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NOVAC
THE NEWSLETTER OF
THE NORTHERN VIRGINIA
ASTRONOMY CLUB
SEPTEMBER 2013

Fireworks on the Fourth at The Mountain Institute

by Bob Traube

Anticipation!

That's what most of us felt during the weeks before the extended observing session held this past July at The Mountain Institute on Spruce Knob, West Virginia. Because of the holiday weekend,

TMI management offered to extend our normal three day observing session to five days, Wednesday through Sunday nights. At one point 27 people registered to attend the session for a day or longer. However, as the week drew closer, the outlook grew dreary as rain and thunderstorms were forecast for all five days. The numbers dwindled as many were deterred by the prospect of a soggy session on the field.

Several optimistic folks arrived on Wednesday afternoon but were greeted with rain and clouds. By Thursday afternoon 15 campers set up on the field, braced to brave the elements in hopes of clearing skies. Despite the forecast, they were not disappointed. Cool breezes and a few scattered clouds dominated the afternoon, but by nightfall the skies opened! It started to cloud over by midnight, so many got some sleep that night.

The rest of the weekend turned out to be fantastic; cool, dry, and mostly sunny! Combine that with TMI's magnificent vistas and suddenly the trip became

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Fireworks on the Fourth at TMI *Continued from p. 1*

worthwhile. The little group wasted no time taking advantage of both day and night activities.With scopes set up and covered, anticipating the worst, they swapped stories, barbequed steaks, roasted potatoes, and toasted "S'mores." The kids played soccer amid the high grass, and several others took time to visit the Spruce Knob summit or swim in Spruce Knob Lake. The meadow was alive with butterflies during the day, and sported an incredible display of fireflies at night. Wildflowers in the field added a touch of beauty to the already picturesque weekend.

Seven scopes plowed Friday's night-time sky. Most sampled the buffet of astro-goodies so prominent at TMI and shared the views with their kids, wives, and girlfriends. Others captured the magnificence of dark sky treasures with camera and scope. Imaging continued until morning light broke over the mountain. In an attempt to score some sleep, some headed to the bunks and blissfully slept till nearly noon, avoiding the morning hubbub on the field and tents overheated by the rising Sun.

Saturday did give everyone a moment's pause.

The predicted thunderstorms finally appeared in the distance creeping our way. But by dusk they skirted the camp to the West and North, and provided yet another dimension to nature's glory. The rest of the night produced the celestial spectacle for which TMI is famous.

A few more views and some more images, and suddenly the weekend was done. Sunday proved to be cloud laden, so everyone packed up Saturday and went on their way having experienced some of the best the Mountain has to offer.

All in all, not bad for a Fourth of July celebration that was forecast to be, well, "damp."

Man-made fireworks rose high above the distant valley; the atmospheric fireworks lent an air of drama to the night, and of course, the celestial fireworks provided the main event we all came to see.

When next you consider making the trip to TMI, or wherever you go, just remember this: If you don't look, you don't see. We astronomers are a patient lot, but ya gotta be outside to have even a chance of "dancing" with the stars. ✶

Celestial fireworks provided the main event we all came to see, Fourth of July at TMI.

The *NOVAC Newsletter* is the official publication of the Northern Virginia Astronomy Club and is published quarterly. The NOVAC Newsletter is available to members of NOVAC as a regular membership benefit.

Membership

Membership in the Northern Virginia Astronomy Club is $25.00 per year and is open to anyone interested in astronomy or the sciences. Additional memberships at the same address are $5.00 per person. Membership in the Astronomical League is free with NOVAC membership and includes the *Reflector* magazine plus access to their Observing Awards.

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Submissions to the newsletter

NOVAC members are invited to submit articles for publication in the *NOVAC Newsletter*. The editor reserves the right to edit all materials submitted. Send article submissions to the Editor, Chris Lee, at newsletters@novac.com.

A Conversation With…
NOVAC Member Cal Powell

By David Werth

In what we hope will become a regular part of the NOVAC Newsletter, *we will present question and answer interviews featuring some of our clubs' notable members who will share their thoughts on different aspects of our mutual interest in astronomy. Club member David Werth interviewed veteran observer Cal Powell.*

NOVAC Cal, you have led the night sky tour at Star Gaze and your knowledge of the cosmos seems encyclopedic! To what do you attribute this knowledge and how long did it take you to reach this level?

Cal I don't consider my knowledge that all-encompassing. Although I know my way around the night sky that is visible at our latitude, I am not that familiar with the constellations south of declination -35°. I learned the brighter constellations as a kid growing up in Brooklyn, New York, and I spent a lot of time reading astronomy books with star charts, particularly *Norton's Star Atlas*. I went off to college and, although I took an introductory astronomy class as an elective, I did not do much stargazing for about 15 years. Shortly after my wife and I moved to Westport, Connecticut, in 1980, I joined the local astronomy club, which hosted weekly public nights at an observatory, and I was able to rekindle and turbo-charge my interest in astronomy. The observatory's 12.5-inch reflector did not have computer control at the time, but I apprenticed with some excellent observers (notably Phil Harrington) and after a few years developed the star-hopping and presentation skills to do telescopic sky tours throughout the year. I also participated in and subsequently ran the club's annual Messier Marathon which is great training for learning the sky.

NOVAC You mentioned working at a planetarium; where and when was this? How long were you there, and what did you like about the work?

Cal In the summer of 1997 I was offered the opportunity to work at the DuPont Planetarium at the Discovery Museum in Bridgeport, Connecticut, where I presented both recorded and lecture shows on Saturdays. I started creating and presenting monthly lectures at the Edgerton Memorial Planetarium at the Stamford Museum and Nature Center in 2003. I left both planetariums in 2010 when we moved to Virginia. I enjoyed talking about the night sky in a controlled environment and I found that it gave me the impetus to stay current with astronomical events in order to provide intelligent answers to questions from the public. I have since lectured a few times as a volunteer at the Einstein Planetarium at the National Air and Space Museum.

NOVAC I know you recently acquired a Celestron 11 inch SCT. How has that been working for you?

Cal I've had the CPC 1100 for more than a year now, and although I'm still learning some of the operational details of the telescope's NexStar handheld controller, I am very pleased with it. It is the largest telescope that I can transport and manage, and it provides excellent views of the night sky at venues such as Sky Meadows. I would also like to mention my deep appreciation of my fellow NOVAC observers who are always eager to offer sage advice, expert assistance, and even loans of accessories to a new owner of an SCT—it's just another aspect of what makes this club great. As a star-hopper, I wondered about my adjustment to using computer control, but I really enjoy the ability to locate objects quickly when you have a line of people eager to see the cosmos. I've discovered that having a "go

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A Conversation With…
Cal Powell

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to" system with a deep-sky object database is like having all of your friends on speed dial!

NOVAC In your nighttime observing, are there any objects that you concentrate on more than others? Have you done any solar observing?

Cal I spend most of my observing time looking at deep-sky objects (nebulas, star clusters, and galaxies). I do some solar observing with a SolarScope which is a clever lens and mirror system that projects a white-light image of the Sun. I also volunteer at the National Air and Space Museum's Public Observatory Project where we give the public an opportunity to view the Sun with several telescopes including one with a hydrogen-alpha filter.

NOVAC I understand you recently completed one of the Astronomical League challenges. Tell us about that.

Cal By logging the details of the NOVAC public events that I have participated in, I have qualified for the Basic and Stellar levels of the Astronomical League's Outreach Award. I will be working to achieve the Master's level of that award during the next few years.

NOVAC What other Astronomical League challenges would you like to go for?

Cal I completed the Basic Messier Award (70 objects) almost 30 years ago, and so I guess that I should get around to formally logging the remaining 40 to achieve the Honorary level. I would also like to go for the double star, carbon star, Herschel object, and other deep-sky observing awards such as those for globular clusters, planetary nebulas, and galaxy groups.

NOVAC What references would you recommend to young people and new club members to help them better learn the night sky?

Cal I still like the book from which I learned the constellations—*The Stars: A New Way to See Them* by H. A. Rey—now in a 2nd edition, as well as its younger reader version *Find the Constellations*. I also recommend *A Field Guide to the Stars and Planets* by Jay M. Pasachoff as a good single-volume reference to astronomy that contains great star maps by Wil Tirion. For observing sessions, *Sky & Telescope's Pocket Sky Atlas* by Roger W. Sinnott is a good choice.

NOVAC You seem to be a regular contributor at NOVAC's public events. What appeals to you about astronomy outreach?

Cal People of all ages are eager for new experiences and knowledge, and whether you show people something they have never before seen, or provide them with a different perspective on the cosmos, their expressions of excitement, wonder, and understanding keep me going — and it never gets old. ✶

Upcoming Meetings

October 13th, 2013
Speaker: Bob Weigel
Topic: An Introduction to Space Weather

November 10
Speaker: Daniel Reichar
Topic: Outreach Growth for Skynet

December 8
TBA

Monthly meetings are normally held at 7 p.m. on the second Sunday of each month in Room 163 of the Research Building on the campus of George Mason University.

The Magic Mountain by Chris Lee

The Mountain Institute (known more commonly as TMI) at Spruce Knob, West Virginia, is the one place I can see in my mind's eye that brings me a sense of calm and a feeling of butterflies in my stomach at the same time. It's hard to explain the effect the place has on me as it's unlike anything else I have experienced, but I'll try to give it my best shot!

My first TMI Experience

I became a NOVAC member in 2010, and had used my new telescope only a handful of times before attending the Almost Heaven Star Party that year. The experience at TMI became a "perfect storm" for me. The superb observing location and wonderful people I met on the mountain were a perfect combination to help a new NOVAC member to discover the world of amateur astronomy. The first night we had dark, clear skies was absolutely amazing, and—for me—almost overwhelming. Objects that were faint fuzzy blobs in my telescope at home were easily picked out with the naked eye. The clear, still air brought out the best in my equipment, and helped my newbie observing skills make every moment a treasure.

Just to give you an example of the synergy TMI and the NOVAC organizations provide, let me tell you about my first night. Rod Mollise (aka: Uncle Rod), one of the legends in amateur astronomy, and Bob Naeye, editor in chief of Sky & Telescope magazine, helped me run my Orion XTG8 dobsonian, putting it through its paces, giving me invaluable pointers and generally offering priceless advice on objects to seek out and—once I had found them--the best way to observe them. My first look at M13, the Hercules Cluster, with Uncle Rod is one of my best memories. Now, it's possible I could have had this kind of experience somewhere else, but I didn't, and consequently—for me—TMI has become a special place where all good things seem to come together. My first night I had struck amateur astronomy gold. The experience ensured my continuing journey as an amateur astronomer.

And I didn't need a telescope to see amazing things. Unless you've already had the chance, I can assure you that looking at the Milky Way Galaxy—so bright it seems to cast a shadow—stretching out from horizon to horizon is a magical, and humbling, experience.

The Staff

TMI staff members are a colorful, independent bunch, who share a love of the Earth and all that is best about our natural world. The leadership at TMI ensures their people work to make our visits comfortable, and are ready to help out at any time. Combining the professional staff at TMI with the NOVAC's AHSP volunteers helps ensure every attendee's experience is the best it can possibly be. My first year at AHSP the NOVAC group's organizational skills, generosity and self-

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The Magic Mountain Continued from p. 5

less attitude made a lasting impression on me. Consequently, I ended up joining them in planning and conducting every AHSP event since. Over the past four years these amazing, talented folks have become like a second family to me, and I consider it a privilege to have the opportunity to work with them to make each year's event better than the last.

The Place

While the Almost Heaven Star Party is the highlight of my observing year, and the memories I have of those events are extraordinary, NOVAC's special arrangements with TMI offer opportunities for observing more than just once annually. This past July 4th weekend I took advantage with other NOVAC members of NOVAC's monthly TMI observing weekend. I have to say, those few days made clear to me it's not just AHSP that makes Spruce Knob extraordinary, the place has a magic all its own. Some of our nights were less than ideal for observing, but NOVAC members still had the chance on those evenings to enjoy each other's company, exchanging experience and sharing stories. My wife and sons joined me later on that weekend. It was their first visit to TMI, and they almost instantly came to understand why it's a special place. Fireflies by the thousands lit up the woods bordering the observing fields, and far out across the mountain valleys on three sides of us we saw lightning storms brilliantly illuminating the countryside.

Weather at TMI is all its own. The mountain has its own climate, cooler in summer than the surrounding country, and without everyday lowlander pests like mosquitoes and ticks. While the fog can flow in unexpectedly, it's a rare night that doesn't have at least a few hours of clear sky.

One thing I've discovered over the years, though, is that each time I visit TMI I can expect to see, or learn, something new.

Conclusion

With all that I've written above about my limited personal experience with TMI at Spruce Knob in last four years I know I can't capture everything that makes this place so special to me, or even come close to encompassing what others who also have been there would say it means to them. If you haven't visited I really encourage you to try to make the trip up. I believe it's a "Bucket List" experience not to be missed. We have NOVAC weekends every month from April to October where NOVAC members can reserve spots, and of course AHSP once a year.

I hope to see you there soon. ✶

The Heartbeat of an Exploded Star

By Phil Plait, Bad Astronomy

A thousand years ago—in July 1054, to be somewhat more precise—the light from a cosmic catastrophe reached Earth. A massive star, probably 20 or more times the heft of the Sun, exploded. This titanic event was vast almost beyond human grasp: It released as much energy in a few weeks as the Sun will over its entire 10-billion-year lifetime.

The devastation was nearly total: Most of the star was torn apart, its octillion tons of matter blasted outward at a good fraction of the speed of light, while the very central core of the star collapsed to form a rapidly spinning white-hot neutron star. Now, 10 centuries later, the expanding debris is 100 trillion kilometers across, glowing from both the influence of the neutron star's fierce magnetic field, and the violent collision of the filaments of the gas itself, creating epic shock waves in the material.

We call this cloud the Crab Nebula, and you can see it in the picture above, taken by my friend Adam Block using the 0.81-meter Schulman Telescope in Arizona. The total exposure time on this image was a whopping 17.5 hours, using several different filters to produce those glorious colors.

Amazing as the image is, there's another, subtler aspect of it that will cook your brain. That debris you see is still expanding, and quite rapidly. Because the Crab is tremendously far away—6,500 light-years or so—any motion is shrunk down to near invisibility. But we've been observing it for decades, which is a pretty long baseline. That means that if you compare an earlier image to a later one, you can actually see the physical expansion of the supernova explosion.

Photo Caption The Crab Nebula, the violently out-rushing debris from a star that exploded a millennium ago. Click to hugely chandrasekharenate.

PHOTO BY ADAM BLOCK/MOUNT LEMMON SKYCENTER/UNIVERSITY OF ARIZONA

Adam did this: He created a video [http://vimeo.com/71117055] which shows his image taken in 2012 compared to one taken in 1999 using the ESO's Very Large Telescope.

Holy. Wow. That's not a trick using exposures or magnification or anything like that. Keep your eyes on the stars and you'll see they are in the same positions in both frames; then pick a knot or filament in the nebula and you can see the material moving. To me it looks like a heart beating, especially given the gas cloud's overall shape.

I've written about this visible expansion before [http://www.slate.com/blogs/bad_astronomy/2005/12/06/crabby_hubble.html]; in fact a few years back when I was developing educational activities based on NASA satellites, I reworked an old classroom exercise [http://xmm.sonoma.edu/edu/supernova/snguide5_508.pdf] where you could compare two images of the Crab and determine how fast it's expanding and trace it back to determine how old it is. Astonishingly, you get the correct date to within a small margin of error!

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Size Does Matter, But So Does Dark Energy

by Dr. Ethan Siegel

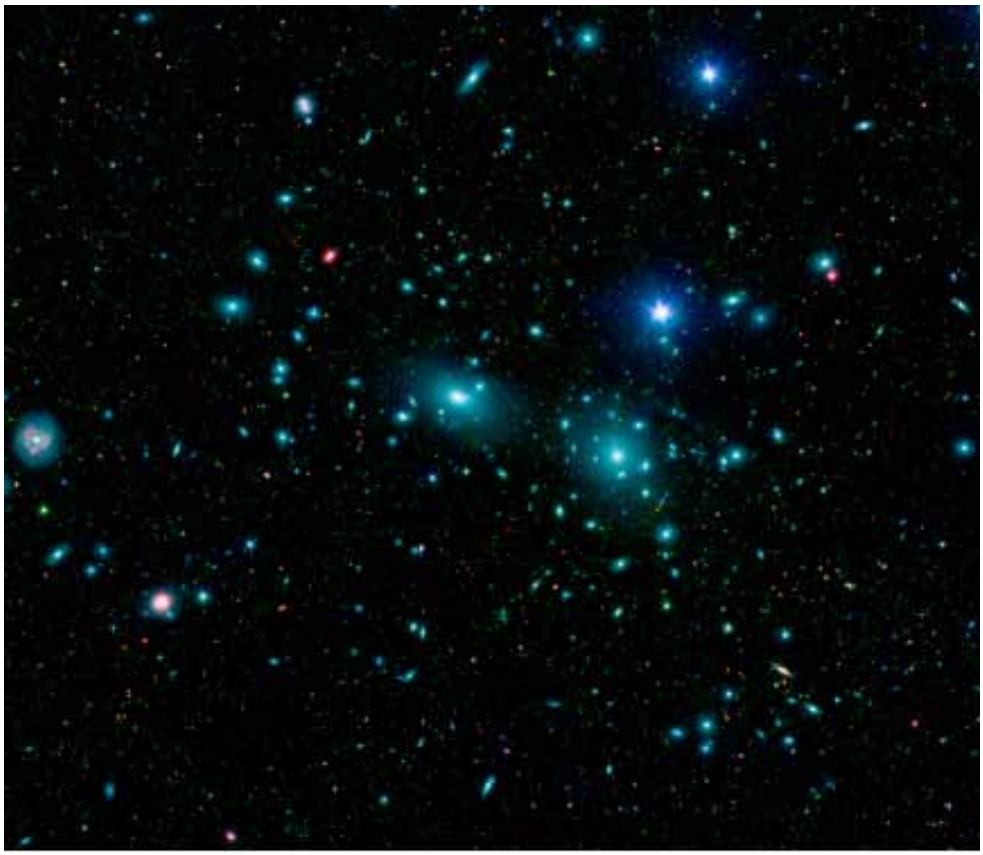
Here in our own galactic backyard, the Milky Way contains some 200-400 billion stars, and that's not even the biggest galaxy in our own local group. Andromeda (M31) is even bigger and more massive than we are, made up of around a *trillion* stars! When you throw in the Triangulum Galaxy (M33), the Large and Small Magellanic Clouds, and the dozens of dwarf galaxies and hundreds of globular clusters gravitationally bound to us and our nearest neighbors, our local group sure does seem impressive.

Yet that's just chicken feed compared to the largest structures in the universe. Giant clusters and superclusters of galaxies, containing thousands of times the mass of our entire local group, can be found omnidirectionally with telescope surveys. Perhaps the two most famous examples are the nearby Virgo Cluster and the somewhat more distant Coma Supercluster, the latter containing more than 3,000 galaxies. There are millions of giant clusters like this in our observable universe, and the gravitational forces at play are absolutely tremendous: there are literally *quadrillions* of times the mass of our Sun in these systems.

The largest superclusters line up along filaments, forming a great cosmic web of structure with huge intergalactic voids in between the galaxy-rich regions. These galaxy filaments span anywhere from hundreds of millions of light-years all the way up to more than a *billion* light years in length. The CfA2 Great Wall, the Sloan Great Wall, and most recently, the Huge-LQG (Large Quasar Group) are the largest known ones, with the Huge-LQG -- a group of at least 73 quasars – apparently stretching nearly 4 billion light years in its longest direction: more than 5% of the observable universe! With more mass than a million Milky Way galaxies in there, this structure is a puzzle for cosmology.

You see, with the normal matter, dark matter, and dark energy in our universe, there's an upper limit to the size of gravitationally bound filaments that should form. The Huge-LQG, if real, is more than *double* the size of that largest predicted structure, and this could cast doubts on the core principle of cosmology: that on the largest scales, the universe is roughly uniform everywhere. But this might not pose a problem at all, thanks to an unlikely culprit: *dark energy*. Just as the local group is part of the Virgo Supercluster but recedes from it, and the Leo Cluster — a large member of the Coma Supercluster — is accelerating away from Coma, it's conceivable that the Huge-LQG isn't a single, bound structure at all, but will eventually be driven apart by dark energy. Either way, we're just a tiny drop in the vast cosmic ocean, on the outskirts of its rich, yet barely fathomable depths.

Learn about the many ways in which NASA strives to uncover the mysteries of the universe: http://science.nasa.gov/astrophysics/. Kids can make their own clusters of galaxies by checking out The Space Place's fun galactic mobile activity: http://spaceplace.nasa.gov/galactic-mobile/ ✶



Digital mosaic of infrared light (courtesy of Spitzer) and visible light (SDSS) of the Coma Cluster, the largest member of the Coma Supercluster.

IMAGE CREDIT: NASA / JPL-CALTECH / GODDARD SPACE FLIGHT CENTER / SLOAN DIGITAL SKY SURVEY.

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Blast from the past—*This article originally appeared in the September 2003 issue of the NOVAC Newsletter.*

Adventures in mirror-making

by Ed Witkowski

More than 35 years ago I smelled pitch for the first time. As a child I watched my older brother, Hank, grind and finish a mirror. For many years he would say, "Grind a mirror and build your own scope." I would browse through my copy (second printing) of Jean Texereau's *How to Make a Telescope*. At times, I would be overwhelmed and intimidated by all of the terms and techniques: grit, pitch lap, rouge, wave error, figuring, and other assorted terms. I avoided the adventure for many years, but finally took the plunge and decided in June of 2001 to grind a mirror.

Part 1: The first Mirror

As a first time "Glasspusher" I opted for an 8-inch mirror and contacted the local mirror making class leader, Guy Brandenburg of the National Capital Astronomers Mirror Making Workshop. The first stage in mirror making is the rough grinding of the mirror; a rough spherical concave depression is ground into the mirror blank. This stage is also commonly known to mirror makers as "hogging out" the mirror and is accomplished by using 60 or 80 grit silicon carbide abrasive. After eight hours, I had completed rough grinding with 80 grit abrasive and had even moved through the 120 and 220 grit abrasives.

It was now time to move on to **fine grinding**. Fine grinding proceeded at a faster pace. Eight hours later and the 320, 302, 303, 304 and 305 grits were done. A great website which explains grit sizes is the Stellafane website at www. Stellafane.com. At this point, I had what I hoped was a nice spherical concave depression in the mirror blank.While looking at the blank at a lower angle, a nice even sheen reflected off of the surface. This was very exciting for me, almost as good as witnessing the birth of my daughter—almost!

Next up is **polishing**. During this stage, a pitch lap is made from pitch and a polishing agent is used. Different polishing agents were available to me, one being cerium oxide (CeO) and the other rouge. I picked cerium oxide as it polishes faster and my wife was nagging me about the "never ending process." Rouge polishes more slowly (and can provide a smoother surface) it also allows the mirror maker to sneak up on the final figure. I will tell you more about figuring later. During polishing, the mirror blank is slowly slid over the pitch lap in a 1/3 center over center W-like stroke. After seven hours of cerium oxide and one hour of rouge, the surface was beautifully smooth and polished.

The final step is **figuring the surface**, this step is also known as parabolizing. This stage involves making a slight change of the spherical surface into a parabola. Remember my mentioning overwhelmed and intimidated, well this is when it can get tricky! The "classic" technique a la Texereau has the mirror slide across the tool in a zigzag pattern. Using such a stroke deepens the center slightly, if you're lucky—or ruins the mirror if you're not. Ruined mirror … please go back to stage one, hogging.

Tests are performed on the mirror during this stage. The two tests that were used on my mirror were the Ronchi "Ron-key," or if you have a sense of humor "Rauncie," the other was the Foucault test. Explaining the tests and their results can take up many pages. So, here are two excellent web links, which explain each:

www.atm-workshop.com/ronchi-test.html
www.atm-workshop.com/foucault.html

It took four Friday nights to finally figure the mirror. This stage can take a lot longer.

One of the hardest questions that some mirror makers have to answer is "when am I done?" A frequent end point is when you have reached a wavefront error of 1/8 wavelength.

After 12.75 hours rough/fine grinding, eight hours polishing (seven CeO and one Rouge) and four Friday nights of "figuring" sessions, I had an 8-inch f 5.5 mirror with a 1/10-wave error.

Was it "hard" to make a mirror? No, not really. The "hard" part was allocating time for the process.Was it worth it? A big yes! There are many reasons why making a mirror can be a rewarding experience. Here are a few:

1. Learning about what's involved in making optics, testing them and how they work.
2. Knowing your mirror, "quality control." Your mirror is made as well as you want. Some of the best mirrors are ATM mirrors.
3. The pride and joy of making your own high quality optic.When you are done grinding, polishing and figuring by hand, you will have a mirror surface that is accurate to within a millionth of an inch!
4. Next: A bigger and better mirror

Part 2: Delmarva Mirror Mania

In 2002, I attended the Delmarva Stargazers 2nd Annual Mirror Making Seminar—or was it "Grinding Mania!"—or should it have been "The Mirror Marathon"?

Whichever term applies, it was a great experience. The seminar and workshop started on a Friday afternoon with a quick introduction followed by the fine grinding of our generated blanks, a 10-inch f6 in my

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Book Review

The Day We Found the Universe, by Marcia Bartusiak,Pantheon Press, January 2009
Reviewer: Harry J. Foxwell, PhD, NOVAC Member

As we view the magnificent galaxies, nebulae, and star clusters through our amateur yet very modern telescopes, it's easy to forget that not so long ago there was raging debate over the nature and distance of those fuzzy patches of light. We often quite casually mention that M31 is 2.9 billion light years distant, not realizing that it wasn't really that long ago, 85 years in fact, that Edwin Hubble and others were able to determine that such objects were not within our own Milky Way galaxy.

Science requires evidence, and observations of the Messier objects through the great telescopes of the early 20th century yielded intriguing but inconclusive data. Then came a day (almost literally) when the discovery of a Cepheid variable in the Andromeda spiral allowed its distance to be estimated. And the universe was expanded, infinitely beyond humanity's primitively centrist view of our place in the cosmos.

Bartusiak's engaging and well-written book chronicles the discoveries, and the discoverers, that changed our understanding of the size and state of the universe. She rightly and extensively credits those whose earlier work allowed Hubble to measure galactic distances, particularly that of Henrietta Leavitt whose insight showed that Cepheid variable stars were the key to a cosmic yardstick.

The Day We Found the Universe makes for great reading as it describes the people, telescopes, and science behind our current view of the universe. I've donated my copy to the NOVAC library. See John Deriso, club Librarian, to borrow it at the next meeting. ✶

Blast from the Past *Continued from p. 9*

case. A pregenerated blank has a rough curve ground into the mirror blank surface. The grit sequence was silicon carbide (SiC), 220 grit, aluminum oxide (AlO), 25, 12, 5 micron Rough and fine grinding can be programmed into your brain:

Step 1—Put some grit on the tool and mirror

Step 2—Do the 1/3 center over center "Boogie" (I mean stroke). After approximately eight up and down strokes, you continue with turning the mirror and "going around the barrel" approximately a quarter turn. I mention approximately because randomness helps create a better surface.

Step 3—Go around the barrel twice.

Step 4—Dunk mirror and tool

Step 5—Clean off sludge.

Do Steps 1 through 5, eight times (this is called a wet). Be sure to clean your tool and mirror thoroughly and go on to the next grit. I did about 16 wets between the 220 and 25 micron, this was followed by eight wets each for the 12 and 5 micron. By the time Friday night rolled around, I had completed the fine grinding and was ready to start polishing in the morning.

"Ah, pitch in the morning, smells like, (sniff, sniff) victory." Pitch: messy stuff, but fun! Was it hard or was it soft? If pitch is too hard or too soft, you may encounter problems while polishing. All I know is it worked. The CeO was very effective as a polishing agent and the glass was looking fine!! It went so nicely that I was ready to start figuring by late Saturday afternoon.

Figuring is when the "final" touches are applied to the mirror. The transformation of a smooth sphere to a parabola can be a long process or it can be a short one. Using CeO you really don't creep up on the final figure. In my case, I had a "very nice" sphere, so the transition was quite short when compared to when I used rouge on my first mirror. Some people appeared to be rushing through their mirrors and they wound up spending much more time finishing.

So how did my mirror end up? It has an "excellent, smooth parabola" but a turned-downedge that is about a 1/8 of an inch from the edge. The results of Foucault testingat the NCA Mirror workshop show that I have a 1/15 wave mirror, not bad for a marathon.

As I mentioned, it was a great weekend! The Delmarva Stargazers are a great group of people and the food was excellent. Steve and Bruce Swayze were outstanding teachers, tutors and testers!

Occasionally a message pops up on the Internet, in newsgroups, which goes something like this: "How hard is it to make your own mirror?"

Having completed *two* mirrors I canhonestly say, "It's not very hard." But, there are a few "ifs, ands, or buts" included. Here are a few:

1. Take your time. If you rush, you may end with lots of errors.
2. Keep your area clean (I better not let my wife see that tip, I'd never hear the end of it).
3. Most important—take pleasure in the process!

Enjoy the sky! ✶

"To observe, and to help others observe"

NOVAC is a non-profit, all-volunteer organization chartered to advance amateur astronomy in Northern Virginia. Member benefits:

Access to dark sky observing sites

NOVAC maintains agreements that provide club members with year-round access to observing sites away from city lights. **www.novac.com/wp/observing/**

Monthly meetings

Monthly meetings are normally held at 7 p.m. on the second Sunday of each month in Room 163 of the Research Building on the campus of George Mason University. Each meeting features a lecture on an interesting topic by a local expert. See the meeting web page or future newsletters for a schedule of speakers.
www.novac.com/wp/outreach/meetings/

Quarterly newsletter

The NOVAC newsletter provides information specifically for NOVAC members, as well as general interest articles on such topics as observing reports, equipment reviews, upcoming events, amateur telescope making (ATM) projects, and more.
www.novac.com/wp/members/newsletter/

High-quality telescopes to borrow

NOVAC members may borrow one of the club's several loaner telescopes at no charge. Members may choose from among three 6 in. reflectors, two 10 in. f/6 reflectors, an 8 in. SCT, and a hydrogen-alpha solar scope. Binoculars are also available for loan.
www.novac.com/wp/members/loaner-scope/

Club website

Up to date information about club events and activities is maintained on the club website at **www.novac.com**.

Large club library

NOVAC maintains a well stocked library from which members may borrow by contacting John Deriso (**librarian@novac.com**). A full list of titles is available on the club website.
www.novac.com/wp/members/library

Private email listserv

Members keep up with current club information by subscribing to the NOVAC email list, without fear of flame wars or spam emails.

Public outreach opportunities

Several times each year volunteers from NOVAC present astronomy programs to schools, churches, Scout troops and other public groups. Contact **outreach@novac.com** or fill out the outreach form on the NOVAC website to request a program or help in supporting an event.
www.novac.com/wp/outreach/outreach-form/

Membership in the Astronomical League

Through NOVAC's membership in the Astronomical League (AL), NOVAC members gain access to the AL's newsletter, services and observing programs**. www.astroleague.org**

Discounts on astronomy magazines

Subscriptions to *Sky & Telescope* and *Astronomy* magazines are offered to club members at a considerable discount. Contact Kent Allingham: **membership@novac.com**

Mentor Program

Young or old, new or experienced, this program is for everybody. If you would like to meet with a mentor, think you would like to be a mentor, or have any questions about the program, contact: **mentor@novac.com**.

See your Membership Guide for more details about member benefits.
http://www.novac.com/wp/members/

The Heartbeat of an Exploded Star

Continued from p. 7

It's easy to think of the sky as static, unmoving, and unchanging. Because most objects are so terribly far away, we don't notice the motion they undergo. But sometimes they move rapidly enough, and our technology is sensitive enough, that their velocity betrays them. And seeing that motion, as in the video, gives you a real sense of it. Remember, what you're seeing is a superheated cloud of gas with five times the mass of the Sun screaming outward into space at speeds up to 1,500 kilometers per second—*well over 3 million miles per hour*!

The Universe is an amazing place. I love that we have such a wonderful chance to study it. ✶

This content distributed by the AAVSO Writer's Bureau

Phil Plait, the creator of Bad Astronomy, is an astronomer, lecturer, and author. After ten years working on Hubble Space Telescope and six more working on astronomy education, he struck out on his own as a writer. He has written two books, Death from the Skies *and* Bad Astronomy, *dozens of magazine articles, and 12 bazillion blog articles. He is a skeptic, and fights misuses of science as well as praising the wonder of real science.*

2013 Astronomy Events

October 5
Star Gaze
Crockett Park
Catlett, VA

October 1–6, 2013
Staunton River Star Party

Find more info at
www.NOVAC.com