STAR STUFF

The Newsletter of the Ford Amateur Astronomy Club

Volume 24, Number 4 April 2014

In This Issue

Page One

The Power of the Sun's Engines

By Dr. Ethan Siegel

Here on Earth, the sun provides us with the vast majority of our energy, striking the top of the atmosphere with up to 1,000 Watts of power per square meter, albeit highly dependent on the sunlight's angle-of-incidence. But remember that the sun is a whopping 150 million kilometers away, and sends an equal amount of radiation in all directions; the Earth-facing direction is nothing special. Even considering sunspots, solar flares, and long-and-short term variations in solar irradiance, the sun's energy output is always constant to about one-part-in-1,000. All told, our parent star consistently outputs an estimated 4 × 1026 Watts of power; one second of the sun's emissions could power all the world's energy needs for over 700,000 years.

(continued on Page 3)

President's Article

By Tim Campbell

Here's a topic that comes up over and over again on astronomy forums. I've noticed an increasing number of queries on astronomy forums from people who want to get into astronomy… but want to get into astronomy and do imaging right away. I find myself writing a lot of replies on this topic. So many, that I feel I should really write one long, comprehensive reply and then whenever I see the question come up again (which happens about twice per day) I can just provide a link and say "Here, read this."

In this article, I'll discuss a few general rules that can help anyone get started in fairly easy entry-level imaging, and then mention ultimately how you can get access to more advanced imaging equipment without actually spending any money at all.

(continued on Page 2)

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Club Information:

The Ford Amateur Astronomy Club(FAAC) meets on the fourth Thursday each month, except for the combined November/ December meeting on the first Thursday of December - at Henry Ford Community College Administration Services and Conference Center in Dearborn. Refer to our website for a map and directions (www.fordastronomyclub.com).

The FAAC observes at Spring Mill Pond within the Island Lake State Recreation Area near Brighton, Michigan. The club maintains an after-hours permit, and observes on Friday and Saturday nights, and nights before holidays, weather permitting. The FAAC also has use a private observing site near Gregory Michigan and lake Erie Metro Park. See the FAAC Yahoo Group* for more information.

Observing schedules and additional info are available on our website, or via the FAAC Yahoo Group.* Or call the FAAC Hotline, for info and leave a message, or ask questions: 313-757-2582. or send email inquiries to info@fordastronomyclub.com.

Membership in the FAAC is open to anyone with an interest in amateur astronomy. The FAAC is an affiliate of the Ford Employees Recreation Association (F.E.R.A.). Membership fees:

Annual - New Members: $30 ($15 after July 1)
Annual - Renewal: $25 ($30 after January 31)

Membership includes the STAR STUFF newsletter, discounts on magazines, discounts at selected area equipment retailers, and after-hours access to the Island Lake observing site.

Astronomy or Sky & Telescope Magazine Discounts

Obtain the required form from the FAAC club treasurer for a $10 discount. Send the completed form directly to the respective publisher with your subscriptions request and payment. Do not send any money directly to the FAAC for this.

Star Stuff Newsletter Submissions

Your submissions to STAR STUFF are welcome! Send your story and/or images to the editor: StarStuff@fordastronomyclub.com Email text or MS Word is fine. STAR STUFF will usually go to press the weekend prior to each general meeting. Submissions received prior to the 15th can be included in that issue.

* FAAC Members are welcome to join our Ford Astronomy Club Yahoo!Group. Messages photos, files, online discussions, and more! URL: groups.yahoo.com/group/FordAstronomyClub.

This months background photos of the moon Page 1 courtesy of John Kirchhoff. See more of John's photos at:

http://www.flickr.com/photos/33926475@N06/with/4311533997/

It's worth mentioning that more than one mentor has given me the sage advice that one should not plunge into astronomy and astrophotography at the same time. Do visual astronomy first… preferably at least a year or more.

Astrophotography can be very expensive, but complicating this is the risk of buying gear in the hope that it will be adequate only to be disappointed with it.

Astrophotography has what I like to think of as a continuum of both difficulty and complexity (which translates into expense). You can spend practically zero dollars on special equipment (or perhaps a few hundred dollars) or you can spend tens of thousands of dollars. What you really need to spend all depends on what sort of results you want to get.

There are two basic challenges to astrophotography. The first challenge affects every photographer: collecting enough light. Ever take a photo with a regular camera in a room that doesn't have much light? The image is dark, lighting is a problem, there's lots of digital "noise" in the image. Astrophotography takes this issue to an extreme.

The next challenge is that the sky is always moving — or, more accurately, the Earth is always moving — this means you're trying to take what may be quite a long exposure of a subject that refuses to remain still for the camera.

In my continuum of astrophotography difficulty, I make two broad generalizations that tend to hold true.

It's easier to take photographs of bright objects than it is to take photographs of dim objects.

It's easier to take wide-field images (low magnification) than it is to take narrow-field (high magnification) images.

It follows that a wide-field image of a bright object would be the easiest way to start.

To this end, there are two areas of astrophotography which are so easy that they don't really require any special equipment at all… other than perhaps the camera (there's no getting around needing a camera) and a way to hold the camera still (preferably a solid tripod.)

(continued on Page 7)

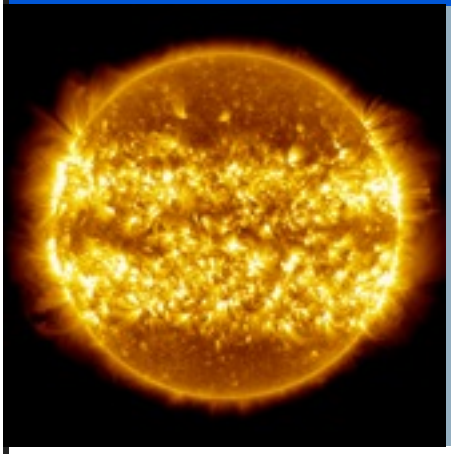


Image credit: composite of 25 images of the sun, showing solar outburst/activity over a 365 day period; NASA / Solar Dynamics Observatory / Atmospheric Imaging Assembly / S. Wiessinger; post-processing by E. Siegel.

The Power of the Sun's Engines

(continued from Page 1)

That's a literally astronomical amount of energy, and it comes about thanks to the hugeness of the sun. With a radius of 700,000 kilometers, it would take 109 Earths, lined up from end-to-end, just to go across the diameter of the sun once. Unlike our Earth, however, the sun is made up of around 70% hydrogen by mass, and it's the individual protons — or the nuclei of hydrogen atoms — that fuse together, eventually becoming helium-4 and releasing a tremendous amount of energy. All told, for every four protons that wind up becoming helium-4, a tiny bit of mass — just 0.7% of the original amount — gets converted into energy by E=mc2, and that's where the sun's power originates.

You'd be correct in thinking that fusing ~4 × 1038 protons-per-second gives off a tremendous amount of energy, but remember that nuclear fusion occurs in a huge region of the sun: about the innermost quarter (in radius) is where 99% of it is actively taking place. So there might be 4 × 1026 Watts of power put out, but that's spread out over 2.2 × 1025 cubic meters, meaning the sun's energy output per-unit-volume is just 18 W / m3. Compare this to the average human being, whose basal metabolic rate is equivalent to around 100 Watts, yet takes up just 0.06 cubic meters of space. In other words, you emit 100 times as much energy-per-unit-volume as the sun! It's only because the sun is so large and massive that its power is so great.

It's this slow process, releasing huge amounts of energy per reaction over an incredibly large volume, that has powered life on our world throughout its entire history. It may not appear so impressive if you look at just a tiny region, but — at least for our sun — that huge size really adds up!

Check out these "10 Need-to-Know Things About the Sun": http://solarsystem.nasa.gov/planets/profile.cfm?Object=Sun.

Kids can learn more about an intriguing solar mystery at NASA's Space Place: http://spaceplace.nasa.gov/sun-corona.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Treasurer's Report
April 11, 2014
By Gordon Hansen

	Apr 11, 14
ASSETS	
Current Assets	
Checking/Savings	
10000 · Checking	1,103.40
11000 · FAAC Savings	
11100 · FAAC Club Savings	2,106.99
11200 · Equipment	1,155.31
11300 · Scholarship	544.21
11400 · GLAAC	4,059.56
11000 · FAAC Savings - Other	1.60
Total 11000 · FAAC Savings	7,867.67
12000 · Petty Cash Account	170.25
13000 · CD's	
13100 · CD 200599272	1,059.51
13200 · CD 205196033	1,004.02
13300 · CD 89265268	1,106.97
Total 13000 · CD's	3,170.50
Total Checking/Savings	12,311.82
Total Current Assets	12,311.82
TOTAL ASSETS	**12,311.82**

Meeting Agenda - April 24th

HFCC – Berry Auditorium -Admin. Services & Conference Center www.fordastronomyclub.com
5:30

Opening/Introduction/Member Observing

Main Presentation:
Planetarium Demo & Show Bob Clubb & All

Club Projects/Committees/Member Support

Club Business/Secretary/Treasurer/Equipment Reports

Club Wear

You can order online from LL Bean, using the instructions contained in a file that you can view on our club Yahoo Group website Club Wear file folder at

http://tech.groups.yahoo.com/group/FordAstronomyClub/files/Club%20Ware/

Classified

Meade LX200GPS – 8 inch SCT with a Scope Buggy dolly.
Asking $1800
Contact: Joan Onkka, 734-525-0228

Orion SkyQuest XT10 Classic Dobsonian
Asking $350
Contact: Gordon Hansen, 734-624-1102 or on Yahoo

Astro Imaging SIG

Gordon Hansen

All are invited to join us in the Astro Imaging SIG meetings, to share and discuss images, experiences, and techniques.

We always have a good time, with lively discussion, and sharing of valuable information.

Next meeting is **May 8th.** The meeting room location – HFCC Admin. Services and Conference Center (same building), Berry Amphitheater Auditorium.

Topics invited. Pizza served.

FAAC Events 2014

May 10th - Astronomy Day

May 17th - Annual Club Banquet

May 22nd - Next General Membership Meeting in HFCC Technology Building / Ghafari conference room (this meeting only)

Background Photo from Lunt Solar Scope Image taken at the Hector J Robinson Observatory, June 28, 2010

One FAAC members blog

http://hjrobservatory.blogspot.com/

A few updates on the observatory, quick articles and photos. I'll try to improve my writing on this blog. Also, I try to keep daily updates on this blog. - Greg Knekleian, HJRO volunteer.

FAAC Equipment Report 4/15/14

By Dennis Salliotte

Item	Currently Held By:	Date Last Verified
Telescopes		
4" Dobsonian	George Korody	1/18/14
4 ½ " Galileo Alt/Az Reflector	James French	4/5/14
8" Orion 8XTi Dobsonian	James French	4/5/14
4" Donated Reflector in need of repair	George Korody	1/18/14
Presentation Tools		
Projector	Gordon Hansen	1/8/14
Projection Screen 8'	Bob MacFarland	2/13/14
Speaker System w/wireless mic	Bob Mac Farland	2/13/14
Bullhorn	George Korody	1/18/14
DVD Player	Gordon Hansen	1/8/14
Projection Screen 6'	Gordon Hansen	1/8/14
Projector, ViewSonic	Gordon Hansen	4/11/14
Demonstration Tools		
Weight On Planets Scale	George Korody	1/18/14
Lunar Phase Kit	Bob MacFarland	2/13/14
100 ft Scale Model Solar System Kit	Bob MacFarland	2/13/14
Display Items		
Astronomy Event Sign (3' X 6')	Gordon Hansen	4/15/14
PVC Display Board - Folding	Dennis Salliotte	4/15/14
Banner – Large (32" X 16')	Dennis Salliotte	3/15/14
Banner – Medium (24" X 72")	George Korody	3/15/14
Banner – Small (24" X 32")	George Korody	3/15/14
Tri-Fold Presentation Boards	Don Klaser	1/23/14
Tri-Fold Poster Board (Early Club Photos)	George Korody	1/18/14
Other		
Sky Quality Meter	Syed Saifullah	3/15/14
Canopy (10' X 10')	Greg Ozimek	2/6/14
Equipment Etching Tool	Dennis Salliotte	4/15/14
Pop Cooler	Michael Dolsen	1/23/14

FAAC General Meeting Minutes March 24th, 2014

By Jim Frisbie

Opening:
Members and guests enjoyed pre-meeting pizza (brought by Greg O)and pop (brought by Mike D).
FAAC president Tim C called the meeting to order at 5:30 p.m.
Everyone introduced themselves. We had 3 new people, and Tim mentioned the mentoring program.
Members reported on observing experiences, including yesterday's outreach at Robert West Middle School, where the students observed sun, venus, and meteors. Members talked about observations in Maui.
Club equipment report--to borrow, contact the person who has the item--list on Yahoo group--or contact Dennis S at equipment@FAAC.com.
George K reported 10" newtonian scope on equitorial mount donated to the club at the last swap meet.
Tim D has a limited number of passes/permits to observe at Lake Erie Metropark after hours. If you are a member, you can get one from Tim by giving him your name and contact info.

What's Up in March:
John S being unable to join us by Skype this month, Steve W presented "What's Up in April," pointing out many possible observing experiences for the coming month using Stellarium, including moon phases (great visuals!), Mars at opposition April 8, Saturn opp May 10, Jupiter in Gemini, beehive nearby, Lyrid Meteor Shower from April 16-25 peaking night of April 21/22, bright meteors but not a lot per hour.

Main Presentation:
The main presentation was "Extraterrestrial Intelligence" by Dale Partin. Exoplanet discovery methods from Doppler shift technique to transits showing a dip in luminosity. With new insights into the techniques, hundreds of new planet discoveries have been confirmed this year. Conclusion, we may or may not find life outside of the earth. Knowledge is exploding, and the next decades should be filled with discoveries. Enjoy!

Tech Talk:
The Tech Talk was "Winter Observing from Indoors" by Greg Knekleian. Greg talked about winter observing from inside a warm house--don't look through a closed window because glass distorts the image--don't look though an open window, currents distort image. Use alt/az mount on strong tripod, 2 tripod legs against wall, short focal telescope or binoculars, look through lowered upper sash. A good friction clutch is useful. You can observe for up to 90 minutes, then when the room temp drops to 50F, close the window and go to bed.
10x 50 binocs work well too.

Business Meeting:
- Ellen Duncan gave the secretary's report, saying that last month's minutes taken by Jim Frisbie are now published in Star Stuff. Gordon Hansen gave the treasurer's report, which is also published in Star Stuff.

Projects and Events:
- March 28/29--Messier Marathon at Lake Hudson (possible rain date on Friday)
- April 5--D-Bar-A Scout Ranch, an all-clubs astronomy event
- April 5--Beginners' Night at Lake Erie Metropark
- April 12 & 22----Solar Observing at Michigan Science Center
- April 14/15--Full lunar eclipse morning of April 15, group observing at Island Lake State Park
- Penumbral starts 4/15 12:53 am EDT
- Partial starts 4/15 1:58 am EDT
- Total starts 4/15 3:06 am EDT
- Greatest eclipse 4/15 3:45 am EDT
- April 15--6:30 pm "Science Night" at Lincoln Park Middle School (pre-sunset). Held rain or Shine
- May 10--Astronomy Day at Kensington Metropark and Michigan Science Center
- May 17--Annual Club Banquet at Karl's Cabin 6 pm (dinner at 7)

Announcements:
We need more donations for door prizes for the Annual Banquet--contact the Korodys.
Dan Barribal is looking for a collaborator to help with social media.
HFCC planetarium is looking for more people to be trained to be a presenter/operator for the planetarium. Contact any HFCC planetarium operator if you are interested.

Tim C. adjourned the meeting at 8:03 pm.

President's Article

By Tim Campbell

(continued from Page 2)

This makes the Moon a particularly easy beginner astrophotography target. This brings us to our first rule.

Loony 11 Rule

Before you giggle, no… I did not make up this name. There really is a "rule" (or "guideline" is perhaps a better term) for this. This is a rule that will help you nail the exposure when taking a photograph of the moon. The name "Loony" is, of course, a play on "Lunar".

Before the days of cameras that had built-in light meters, a photographer would need to know how to adjust the camera to take an adequate exposure. One could own a hand-held light meter — but there were certain situations where the amount of light was well-known so a meter wasn't needed. It turns out the Sun provides a very consistent amount of light. So consistent, that there's even a rule for it. That rule is called the "Sunny 16" rule (I didn't make that rule up either). The rule says that in the mid-day sun if there are no clouds present, then you can set your camera to f/16 and set the shutter speed to the inverse of the camera ISO setting (or film ASA sensitivity). If you are using ISO 100, then 1/100th will be a perfect exposure. At ISO 200, use 1/200th. But this neat little game of setting the shutter speed to the inverse of the ISO only works at f/16.

It turns out that when you take a photograph of the moon, it is lit… by mid-day sun… and with no cloud cover! So the Sunny 16 rule should work here. In fact… it doesn't yield nearly as impressive results as you might expect (though it probably does yield more accurate results.) This is because the moon is a terrible reflector of light. The moon has all the reflectivity of a black asphalt road or a black sidewall tire. It's "surface albedo" is low.

This brings us to the Loony 11 rule. This rule works exactly the same as the Sunny 16 rule, except… it compensates for the fact that the moon isn't very reflective.

The rule says that if you set your camera to f/11, then you can set your shutter speed to the inverse of the ISO setting. If you set your camera to ISO 100, use 1/100th seconds as your shutter speed. At ISO 200, use 1/200th, etc.

If you use a telescope, then the telescope itself dictates the focal ratio because, as you may have noticed, there is no adjustable aperture setting on the side of your telescope. It is whatever it is. I have an f/5.4 refractor which is very close to f/5.6 — a standard full f-stop value. (In photography the order for f-stops is f/1, f/1.4, f/2, f/2.8, f/4, f/5.6, f/8, f/11, f/16, and f/22. There are more, but that's probably far enough. Incidentally, these are based on powers of the square root of 2, but that's another article.) Each of these values represents either a halving or doubling of the amount of light collected vs the adjacent value. Notice that f/5.6 is two f-stops lower than f/11.

(continued on Page 8)

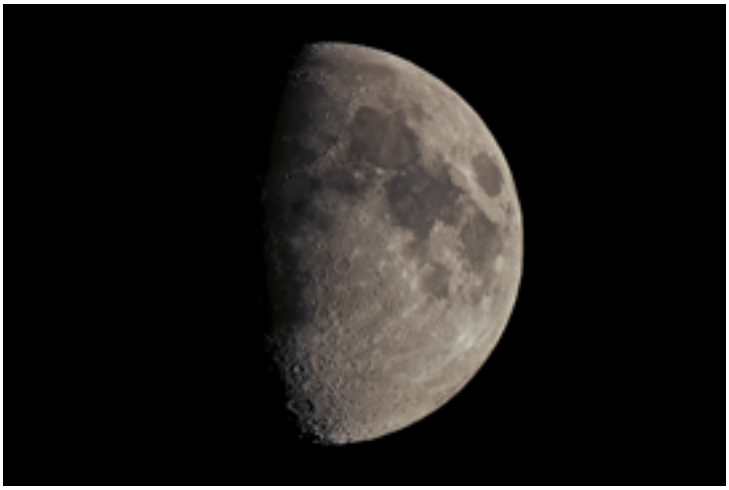
President's Article

By Tim Campbell

(continued from Page 7)

That means my f/5.4 telescope is collecting more than four times more light than the f/11 rule needs. In photography, the exposures really are a simple trading game… if my scope collects more than four times as much light as compared to f/11, then my shutter speed only needs to be 1/4th as long. This means at ISO 100, I can take a 1/400th second exposure and nail the shot. This point is that while the rule is based on f/11 — that's only because the name "Loony 11" is easy to remember… but you don't have to use f/11 if you know how to play the trading game to find equivalent exposures.

Don't believe me? Have a look at this image which Tim Dey and I captured using the Meade f/6 refractor at Hector J Robinson observatory. The image was captured following the "Loony 11" rule. There were virtually no exposure adjustments applied to this image. This was a single image (not stacked). I applied a tiny amount of edge sharpening and very tiny amounts of curves and levels adjustment to mildly tweak the shadows and highlights and that's about it (I did crop in on it slightly.)



This is relatively easy. This image was taken through a telescope, but I could have followed the same rule and not bothered with a telescope (the moon would have been smaller depending on the focal length of the lens.) But the exposure results would have been the same.

The Rule of 600

This next rule applies to how to take photos of the sky without getting blurry results. I mentioned my generalization above… it's easier to take wide-angle photos than it is to take narrow-field images. This is because the narrower the angle of view, the more apparent any camera or subject moving will be when viewing the resulting image.

This rule was designed for use with 35mm film cameras but you can adapt it to use with DSLR cameras. This rule helps you determine the longest exposure time you can take in a single exposure when taking a photograph of the night sky and not have blur or elongation of stars (aka "star trails") caused by the long exposure times.

The rule assumes your camera is mounted on a stationary mount (such as a solid tripod).

The rule says that you can divide 600, by the focal length of your camera lens. The result, is the amount of time (in seconds) that you can keep the shutter open and not see any noticeable elongation of stars (or other objects).

(continued on Page 9)

President's Article

By Tim Campbell

(continued from Page 8)

With a full-frame DSLR (e.g. Canon 5D or 6D, etc. or any Nikon FX format camera body — because these have digital sensors which are roughly the same size as a single frame of 35mm film) you can divide the 600 by the focal length of your lens.

eg. I have a 14mm lens. Therefore, if I use a full-frame camera body, I do the following math:

600 ÷ 14 = 43 (that's rounded) seconds.

I could set my camera on a tripod, point it at the sky, dial in a 43 second shutter speed and not see any noticeable elongation or blur.

Most Digital SLR (DSLR) cameras don't have full-frame sensors. They use something called "APS-C" crop-frame size sensors. APS-C is an acronym for "Advanced Photo System - Classic" size film. Those were those cameras that used drop-in cartridges that were getting popular in the 1990's. The frame is a bit smaller than 35mm film… about 50-60% smaller. This means you'll need to tweak the math just a bit to compensate. To do this, you need to know your "crop factor".

If you have a Canon EOS series camera which is not a full-frame model then your crop factor is 1.6. If you have a Nikon camera with DX-format then your crop factor is 1.5. This is the vast majority of DSLR cameras.

Using the crop factor, you need to multiply the focal length of your lens by the crop factor value.

E.g. suppose you have a 10mm wide-angle lens and a Nikon camera body (any Nikon camera with a Nikon "DX" size sensor.) You would multiply the 10mm focal length by 1.5 to arrive at 15. Now divide 600 ÷ 15 = 40 seconds and there's your shutter exposure time.

If you know that you have a Canon DSLR or a Nikon DSLR but do not know what size the sensor is on your camera, then assume you've got an APS-C size sensor. This is because nearly all models use that size. Only a few models have full-frame sensors (or any other size sensor) and these models tend to be extremely expensive. So expensive, in fact, that if you actually do own such a model, you know what you've got. All Canon "Rebel" series cameras use the APS-C size…. as do all models with 2 numerals in the model number (e.g. 20D, 30D, 40D, 50D, 60D, or 70D). On the Nikon side, all bodies with 4 numerals in the model number are APS-C… e.g. the D3000 series, D5000 series, D7000 series are all APS-C. Also all Nikons with 2 numerals in the model number… a D90, for example, is a Nikon "DX" series body (Nikon uses "DX" to refer to all bodies with APS-C sensors and "FX" for all bodies with full-frame sensors.)

Up to this point, I've mentioned how to capture astro-images without using a telescope or tracking mount at all. There are a number of star-tracking mounts that can be attached to ordinary camera tripods to take even longer duration images. The Losmandy StarLaps, the AstroTrac, the Vixen Polarie, and the iOptron SkyTracker are all examples of such gadgets. Again… no telescope needed when using these devices. The Losmandy StarLapse and the AstroTrac are in the "more than $500" category and the Vixen and iOptron devices are in the "less than $500" category.

(continued on Page 10)

President's Article

By Tim Campbell

(continued from Page 9)

One more thing… The Mentor Rule

I would be remiss if I didn't mention there is a way to dip your toe into the astro-imaging world without buying any additional equipment (other than the camera you might already own) without spending any money at all.

Join an astronomy club (and if you're reading this, you likely already have.)
Make a friend (or two or three) in said astronomy club who likes to image.
Get together with said friend on imaging nights.

This is a huge advantage of club membership. Astro-imaging can be expensive but partly because it's so easy to spend money on gear that isn't up to the task. You can learn a lot by gaining imaging experience via shadowing someone else rather than buying your own gear right away. It also offers social advantages as well. Frankly, even when skies degrade we tend to hang out and just chat.

The Hector J. Robinson Observatory in Lincoln Park is maintained and operated by members of the Ford Amateur Astronomy Club. The observatory has a 14" Celestron C14 SCT and a Meade 80mm Apochromatic refractor which are both mounted on a Losmandy Titan mount. The observatory is already set up for imaging with computer, software, auto-guiding camera, etc. and we even have the nose-piece compatible with any Canon EOS camera (by far the most commonly used DSLR camera series for imagers who use DSLR cameras.) We're glad to have the company down at the observatory. Four different club members are able to open the observatory (the key-holders). These are: Tim Dey, Greg Knekleian, George Korody, and me. Greg opens the observatory more than anyone else… followed by probably by myself, and then Tim Dey. George generally does not use the observatory except to help us out with equipment, maintenance and he comes to our aid when we get into a jam.

If you'd like to learn to do imaging, it's a great way do astrophotography on a budget… as you don't necessarily need to buy anything at all. When you are ready to buy gear, you'll have a much better idea of what sort of equipment you might need and can avoid spending money on gear that's unlikely to live up to your expectations.

Clear Skies!
Tim

Taylor Middle School Outreach

By Tim Campbell

The club received a request to do an outreach event for West Middle School in Taylor and this would be for all the middle school science classes. The event was held on Wednesday, March 26 from 8am to noon. The day was selected because the moon was in the 3rd quarter, so it would be up in the sky before dawn… as would the planet Venus. This would provide the students with at least three different objects to observe in the daytime sky.

The day was quite cold, but remarkably clear. The school kept us warm with a generous supply of hot cocoa, coffee, and cookies.

The school organized the day so that all students would have an opportunity to participate in one of four different hour-long sessions. The middle school has six periods, but students in the last two periods of the day were given hall-passes and allowed to attend during the morning.

Gordon Hansen, Brian Kutscher, Dennis Salliotte, Sandar Macika, John McGill, Rick Arzdon, Greg Knekleian, and I were all there with a variety of telescopes to view the Sun, the Moon, and Venus. Sandra brought her meteorites and students were able to learn about shooting stars. (I hope I did not miss anyone from the club who participated.)

The students really seemed to enjoy the meteorites and views through the telescopes with a lot of "Oh wow!" moments being heard as they looked through the scopes.

Quite a number of them were surprised to see that Venus has phases like the moon (they weren't expecting that.) There were also a lot of comments about being able to see the sun spots and prominences through the solar scopes as well as comments about Sandra's meteorites.

The club received a "Thank You!" note from the school's event coordinator as well as quite a stack of hand-written thank-you notes from the students themselves.

I've scanned all the letters and will post them in the files section of our Yahoo! group. I will provide the link via the Yahoo! group email list.

This being a "school day" / "work day" event, means not everyone was able to participate, but I did want to express my appreciation to all those who were able to help out. I am sure this is a memory that the students will have even years after they are out of school and many of the letters from the students reflected on the fact that they've never seen anything like this in their lives before… and may never again.

Thank you!

Kind Regards,
Tim Campbell

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