Arunah Hill, where on a good clear night a limiting magnitude of 6.5 is not uncommon, and vistas of these four denizens of the "Heavenly Sea", and many more, will reward your effort as they shine into your eyepiece.

**Coordinates of Featured Objects**

| Object | R.A. | DEC. |
|---|---|---|
| M30 | 21h 40.4m | -23 deg. 11 min. |
| NGC 7293 "Helix" | 22h 29.6m | -20 deg. 48 min. |
| NGC 7009 "Saturn" | 21h 04.2m | -11 deg. 22 min. |
| M2 | 21h 33.5m | -00 deg. 49 min. |