

Gemini

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2007 Cedar Key Star Party

By Steve Emert

View the Great Orion Nebula... without shivering! Check out open clusters in Puppis and Canis Major without having to peek between the trees or peer through the light domes to the south. Observe the large open cluster IC2391 in Vela... which you can't even see while observing in Minnesota. Participate in a five or six hour observing session and still be able to visit local tourist attractions the next day. We were able to do all these things at the Cedar Key Star Party on the gulf coast of Florida this February.

Vic and Joan Heiner and John Connery have been going to the Cedar Key Star Party (CKSP) for the past four or five years. This year Bill Kocken and his wife Mary, and my wife Liz and I also decided to go to Florida to attend the star party. The Minnesota contingent at the 2007 CKSP was the largest group attending by far! Cedar Key is a very relaxed, laid-back star party as compared to some of the major regional star parties like the Winter Star Party in Key West or the Texas Star Party, Okie-Tex and Nebraska Star Parties in the summer. A major advantage of Cedar Key as compared to the major regional star parties is this star party is located in a part of Florida that has enough tourist attractions that you can make it a family vacation in addition to the star party but has



dark enough skies to give worthwhile views. Also, because it is held in the winter, twilight begins early and you can get a full night's observing in before midnight - and be fresh and awake to go hiking, birding, or just touring the town or visiting the nearby tourist activities during the day.

When we planned the trip, Mapquest told us it was 1,501 miles and 24 hours of driving from our house to Cedar Key, which was exactly right! Not knowing how the weather would affect our drive, I scheduled two weeks of vacation and we planned to allow at least three days for traveling from Minnesota to Florida, with about the same time to return. Our departure day, Thursday February 8th, arrived as a partly sunny day, and cold! In the 8 degrees below zero temperature of the early morning, we packed up my 12" truss Dob and 25 x 100 binoculars along with all the other miscellaneous stuff needed for extended observing, our clothing, and all the other goodies necessary for a long trip and set out on our journey by 9:00 am. We got to Effingham, Illinois before stopping for the night. By late Saturday morning, we were in Florida! Glorious, WARM, Florida! Bright and sunny and temperatures in the 70's! What a great place to have a star party! After stopping to stock up at a grocery store in Gainesville, we headed down Highway 24 to the gulf coast and Cedar Key and found Pirate's Cove, the resort where we were to stay for the week, and checked in with Vic and Joan and John who had arrived the previous day.



The star party gets kicked off Sunday night with an observing session at the "private"

Continued on Page 2



observing area in Shell Mound Park. The observing site is actually the public boat launch area at the shore of Shell Mound Park, about five or six miles from downtown Cedar Key. Because we all planned to be in Cedar Key by Saturday evening, we decided to head out to Shell Mound after dinner for our own early kickoff to the star party. Bill and Mary Kocken were arriving a little later Saturday evening, so we left a note for them and headed off to Shell Mound. Setting up at dusk, we found that even though the site is fairly

small, we could get good views especially to the south, west and the north. Only a very small light dome was visible from Cedar Key to the south-southeast. The worst light pollution we encountered at this site was a cone of light seen directly to the west after dusk... the Zodiacal Light! Once dark adapted, our eyes could clearly see the tall, skinny cone of light blotting out the dimmer stars of the constellations along the ecliptic to the west. Bill arrived a little after dark and set up his scope (his 16" Meade Starfinder which he is mostly finished converting to a truss Dob) for a couple hours viewing. After getting our first chance to view the constellations south of Orion and Canis Major for a couple hours (Cedar Key is located at 29 degrees north latitude, giving us access to over 15 degrees more southern sky that we see at home), the clouds blew in and we packed up for the evening.

During the morning hours Dan Newman, who is the organizer of the star party, hosted public solar viewing sessions on the beach next to the harbor in downtown Cedar Key. Unfortunately, the clear bright skies and warm temperatures we first encountered when entering Florida turned into partly cloudy skies and cooler temperatures throughout the remainder of the week. Thanks to clouds, a majority of the solar viewing sessions turned out to be a



bust. Thank goodness Dan also was able to entertain people with his huge kites flying over the ocean in addition to solar observing. Although most days we watched the clouds come and go and fretted over whether it would clear in the evening so we would have a chance to observe, miraculously the only evening we lost to the clouds was Monday night.

There is plenty of time to tour the area during the day. Daytime activities included walking tours of nearby Manatee Springs State Park and Shell Mound Park. Boat tours are available starting from Cedar Key as well. In Manatee Springs, we were

able to watch a wide variety of birds including egrets and turkey vultures and even woodpeckers. This was in addition to, of course, getting glimpses of manatees in the Lower Suwannee River. With all the birds in the area, we even were able to do quite a bit of bird watching from our cabins. Cedar Key is one of the oldest fishing villages in Florida. It has an interesting mix of newer condos and hotels and waterfront shopping and restaurants along with small eclectic restaurants and shops and old falling-down piers and waterfront sheds which are a haven for the pelicans and seagulls in the area. Being directly on the gulf coast, property costs are high. The property next to where we were staying at Pirate's Cove was a lot for sale which contained an old, falling down shack. For only \$650,000! A steal for prime Florida waterfront property!



Sunday evening we had our first chance for an extended observing session at Shell Mound Park. Everyone set up before dark in various places on the observing field. Bill and Mary, John and I all elected to line up along the southern side of the parking lot next to the water in order to get the best view of the southern skies, while Vic and Joan decided to set up in the northwestern part of the parking area to get a better view of the north and western skies as well

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Editors

Brian Litecky
Ron Bubany

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John Treadwell

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blitecky@yahoo.com
bubanyrc@masrepository.org

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Minnesota Astronomical Society
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P.O. Box 14931
Minneapolis, MN 55414

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MAS Officers

President: Ben Huset

E-Mail: benhuset@skypoint.com
651-631-1987

Vice President: Ben Mullin

E-Mail: benjamin.t.mullin@gmail.com
651-784-7469

Treasurer: Bob Benson

E-Mail: rrbsn@earthlink.net
952-937-5451

Secretary: Bill Kocken

E-Mail: wmkocken@hotmail.com
612-554-6712

Board Member: Jon Hickman

E-Mail: jon@thehickmans.com
763 593 3936

Board Member: Ron Bubany

E-Mail: bubanyrc@masrepository.org
320-275-1981



as the higher latitudes to the south. The Minnesota contingent again appeared to be in the majority, although we noted people from Canada, Michigan, Indiana and Wisconsin. The total size of the group was perhaps around twenty people. Although it's not a huge star party, it

appears the CKSP is popular with people from colder climates!

Monday night was our night to be skunked during this trip. It was a good night to stay inside and watch a movie. Tuesday evening was the first of two scheduled public viewing sessions at the Cedar Key State Museum. During the late afternoon hours we watched the completely overcast skies and assumed we could expect the public viewing would be a washout. As a result we arrived at the museum at just in time for the 7:00 pm lectures, with no time to set up our telescopes for public viewing. A star party attendee from Michigan gave a talk and slideshow on webcam imaging. Dan Newman gave a slideshow of the relative sizes of the planets and some nearby stars and showed images of some of the objects we hoped to see while observing this evening, followed by an impromptu walk through the winter constellations using Starry Night, after which the crowd went outside to see if we could observe anything. To our amazement, the skies had cleared to partly cloudy and were continuing to clear even more. Fortunately Dan and some others had set up their scopes for public viewing. We ran to our cars to grab our green laser pointers and help as much as we could. After a while Bill and I set up his telescope and continued public viewing until the crowd dissipated. Considering we were in the middle of town, the skies were amazingly dark. Aside from a few neighboring porch lights which were mostly obscured by trees, it was almost completely dark. We continued observing along with a couple of other star party attendees, bagging several galaxies in Leo and Sextans, until the skies clouded over about 11:30.

In addition to the daytime sidewalk astronomy, we got to do a little sidewalk amateur telescope making (ATM) while in Cedar Key. For this trip, Vic had his brand new 12" Meade Lightbridge out for its inaugural run. The Lightbridge gives great views and is an easy scope to use. The only flaw that Vic had to complain about was the bottom edge of the mirror tube would scrape against the top of the azimuth tension knob in the base when tilted near zenith. It seems the knob is about 1/8th inch too tall, causing it to bump into the bottom edge of the mirror tube. Vic had contacted Meade who said they'd send him a new rocker box base. In the meantime we looked at it and decided we could simply sand the top of the knob down until it didn't hit the mirror tube. But without sandpaper or a file, how could we sand it down? Well, this IS a Dob, and John Dobson's philosophy is to use whatever tools and materials are available to get the job done. We had the concrete sidewalk and steps to our cabins available, so



why not use them? We took the knob off and ground it on a step, sanding the top of it down until it was short enough to clear the bottom of the mirror tube. Literally, sidewalk amateur telescope making - or at least modifying!

The wind was blowing strong all day Wednesday and we hoped that it would die down for observing that evening, but unfortunately it didn't. We had cooler temperatures and strong winds all evening. We were back to observing with coats, mittens and stocking caps again. Becoming the wimp of the group, I decided to call it quits about 9:30. I was amazed to look at the car thermometer when driving back to the cabin and saw that it was still 50 degrees outside! A cool, strong sea breeze can really feel chilly!

As a compromise between a star party and a vacation, Liz and I had decided earlier that we'd check out Thursday morning and travel southeast to the Orlando area to visit the Kennedy Space Center. We spent a day and a half at KSC and would highly recommend the visit to anyone. The Vehicle Assembly Building, the view of the shuttle on its launch pad, and the chance to walk under an entire Apollo Saturn V stack is awesome. We had hoped to watch the launch of a Delta II rocket with the THEMIS satellites for tracking auroras which had been first scheduled for Thursday evening and later delayed to Friday. But less than ten minutes before liftoff on Friday the launch was scrubbed due to excessive high level winds. It was rescheduled for Saturday and did lift off on time that day, but we missed it as we were already on our way home. By Saturday evening we had made it as far north as Dalton Georgia. Although we took about two and a half days to come down to Florida, we decided to make a run for it on Sunday. We got on the road at 6:00 am and made it home by 9:45 pm the same day. From Georgia to Minnesota in one day is a long ride!

All in all, the Cedar Key Star Party is a very fun star party. You have the flexibility to observe for only a few hours and turn in early if you want, or observe all night as is common at the other regional star parties. It's attended by a small enough group that you can get to know just about everyone personally. Time slows down when you cross the bridge into Cedar Key, so you can take your time touring the town or doing some bird watching or hiking in the area. Also, Cedar Key is only a couple hours away from major tourist areas including Orlando, Tampa and Daytona Beach, so you can also play tourist if you like. We're planning to go back next year, although I found out we can get there in two days instead of three, so I'll get by using a single week of vacation for the next trip.

☛



Recommended Road Trips for 2007

By Gene Kremer

Ever notice that the sky looks different in a new place? That you can see new things even in the same objects? And that you see them differently after talking to someone who you haven't observed with before?

Those are just a few of the reasons for going to a star party or two. Some are major getaways with friends or family. Some are just a quick weekend away. And they are usually at a very reasonable cost.

One of the most popular parties for MASers is the Northwoods Star Party just east of Eau Claire, - August 10-12, 2007. This is a club that combines a park, an observatory, very respectable presenters, and lodging or camping, meals, and good folks.

<http://www.cvastro.org/events.htm>http://www.cvastro.org/event_s.htm

The second most popular destination is Jeffers Petroglyphs Starry Night, Prairie Night - July 12-14, 2007

<http://www.thudscave.com/petroglyphs/2007events.htm><http://www.thudscave.com/petroglyphs/2007events.htm>

They have exceptionally dark skies for a short drive to southwest Minnesota. This is a MN Historical Society site featuring native art and prairie information. They provide a mowed field next to the site, a public viewing night, and a grilled dinner one night, and facilities in the interpretive center. Current news on this trip can be found in the Road Trip SIG forum at

<http://www.mnastro.org/forums/viewforum.php?f=9> .

The Road Trip forum is a good place to find out about and to ask other members about astro trips. It is moderated, but primarily member run. Go ahead and post a question, offer or request.

If you are ready to go to some major events around the country, there are some good ones! Many MAS members have gone to these and could offer information. A brief list would include:

Texas Star Party - May 13-20, 2007

<http://www.texasstarparty.org/><http://www.texasstarparty.org/>

The ultimate for serious astro programs. Multiple distinguished presenters and many of the amateur astronomy heavy hitters are there. Excellent viewing with occasional high winds/storms. Prude Ranch is in a good location and lodging is moderately priced. Fort Davis is a few miles away and has B&Bs, and good food.

Rocky Mountain Star Stare - June 14th-17th, 2007

<http://www.rmss.org/><http://www.rmss.org/>

According to recent attendees, "one heck-of-a-good star party in the Colorado Rockies."

Nebraska Star Party - July 15-20, 2007

<http://www.nebraskastarparty.org/><http://www.nebraskastarparty.org/>

Awesome skies. A family vacation oriented star party. Maybe hit Jeffers on the way?

Okie-Tex - Oklahoma - October 6-14, 2007

<http://www.okie-tex.com/><http://www.okie-tex.com/>

Great viewing, big winds. See the winter, 2004 issue of Gemini.

ICSTARS Star Party - Missouri - October

<http://www.icstars.com/Ranch/starparty/><http://www.icstars.com/Ranch/starparty/>

A great, family oriented star party hosted by tour guides and photographers Vic & Jen Winter. About an hour from Kansas City. Nice folks.

But maybe you're ready for that trip of a semi-lifetime?

Star Party of the South Pacific - Australia - April 13 - 15,

2007 (just missed it...maybe next year)

<http://www.asnsw.com/spsp/index.html><http://www.asnsw.com/spsp/index.html>

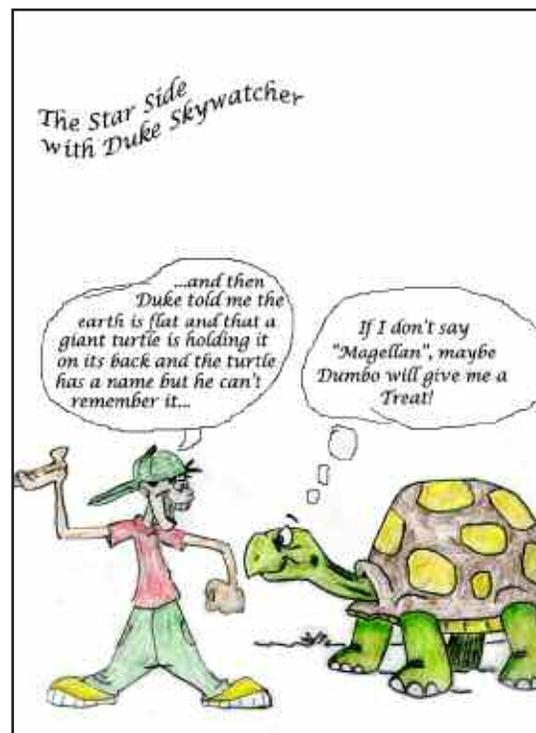
Excellent viewing and camping at a dark sky site three hours from Sydney. Good food available on-site. The best part is the friendly, knowledgeable people. Several great astro sites a few hours north. If you can go, "G'd on ya, mate!"

Southern Skies Star Party - Bolivia - July 14-21, 2007

<http://www.astronomicaltours.net/SouthernSkies/><http://www.astronomicaltours.net/SouthernSkies/> A week of awesome southern skies with a 4 star hotel for a very reasonable price. Rick Singmaster donated a 21" Starmaster that is on-site for use.

There are very many more trips that I'd like to go on (Grand Canyon in June, Oregon Star Party...). It's good to stretch yourself a bit and enjoy it in the process. Clear Skies!

Duke Skywatcher



A Little Night Lie

By Michael Kibat

The man was tall and soft-spoken. In the deepening twilight, I could barely make out the features of his face as he stood before me.

"We were wondering," he began, "if someone could help us find our star. We registered it in memory of my mother-in-law. She passed away a few months ago."

Public nights at the observatory are hectic even without such requests. How to respond? Should I rail against the evils of commercial star registry scams? Perhaps a kindler, gentler explanation of the fact that the registration carried no official weight, that it was, at best, a novelty?

As I studied the faint, anonymous star bounded by a red circle on his "official" star chart, a way out presented itself. This particular evening, the star was positioned low on the northern horizon, most likely blocked by trees and the roof of the observatory. I shared this information with the man.

"You might want to come back later this year, maybe in the fall. The star will be placed higher in the sky and more visible", I offered, selfishly hoping that after a few months interest in "their star" would fade and I could avoid addressing their request.

The man turned to his family members - the widower, the daughter and the granddaughter - with my explanation and suggestion. Minor disappointment registered in their voices. But still they remained for a brief while, enjoying the beauty and wonder of the night sky that early summer evening.

Months passed, and the memory of the family and their request faded. Until one night in October, when I overheard a vaguely familiar voice in conversation with another observatory volunteer.

"We were here a few months ago to find my mother-in-law's star", the soft voice intoned. I realized that my hope of the family's forgetfulness was futile. Forced to accept the inevitability of the situation, I slipped into the conversation and reintroduced myself.

Now, committed, I studied the star chart more carefully. The circled star was not impossibly faint - certainly well beyond the limits of the unaided human eye, but within reason given the telescopes available at the observatory. But finding the star would still be a challenge, located as it was in a corner of the sky relatively unfamiliar to me, an area not populated by any obvious stellar signposts that could provide guidance.

As I pondered my plight, a plot developed. Except for slight variations in color or more obvious differences in brightness, all stars appear as mere pinpoints of light, even in the largest and most powerful telescope. A seasoned observer might notice these characteristics distinguishing one anonymous star from another. But to the inexperienced, any star would be "their star". Selecting a random star in the general vicinity of the red circle on their chart would do. Consider it a "little white lie". Why not? What could be the harm?

I set about executing my plan by first providing them a general sense of their star's location relative to the brighter stars of nearby constellations. No deception here. My directions were legitimate. But turning to the telescope, I began my ruse in earnest. A few moments of feigned searching and pondering, a quick, arbitrary selection of a star in the eyepiece, then the fabrication. "I

believe that is your star"; I perjured, turning to face them. The dark of the night hid any facial clues that might disclose my deception.

The son-in-law stepped forward and peered into the telescope eyepiece. He had no reason to doubt the veracity of my claim and after a brief moment, he called his wife to take his place at the telescope.

"My, there are lots of stars there. Which one is it?" she asked, her eye remaining fixed to the telescope.

"The one directly in the center," I fibbed, "the pretty, blue-white one." She didn't need to know that almost all the stars visible that night were the same, common color, and equally pretty.

"Oh, that one." She seemed satisfied. As she lingered over the eyepiece, I couldn't help but wonder about the memories unwinding in her mind. Perhaps a childhood recollection of sitting on the porch of the family's cabin up north, cuddled in her young mother's lap, both quietly awed by the beauty of the northern lights. Her voice interrupted my musings. "Dad, come take a look."

The widower gazed at the field of stars, but remained silent. Once again I wondered, "What are his thoughts?" Maybe their first kiss, parked in his father's car with the full Harvest Moon gently highlighting the delicate features of her young face? Or walking hand-in-hand with his new bride along a starlit beach? He gave no indication of his thoughts, but said a simple "Thank you", and relinquished his position at the telescope to the granddaughter. She was nine or ten years old. Just tall enough to reach the telescope eyepiece and gaze into it.

"Does that star have a name?" she asked.

"Not officially", was my technically truthful reply. "What was your grandmother's name?"

She looked up at me. "Lois".

"Then let's call it 'Lois'", I gently suggested.

"'Lois'", she repeated softly as she turned back to gaze at the newly named, and suddenly more significant star. A few moments remembering her grandmother - possibly a memory of helping bake star-shaped sugar cookies at Christmas - then her turn at the telescope came to an end.

As during their first visit, they lingered a while, asking questions about the night sky and enjoying the quiet serenity of the twinkling stars. Then, the unexpected. The daughter stepped forward, gathering me into a heartfelt embrace of thanks.

"Thank you," she muttered with some emotion, "this was wonderful." A handshake from the son-in-law and the widower, and they disappeared into the darkness.

Did I do a disservice with my little white lie? Should I have seized the opportunity to make them better consumers by explaining the mercenary realities and practical limitations of commercial star registry ventures? I think not. And if the opportunity ever presents itself again, I'll not hesitate to respond with a similar little white lie. For not all astronomical answers need be technically true or scientifically accurate to achieve an honorable goal. A little white lie is sometimes more appropriate for those who seek solace, and not science, under the night sky. ■

Astronomy Day 2007

By Jon Hickman

Daylight Saving Time has come, Spring is in the Air, that can only mean one thing! You guessed it! Astronomy Day is right around the corner! Save Friday evening, April 20th and all day Saturday, April 21st to celebrate this annual event.

This year, the Minnesota Astronomical Society will again be hosting members and the public with a wide variety of programs at our Onan Observatory location in Norwood-Young America. On Friday, April 20th, we will open the observatory (weather permitting) by 7:00pm and run video and visual observing sessions until 11:00pm. On Saturday, we roll back the roof at noon (again, weather permitting) to enjoy spectacular solar views through our dedicated solar binoculars and telescopes, and we'll keep viewing until at least 11:00pm. Both days will also offer presentations on a wide variety of astronomical topics such as: The Constellations; Viewing Deep Space Objects; Double Stars; Astrophotography; and How to Get Started in Astronomy.

In addition to the events at Onan Observatory, some of our Outreach Members are hoping to put together a smaller Urban Viewing Event on Friday evening. The plan would be to set-up some telescopes in a downtown location and do some good, old

Beginner's Special Interest Group - April 2007

By Jackie LaVaque

It's hard to believe that spring's right around the corner, but it is, and you know what that means — so is Astronomy Day! This year's Astronomy Day is on April 21, 2007, and the MAS Beginner's Special Interest Group (BSIG) will be hosting our April meeting at Onan concurrent with other A-Day events. To top it all off, we'll also be hosting a cookout for participants, presenters and the BSIG at the Baylor picnic pavilion. We'll be grilling burgers and hotdogs, and will provide chips and other snacks. Since we'll be outdoors for this meeting, let's hope for clear skies so we can actually do some observing of spring sky

ATM SIG Update:

By Ben Mullin

The ATM SIG has been rolling along with meetings approximately every other month now. By the time you read this the most recent meeting will have already occurred. The meeting will hopefully feature a show and tell session with the new drive corrector for the Cherry Grove 16" and a spectrophotometer that sounds like it will need a little help to be suited for astronomical purposes.

The next meeting after this publication will be May 23rd at 7:00 p.m. at Bill Volna's shop (www.volnaengineering.com). It is possible that there will be a live aluminum casting demonstration at this upcoming meeting. If not this meeting then the

fashion, sidewalk astronomy! This effort will get even more traction as this year, The Astronomical League is planning two separate Astronomy Day Celebrations! On September 15, 2007 the first ever Fall Astronomy Day will be celebrated. The MAS Board and our Outreach Chairs have decided the September 15th event will be dedicated especially to Urban and Suburban Astronomy. While details are still in the planning stages, the hope is to have at least one urban or suburban location on each the Minneapolis and St. Paul sides of the river staffed and running that afternoon and evening.

For new members of the MAS, this is a great opportunity to check out our Onan facility, meet and greet other members and get insight on equipment. Typically, many of our members will bring and set-up their own astronomical equipment on the observatory grounds, giving all the opportunity to see through a variety of sizes and types of telescopes and binoculars.

For long time members, this is a great opportunity to share your knowledge and passion with the public and other members. Astronomy Day is also a great opportunity to include your family and friends in your hobby.

This year, Mike Kibat and Jon Hickman have volunteered to be our Astronomy Day Co-Chairs. They encourage you to watch the forums and email lists for announcements and the opportunity to volunteer as we get closer to the dates. 🐾

delights. There is a lot to look at in the springtime night sky. Bring your scope, binoculars, star charts, and any questions you might have.

The BSIG plans to hold our every-other-month meetings concurrent with the Metcalf star parties through the fall. Check out the star party schedule on the MAS website for dates and times: <http://www.mnastro.org/events/showparties.php>.

As always, the BSIG forum at the MAS website is open 24/7. Feel free to post new topics, your questions, or ask for assistance with any conundrum you might be having with observing or astronomy equipment.

Hope to see a bunch of you at Onan on Astronomy Day! 🐾

yet to be scheduled meeting for July.

As always, I'm interested in hearing what you would like to see from the ATM SIG or better yet, what you might be interested in sharing with the SIG. Although we've strayed away from the traditional optics discussions of the past, I'm willing to try and drive some attention back that way if there is interest. I haven't heard of a single person interested in another mirror grinding workshop so unless I hear from interested parties, I'm going to let it rest, just as my mirror grinding project is doing.

Ben Mullin ATM SIG Coordinator 🐾

Virgo Venture - April 13th

By Bill Kocken, Observing Chairman

"This is the most famous cluster of galaxies. It is much larger than any other group within 100 million light years. There are about 150 large galaxies in this cluster and at least a thousand known dwarf galaxies. This cluster completely dominates our tiny corner of the Universe, and even our Local Group of galaxies is being gravitationally pulled by this cluster. At the core of the Virgo cluster lie the three large elliptical galaxies M84, M86 and M87. These galaxies were probably formed from the merger of many smaller galaxies and are much more massive than our own galaxy." (Reference 1). The photo to the right shows at least 8 of the messier galaxies in a 4 degree by 4-degree central area.

The Virgo Cluster of Galaxies isn't just some distant, far-off clump of faint fuzzies discovered by the Hubble telescope staring into space for 100 hours. No, the Virgo Cluster is something that almost any amateur astronomer can enjoy. Charles Messier cataloged 16 galaxies in the cluster. They lie approximately 60 million light years distant, with magnitudes between 8.8 and 10.2. All it takes to observe them is a 3 1/2-inch or larger scope, reasonably dark skies, and a plan. The optimum time to see these galaxies is in the spring, when the constellation Virgo reaches its maximum altitude in the south before midnight. The hardest thing about observing these galaxies is that it can be easy to get disoriented and confused about which galaxy it is you're looking at. Even Goto scopes or digital setting circles can't always definitively point to a particular galaxy because some of them are quite close together in the eyepiece.

Since these galaxies are so densely packed together, how do you make the plan? The best resource I've seen is a detailed finder chart and instructions put together by our own "Messier Madman", Greg Haubrich. I will not reproduce his chart or his helpful guidance here. Greg wrote a very nice, detailed article in the winter 2004 edition of Gemini. It can be downloaded from the MAS website at: www.mnastro.org/gemini/files/gemini_2004winter.pdf. Another good resource is the SEDs site at

www.seds.org/messier/more/virgo_obs.html. They have several other suggested routes through the Virgo Cluster.

Of course, no good observing opportunity should pass without a star party to celebrate it. On April 13th (with the 14th as a backup), we will host the 3rd (or is it 4th or 5th?) Annual Virgo Venture Star Party at Cherry Grove. We will have Virgo Bingo, prizes, Greg's finder charts, warm beverages and the best bunch of amateur astronomers around. In case the 16 galaxies in Messier's catalog aren't enough, we'll have the 24" Starmaster up and running. The entire list of 150 should be theoretically possible in that "BAD" boy. Join us on the 13th.

(1) Source : <http://www.atlasoftheuniverse.com/virgo.html>)

DSS photo from same source



30 Years Ago in Gemini

From the archives of Bob Schmidt

Minutes of the regular meeting of Tuesday, April 5, 1977

Lauren Nelson spoke next on club activities. There will be an observing session at the Metcalf Nature Center on Friday, April 22. In case of inclement weather, the following night, Saturday, April 23 will be the date. Lauren reminded us not to forget the Thursday night astronomy talks held right here in the auditori-

um. The schedule of remaining talks is as follows:- Thursday, April 7th, James Rahn will speak on "mars". On Thursday, April 14th, Lauren will speak and show a film on the "Sun". On Thursday, April 28th Kevin Marx will speak on the "Developing Universe", and on Thursday, May 5th, Dave Schumann will speak on "Bizarre Celestial Objects". The talks start at 7:30 P.M. These talks are open to the public and are sponsored jointly by the Museum and the Twin City Astronomy Club.

Onan Observatory Workshop for Imagers

By Russ Durkee

Over the last few years, Onan Observatory has been fortunate to have been the recipient of a number of generous donations. It is a very exciting time in the history of the club. We have state of the art video systems in place that allow large groups of people to view live, close up images of the moon, stars, galaxies and planets. It has changed the way we do public outreach at Onan. But now, it is time to take it a step further. On April 7, 2007, MAS will be hosting a workshop in which members will learn how to use the two Paramount based systems to take images of their own. Attendees will be trained on how to use the Bisque Paramount

equatorial mounts and telescopes.

In addition a variety of other subjects will be presented including configuration and imaging with the Stella and Planet Cams, piggyback astrophotography, webcam imaging, imaging with a digital SLR, autoguiding, and CCD imaging with the Onan STV camera. The workshop will include time for hands-on experience with the hardware and will practice under a clear sky (weather permitting). Space will be limited to assure plenty of hands-on time with the equipment. It should be a fun day.

Hope to see you there!

To register contact: Russ Durkee at russdurkee@earthlink.net or call 612-929-7905.

MAS Board Meeting Summary, January and February 2007

By Bill Kocken, MAS Secretary

2007 is off to a great start. Our first meeting was one of the most important of the year. Bob Benson, our treasurer, presented the annual budget. Revenues are projected to be \$12,443, mostly generated by membership dues from 367 members and donations from our generous patron members. We plan to spend \$9,563 of it and put \$2,880 into the special project funds. Our biggest expense every year is the printing and mailing of this newsletter, the Gemini. Since this is the one communication that every member sees, it is a vital part of the workings of the MAS. Other large budget expenses are costs necessary for insurance, electricity at our sites, meeting costs and dues paid to the Astronomical League.

In addition to the run-the-business items, the board approved \$2,570, out of the special project fund, for improvements at our Cherry Grove site. The main improvements will be landscaping on the eastern side of the property to increase parking space, additional light shielding and a new storage shed to replace the old one. There is also funding available to add a drive corrector to the 16" equatorial scope and for more accessories for the 24" Starmaster. As Vic Heiner, the Cherry Grove site manager says, Cherry Grove is the one site that the club owns outright and it's very important to invest some funds there in order to make maximum use out of it.

The club will be acquiring a new LCD projector for use at Onan and for outreach activities. This will put us firmly into the 21st cen-

tury in our ability to put on exciting multi-media presentations.

Expenses for the Onan Observatory are paid for out of a separate fund, derived from donations from the Onan foundation. We reviewed the Onan budget for operations and equipment. The project to put in a paved, handicapped-accessible drive to the observatory is still proceeding slowly. We signed a contract for our consultant to develop a plan and cost estimate for the project.

At the February meeting, Onan items were key parts of the discussion. Dave Olmstead will continue on for another 2 year term as Onan committee chair. We appreciate all of the tremendous effort he's put in with the expansion of the equipment and maintenance and improvements to the site. Thanks Dave!

Mike Kibat and Jon Hickman have agreed to be co-chairs of our Astronomy Day activities. Astronomy Day is April 20 and 21st. Mike and Jon will be putting out a call for volunteers for this event. With all of our new equipment and the success of Public Nights at Onan last year, A-day promises to be a busy one this year. Please consider how you can help out!

I'd like to thank Mike Kibat, Steve Emert and Greg Haubrich for their service on the board for the last term. As board members, they've left big shoes to fill. Though no longer on the board, they continue to serve and help out in numerous and important ways.

2007 promises to be a busy year for the MAS. We're making site improvements at Cherry Grove, we're branching out to the north with our arrangement with the Long Lake Conservation Center, we've added a new telescope platform at the Onan Observatory, and we have ever more outreach opportunities. It's going to be fun. ▀

Spectroscopy Corner "The VSPEC Program"

By Ron Bubany

Do you find stars boring to observe? If so, it's understandable. After all, stars only show up in your telescope as small points of light with no visible features except possibly for color or an occasional double. Most likely you are quick to move on to more interesting deep sky or solar system objects.



Actually, stars can be very interesting objects if you have a way of looking under the hood. There are a tremendous number of variations among the stars including color, size, composition, temperature and motion - just to name a few. And now with the advent of affordable amateur spectroscopes, more and more amateur astronomers are focussing in on the stars and bringing a whole new level of excitement to observing the nighttime sky.

There are at least three reasonably priced spectroscopes you can

now acquire without opening a second mortgage. They include the DG Spectroscopes from Spectral Optics, the RS Spectroscope from Rigel Systems and the Star Spectroscope from Rainbow Optics. Any of these will enable you to analyze the stars for spectral class, composition and in some cases orbital period of binary stars.

But this article is not about product reviews, so I'll leave it to you to learn more about the various spectroscopes on your own. You can obtain the information on these products by visiting the appropriate web site:

Spectral Optics	www.vreh.com
Rigel Systems	www.rigelsys.com
Rainbow Optics	www.starspectroscopy.com



So let's say you go ahead and purchase a spectroscope. Immediately, observations of stars are escalated to a whole new level of fascination. You observe color spreads (spectra) running from blue to green to red. Within these bands of color you are able to see dark lines representing chemical elements. You start making educated guesses about the spectral classes of the stars being observed.

But you can do more!



Astronomers around the world use a software program called Visual Spec or just “vspec”, to analyze stellar spectra. With this program they can identify many properties of the stars including spectral class, element composition, radial velocity and in the case of novae, the rate of expansion. This program plots your spectral photographs into graphs that can be saved and/or printed. It can correct for the response deficiencies of your camera. It will even animate a series of graphs that you have created for binary systems so that the period of rotation can be observed visually.

And vspec is FREE! You can get it at www.astrosurf.com/vdesnoux/download.html.

When you download vspec you not only get the program but also a valuable set of reference files such as a collection of spectral

classes, a dictionary containing over 5000 of the absorption wave lengths of the various chemical elements, and even spectral profiles of some of the more prominent stars. With all of these files, you have everything you need to practice using the program without having to capture your own spectra.

Although vspec can support many useful functions, you should realize that some of them require very high-resolution spectra that can only be obtained using expensive spectroscope systems. Nevertheless the program can still be useful for the amateur. Using one of the spectroscopes identified in this article you could certainly use the program to plot your spectra, identify its spectral class, calibrate it from pixels to wave lengths (Ångstroms), and even identify chemical elements in the stellar atmosphere.

Vspec was written in France which means that its “help” files have been translated. Any of you who have a Japanese camera are quite familiar with what Japanese English reads like. Well, for the vspec system you are forced to read French English which is just as bad. Things are not always as clear as you would like.

So you might want to download the excellent tutorial below which will help you immensely with learning the various features of the vspec program. It can be found at this address:

www.astrosurf.com/vdesnoux/tutorial.html.

Let's begin!



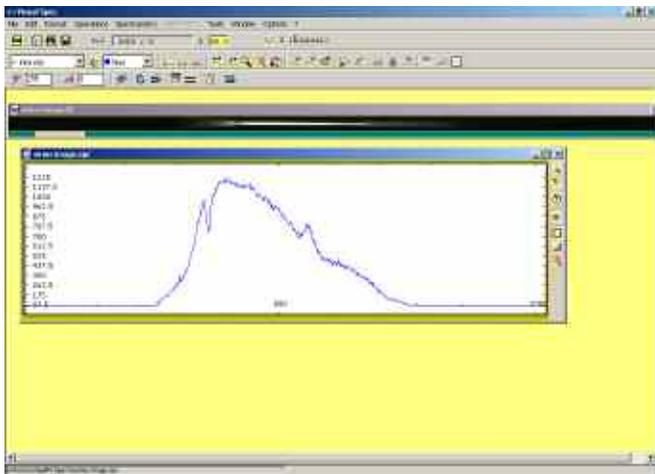
Let's assume that you have photographed your spectra and used image-processing software to rotate the spectral line to a horizontal position. Also, you have cropped the image down to just the line so that you end up with an image like the one above, which happens to be from Sirius.

OTHER THAN ROTATION AND CROPPING, DO NOT FOOL AROUND WITH THE IMAGE. ANY ADJUSTMENTS, ESPECIALLY TO BRIGHTNESS AND/OR CONTRAST, WILL SCREW UP THE SPECTRAL ANALYSIS ROYALLY.

Now we need to save this image in a format that vspec can handle. Only a few programs can create the type of “fit” file that vspec requires. One of the free ones is IRIS and you can get it at <http://astrosurf.com/buil/us/iris/iris.htm>.

Using IRIS, load the spectral image and then save it back to storage as a “.fit” file. This is all you need to do. You can shut down IRIS and start up the vspec program.

Please note that the following explanations are general in nature and not intended to be detailed instructions for using the program. For that information you should refer directly to the program documentation and the tutorial.



Now you can use vspec to open your spectral image. Once you have done so, click on the “binning” button and vspec will plot your spectrum into a graph with pixels running across the bottom and intensities running up and down. The number of pixels running across the X-axis is exactly the same as the resolution of your camera when you took the image. The result should look similar to the picture to the left:

Now that we have a graph of our spectrum, we need to calibrate it. By that we mean that the X-axis needs to be converted from pixels to wavelengths, scientifically known as Ångstroms. There are several ways to do this:

1. If you can identify two lines in the spectra, you can input their wavelengths to vspec and the program will perform the calibration.
2. If you can only identify one line in the spectra, but you know the ratio of Ångstroms to pixels of your image, then you can tell vspec the wavelength of the known line and also the Ångstrom to pixel ratio. From this info vspec can do the calibration.

3. If you can't identify any lines you can ask vspec to display a graph of the spectral class for the star you imaged. By comparing

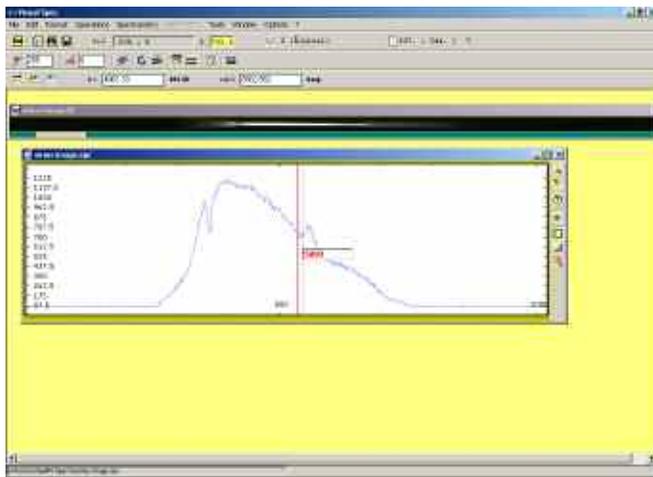
this spectral graph to the one of your image, you might just be able to identify one or two lines. If so, then use one of the preceding methods to perform the calibration.

4. Finally, vspec has a way to superimpose a “reference” spectrum on your graph. You can then use the known wavelengths of the reference spectrum to calibrate your target spectrum. For example, I use the spectrum of a high-pressure sodium streetlight lying across the lake from my house. This is the method you MUST use if you intend to measure Doppler effects.

Stars in our galaxy are all moving in various directions at various speeds. Because of this relative motion to earth and the resulting Doppler effect, the wavelengths of the various elements in the spectrum will not be equal to the exact value of that which would be obtained from a motionless light source. For stars in our local galaxy, these shifts represent only a fraction of one Ångstrom. This difference is so much smaller than the resolution capability of our amateur equipment, that we can just ignore it. On the other hand, if we were able to analyze distant galaxies, there is no way that we could ignore Doppler as it can involve shifts of several to hundreds of Ångstroms.

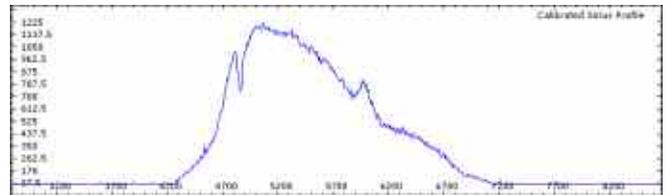
Let’s do method 1 first (make sense?).

It happens that I am a genius and therefore know that the two dips in the Sirius spectra are the H-beta absorption line in the blue end and the sodium absorption line toward the orange/red end. These would be Ångstroms 4861 and 5890 respectively.



So we enter the two references into vspec. To the left we have already entered the H-beta and are now entering the Sodium wavelength.

This gives us the calibrated profile showing the wavelengths (Ångstroms) along the X-axis.

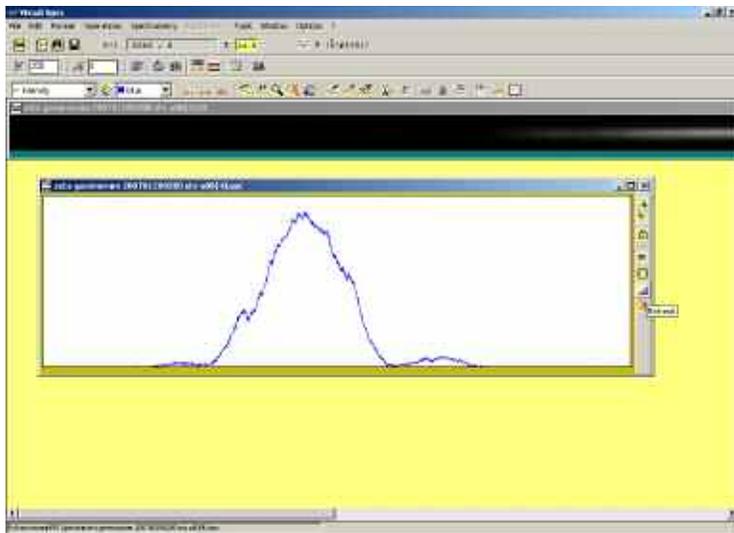


The pixel position is not lost, however. It just is not showing in the graph. It does reveal itself, however in a text box in the vspec header. As you move the cursor across the graph, this text box displays both the pixel displacement and the wavelength for the current position of the cursor. We can use this information to calculate the Ångstrom to

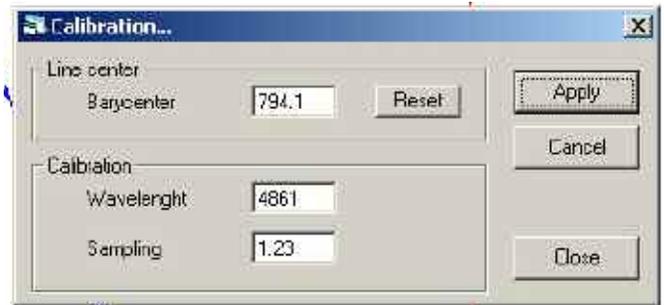
pixel ratio of our graph. Just jot down two positions, such as 500px:1000Å and 1000px:2000Å. A little bit of arithmetic and you can calculate the ratio. For this hypothetical and simplified example it turns out to be 2 Ångstroms per pixel.

This leads us to method 2!

Take a look at the following spectrum of Zeta Geminorum, spectral class F:

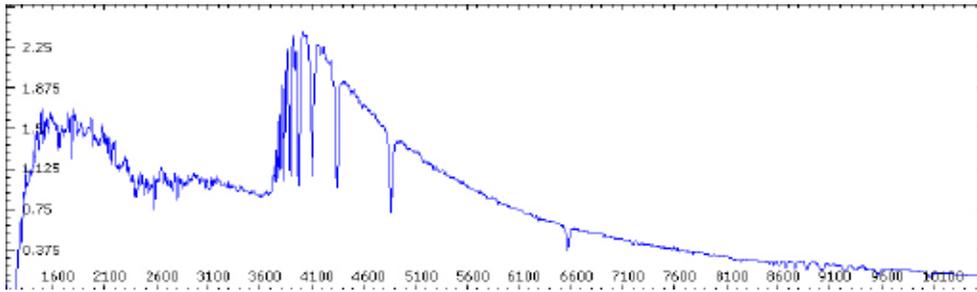


Here we see only one “dip” in the spectrum. Not enough to calibrate using method 1. Not to worry, however, as we can use the ratio calculated from Sirius to calibrate this particular spectrum. Instead of entering two plot points on the graph, we enter only one point (the H-beta line) and then specify the Ångstrom/pixel ratio as shown below:



Once these parameters are entered, vspec calculates the wavelength values and updates the chart. Calibration completed!

Method 3



It is not unusual at all to capture a spectrum for which you are unable to identify any of the absorption lines. Or, perhaps it is a “continuum” showing no absorption at all. In method 3 we are theoretically able to perform calibration, although I honestly have not had much success with it.

What you do is open up the vspec-supplied spectra for the various classes of stars and try to find one that matches your spectrum. Above left is a vspec plot of stellar class K05 as an example:

Notice that this spectrum covers a quite large electromagnetic range, whereas your spectrum would only be covering the visible range running from about 4000 to 7000 Angstroms. So when you compare the sample spectrum be sure to only consider the lines between these two end points.

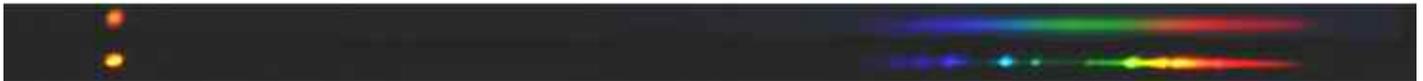
Notice further that this spectrum is not shaped at all like yours. It runs rather smoothly down from left to right in the visible portion of the spectrum. Your spectrum looks more like a bell curve. The reason for this difference is that cameras, especially the CCD varieties, are weak in the blue end of the spectrum and also weak in the red end, usually because they have an IR filter installed. Thus, the intensities fall off at both ends of the graph and you have the resulting bell curve.

Anyway, try to match the absorption lines in the sample to the lines contained in your image. If you are lucky, you will find a match sooner or later and then can use the wavelengths of these from the sample to enter in as parameters against your own spectrum.

Done!

Like I say, I have not had much luck with this method, but I try it every now and then anyway.

Method 4, the way the big boys do it!

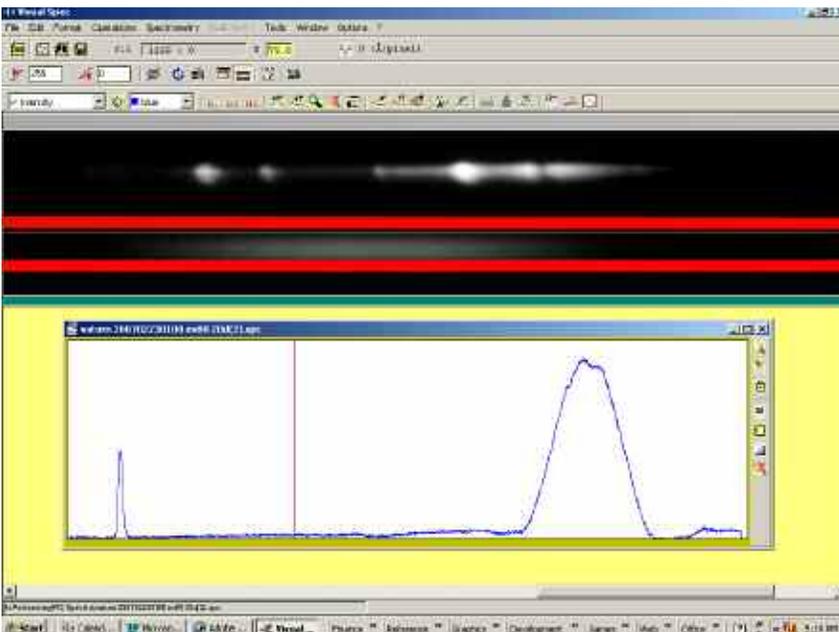


The methods we have been using so far are faulty in that they ignore the fact that stars are moving with respect to the earth. Thus, if we enter the wavelength of the H-beta line as 4861.33 our calibration will be incorrect. And that is because the target star is moving and the actual wavelength, due to the Doppler effect, is not 4861.33 but rather a higher number if the star is receding and a lower number if the star is approaching.

So what do we do?

The answer is to use a reference spectrum from a light source with a known emission spectrum. With vspec we can then superimpose the reference on top of our graph and then enter the reference known wavelengths to finish the calibration.

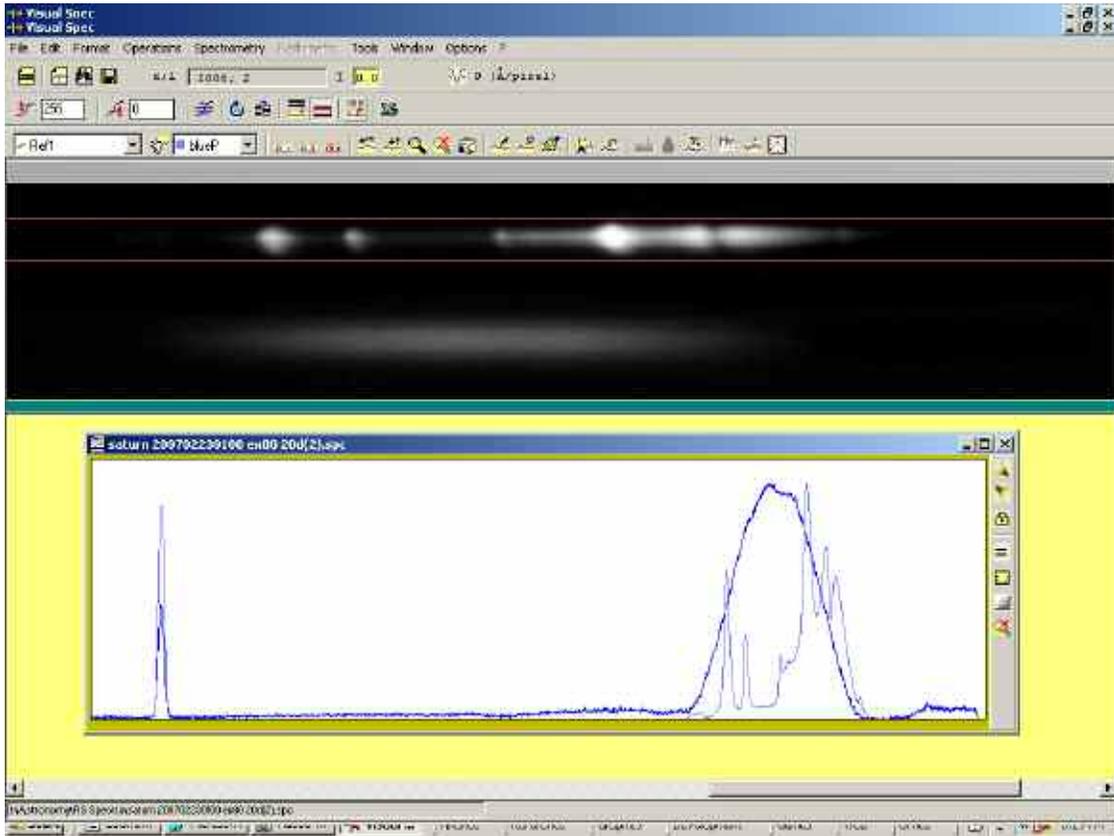
Expensive spectroscopes capture and align a light source and a target source automatically but we are not so fortunate. All we can do is take a separate photograph of a light source with known properties and try to match it to our stellar spectra.



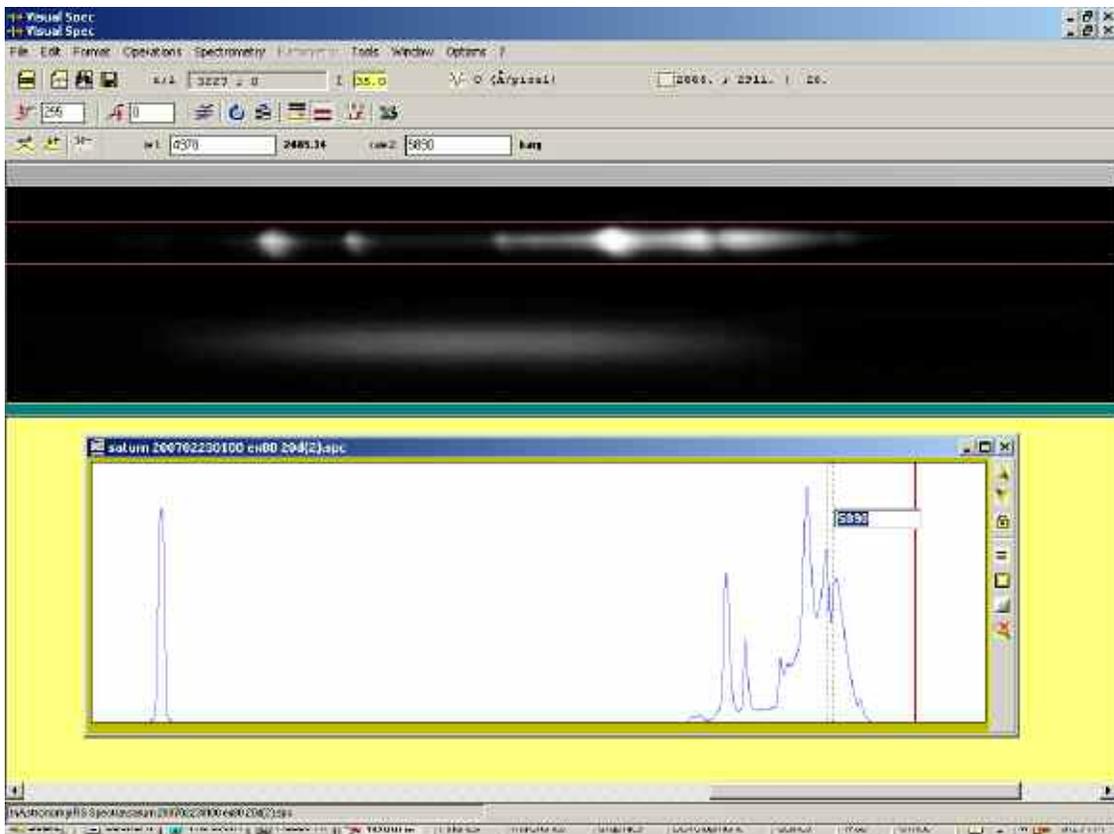
How do we know how to align the reference spectrum to the target spectrum? The answer is to capture the light source as well as the spectrum on the chip and match up the two light sources. This has been done in Photoshop in the example at the beginning of this section. See how I have aligned the sodium lamp source directly under the Saturn light source? This has ensured that the two spectra are in their correct positions.

Now we open the image of the spectra into vspec. Then we select the Saturn spectra and click the “binning” button to get a graph. In the image to the left we have drawn a selection line around the Saturn image and generated our plot.

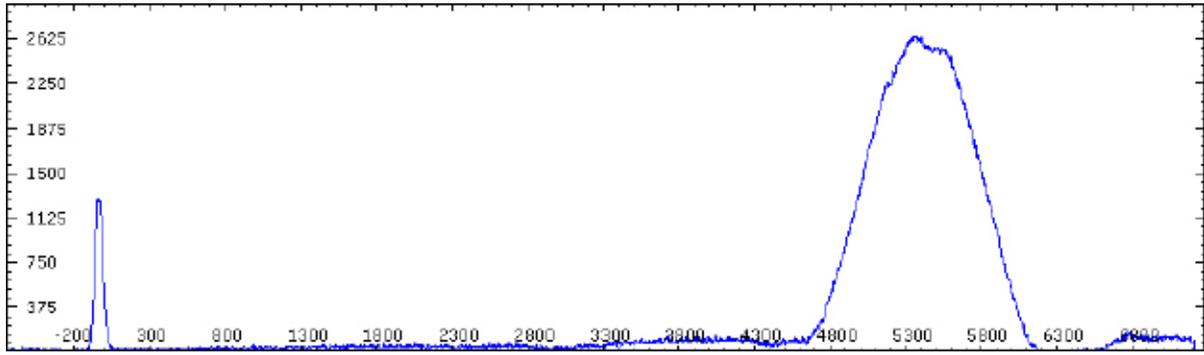
Next we select the Sodium Lamp spectrum and click the “Reference” icon in vspec. This generates a plot of the sodium spectrum on top of the Saturn graph.



Each of the “spikes” of the sodium lamp spectrum has a known value. In the image below we have already entered one of them and are just now entering the wavelength of the double sodium line at 5890\AA .



And thus we complete the calibration.



Summary

In this article we have become familiar with the vspec program and observed how four different methods can be used to calibrate wavelengths of our spectra. Three methods are good enough for simple analysis and a fourth method is much more accurate and therefore is the one to use if we wish to analyze Doppler shifts and calculate stellar radial velocities.

There are a lot of useful things we can do with vspec. These include adjusting for our camera's response curve, identifying the chemical elements in the spectrum, monitoring stars for periodic variations, generating synthesized spectra and more. We'll touch on all of these capabilities in upcoming issues of Gemini. So keep an eye out for "Spectroscopy Corner" each time you receive your copy of Gemini.



Onan Public Night Schedule

Public nights are scheduled for Saturdays only. Astronomy Days are Friday evening and Saturday. Public Nights and Astronomy Days are held whether it is clear or cloudy. For Directions to the Onan Observatory, at Baylor Regional Park, please see the Star Party Schedule

Date	Starts	Ends	Comments
4/14/07	7PM	10PM	Public Night at Onan
4/20/07	7PM	11PM	Astronomy Day at Onan
4/21/07	Noon	11PM	Astronomy Day at Onan
4/28/07	7PM	10PM	Public Night at Onan
5/12/07	7PM	10PM	Public Night at Onan
5/26/07	7PM	10PM	Public Night at Onan
6/9/07	7PM	10PM	Public Night at Onan
6/23/07	7PM	10PM	Public Night at Onan
7/14/07	7PM	10PM	Public Night at Onan
7/28/07	7PM	10PM	Public Night at Onan
8/11/07	7PM	10PM	Public Night at Onan
8/25/07	7PM	10PM	Public Night at Onan
9/8/07	7PM	10PM	Public Night at Onan
9/22/07	7PM	10PM	Public Night at Onan
10/13/07	7PM	10PM	Public Night at Onan
10/27/07	7PM	10PM	Public Night at Onan
11/10/07	7PM	10PM	Public Night at Onan
11/24/07	7PM	10PM	Public Night at Onan

For maps and further details about the sites, please go to our website at www.mnastro.org/facilities.

Baylor Regional Park

To reach Baylor Regional Park, head west on Minnesota Highway 5, through Chanhassen and Waconia, to the town of Norwood-Young America. Turn right onto Carver County Road 33 and continue approximately two miles north. Baylor Regional Park is on the right side of the road, marked with a prominent sign. When entering the park, stay to the right and follow the road approx 1/4 mile.

When visiting the Baylor Regional Park, MAS members are requested NOT TO PARK OR DRIVE on the grass. There is a parking lot just past the observatory.

For an alternate route from the southern suburbs, take U.S. Highway 212 west to Norwood-Young America. Turn right at the second traffic light onto Carver County Road 33. Continue two miles north to the park entrance.

For an alternate route from the northern suburbs, take Minnesota Highway 7 west approximately 30 miles from I-494. Turn left to go south on Carver County Road 33. Approximately 8 miles south, Baylor Regional Park will be on your left after a short series of curves.

Cherry Grove Observatory

Cherry Grove is located south of the Twin Cities, in Goodhue County, about 20 miles south of Cannon Falls. To reach Cherry Grove, head south on Highway 52. On 52 about six miles south of Cannon Falls, and just past the Edgewood Inn, is a large green highway sign for Goodhue County Rd. 1 "WEST". Turn right, and follow County 1 straight south for about sixteen miles until you arrive at a "T" intersection with County A. The observatory is immediately at your right, nestled in the shoulder of the "T". Parking is permitted on the site or along the road, preferably on County A.

Metcalf Observing Field

To reach Metcalf, head east from St. Paul along Hwy. 94. About four miles east of the I-694 / I-494 crossing is Minnesota State Highway 95, also known as Manning Avenue (exit 253). Turn south (right turn) and then almost immediately turn left onto the frontage road (Hudson Road S). Continue east on the frontage road for about one and one-half miles. Turn right onto Indian Trail, checking the odometer as you turn. Follow Indian Trail south for just about one and one-tenth miles, where you'll see an unmarked and unlocked chain-link gate on the right, opening onto a dirt driveway with a slight up-slope. This is the the entrance to Metcalf.

Long Lake Conservation Center from Western Twin Cities

Take I-94 west to Rogers/MN 101. Go north/right on MN 101 through Elk River, where MN 101 becomes US 169. Continue north on US 169 approximately 90 miles to Aitkin. At stoplight in Aitkin, turn east/right onto US 169/MN 210 and go out of town eight miles. Then turn east/right, following MN 210 toward Duluth. Proceed seven miles. A large green highway sign marks the turn off 210 to Long Lake Conservation Center. Turn north/left on County Rd. 5. After three miles, turn east/right on gravel County Rd. 88. It is approximately one mile to the LLCC gate.

Long Lake Conservation Center from Eastern Twin Cities

Go north on I-35 to Finlayson/Exit 195. Turn west/left and go one mile to County Rd. 61 and MN 18. At stop sign turn right/north and go two miles. Follow MN 18 west/left and continue 19 miles to MN 65. Turn north/right on MN 65 and proceed 30 miles to McGregor. Intersect with MN 210 and follow 210 west/left (through McGregor) for seven miles. A large green highway sign marks the turn off MN 210 to Long Lake Conservation Center. Turn north/right on County Rd. 5. After three miles, turn east/right on gravel County Rd. 88. It is approximately one mile to the LLCC gate.

Minnesota Astronomical Society 2007 Star Party Schedule

Date*	Location	Special Event	Long Lake Conservation Center Dates**	Astronomical Twilight Begins	Moon Rise	Moon Set	Moon % Illuminated
6-Apr	Onan			9:31 PM	12:26 AM	8:04 AM	89%
13-Apr	Cherry Grove	Virgo Venture at CG	13-Apr and 14-Apr	9:42 PM	4:45 AM	3:19 PM	24%
20-Apr	Metcalfe		20-Apr and 21-Apr	9:55 PM	7:59 AM	12:55 AM	19%
4-May	Metcalfe			10:22 PM	11:22 PM	6:41 AM	97%
11-May	Cherry Grove		11-May and 12-May	10:36 PM	3:10 AM	2:17 PM	38%
18-May	Onan			10:50 PM	6:39 AM	11:38 PM	3%
8-Jun	Onan		08-Jun and 09-Jun	11:27 PM	1:34 AM	1:21 PM	53%
15-Jun	Cherry Grove		15-Jun and 16-Jun	11:34 PM	5:22 AM	10:18 PM	0%
22-Jun	Metcalfe			11:37 PM	1:33 PM	1:00 AM	47%
6-Jul	Metcalfe			11:29 PM	12:19 AM	12:27 PM	66%
13-Jul	Cherry Grove		13-Jul and 14-Jul	11:20 PM	4:11 AM	8:56 PM	2%
20-Jul	Onan		20-Jul and 21-Jul	11:08 PM	12:24 PM	11:35 PM	31%
10-Aug	Cherry Grove		10-Aug and 11-Aug	10:25 PM	3:08 AM	7:33 PM	8%
17-Aug	Onan		17-Aug and 18-Aug	10:10 PM	11:14 AM	9:57 PM	17%
24-Aug	Metcalfe			9:54 PM	6:18 PM	1:33 AM	80%
7-Sep	Onan		07-Sep and 08-Sep	9:22 PM	2:10 AM	6:08 PM	18%
14-Sep	Cherry Grove	Mini Messier Marathon at CG	14-Sep and 15-Sep	9:07 PM	10:07 AM	8:21 PM	7%
21-Sep	Metcalfe			8:52 PM	4:50 PM	1:00 AM	65%
5-Oct	Onan		05-Oct and 06-Oct	8:24 PM	1:14 AM	4:39 PM	31%
12-Oct	Cherry Grove		12-Oct and 13-Oct	8:11 PM	9:01 AM	6:48 PM	1%
19-Oct	Metcalfe			8:00 PM	3:19 PM	12:28 AM	49%
2-Nov	Onan		02-Nov and 03-Nov	7:40 PM	1:00 AM	3:06 PM	46%
9-Nov	Cherry Grove		09-Nov and 10-Nov	6:32 PM	6:58 AM	4:17 PM	1%
16-Nov	Metcalfe			6:26 PM	12:48 PM	10:28 PM	33%
30-Nov	Metcalfe			6:18 PM	11:24 PM	12:30 PM	63%
7-Dec	Cherry Grove			6:18 PM	5:55 AM	2:48 PM	6%
14-Dec	Onan			6:18 PM	11:16 AM	9:31 PM	19%

* The Onan, Cherry Grove and Metcalfe Star parties take place on the date listed in the schedule above, which is always a Friday. If the event is clouded out, the following night is used as a backup.

** LLCC events are for members only. Vehicle ID card is required - contact Board of Directors or Dark Sky Committee members for a pass.

Due to the relative distance and driving time to LLCC, in 2007 the MAS will include both Onan or Cherry Grove and LLCC parties on LLCC weekends in order to accommodate those who can take the time to travel to very dark skies as well as those who wish to observe closer to home. LLCC weekends will include both Friday and Saturday night.

This schedule is subject to change. You can also check the MAS online calendar at www.mnastro.org/events for a complete schedule of all MAS star parties, Onan Public Observing nights, monthly meetings and other events.

In 2007, daylight saving time begins on March 11 and ends on Nov 4. The times listed above are adjusted for DST.

Onan Public Nights are shown on a separate schedule.



MN ASTRONOMICAL SOCIETY

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How to pay your dues

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

To Renew Your Sky and Telescope Subscription

If you 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 \$32.95) to the MAS Membership Coordinator at: Minnesota Astronomical Society, Attn: Membership Coordinator, P.O. Box 14931, Minneapolis, MN 55414. Make your check 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.