First Light Lite

December 1, 2020

Jim Lynch – Editor

Message from the CCAS President

Somehow, it became December again. Odd, that. Well, at least in 2020 it's odd, as is anything normal. But, December is a month of holidays, and despite the ongoing pandemic, we can keep light and warmth and cheer alive as the days eventually begin to get longer.

CCAS has been hanging tough during the pandemic, and there are some good things to report this month. Unlike past months, I will NOT repeat any material from previous months, but rather will go right to current events. (Interesting material from past months, if you want to see it, is in last month's FLL, which I have enclosed in the mailing for good measure.)

Upcoming Meeting Talks

The winter, spring, and summer's agenda for talks is the first item to discuss, as we already have some good talks lined up (and also one by me.)

Very generously, Dr. Jim Gates, the incoming President of the American Physical Society, who is also well known to the public for his Nova and other media appearances, agreed last spring to give us a rain check for the talk that was cancelled on March 16th. We contacted Jim recently, and both he and his co-author, Cathie Pelletier, said they would come (virtually) this spring to talk to CCAS and the Cape area schools. We are currently working with the schools and Jim and Cathie to arrange an exact date, time and other logistics.

Also, Dr. Alyssa Goodman, whose recent work on the "Radcliffe Wave" discovery has been prominent in the news this year, has agreed to talk to CCAS this summer, hopefully live if meeting restrictions are lifted.

Next, Dr. Jim Head of Brown University, who recently gave a very well received talk on the Apollo Program and US lunar exploration, will give another talk in February on the Chinese lunar program. That program is currently very much in the news with the launch of the Chang'e-5 mission, which will collect moon rocks, the first such effort in many a .... well, you get the idea.

As to January, I'm stealing the slot to talk (at a lay level) about the nature of space and time. As I probably don't understand either very well, this could be amusing to those with a quirky sense of humor. I'll try to make it good, but I'm not optimistic that I can explain the current major mystery - how time passed so peculiarly in 2020.

We are pursuing further speakers for next year, but that's our roster for now. If anyone has any further thoughts or leads, please let me know!

Webcam recording

Webcams are an inexpensive technology to buy into these days, and so CCAF has purchased two cameras so that we can make videos of WSO "restricted star parties" and other events. ("Restricted star parties" are where three CCAS members operate the main scope and transmit the proceedings and images, so as to comply with current gathering restrictions on the DYHS grounds.) This will give us the ability to record at least one star party per month, which almost gets us back to our previous rate, though virtually. We can put broadcast these recordings at specified times, and then place them on our website, as well. This capability will be useful for us even after the Covid era.

Some Inexpensive "Backyard Astronomy"

In last month's newsletter (attached), I talked about "binocular astronomy," which is cheap, easy, and accessible, and could be attractive to our members and friends who don't own telescopes (and maybe some that do). Even modest binoculars give a great, wide-field view of many of the sky's wonders which the unaided eye can't see. This is in the realm of "visual astronomy," and of getting acquainted with the larger and brighter features of the sky.

But there is another part of astronomy which is available to amateurs that goes a level deeper, and is still easy enough to do individually (which is often a requirement during the pandemic), inexpensively, and without a large time expenditure. I will call this "amateur measurement astronomy," as it goes beyond simple "stargazing" and starts you on the road to understanding quantitative astronomy and astrophysics. And, for non-techie types, fear not. This is largely (though not totally) the basic astronomy that has been around for millenia – our ancient forbears understood a *lot* about the heavens even before Galileo turned his small telescope to the skies and began the instrumental measurement revolution. And some of the cheaper technology and knowledge that we now have can also be used quite simply. The orbits of Jupiter's largest moons, trackable by binoculars (new tech!) can be measured by anyone and then used to confirm Kepler's laws (which were discovered just before Galileo's observations, using visual observations by Tycho Brahe.) There is a LOT to one can do and understand with very rudimentary gear! (If this was chemistry, we'd be talking about "kitchen chemistry.")

This month, and in the next few months to come, I'll describe some of the "astro-kitchen-science" that is possible, in hopes that it provides some amusement for those who would like to observe things quantitatively for themselves and also pass a few interesting hours during our wearisome pandemic isolation. It will be a small subset of a much larger available "pantry," but I'll also supply a few references (cookbooks?!) for further pursuits. (And please forgive the wonky references and analogies – it *has* been a long year!)

Three items I'll look at this month are: 1) astrophotography with either a standard DSLR camera or a cellphone (which cost more, but are commonly owned), 2) tracking the sun's seasonal path with a plastic compass, and 3) tracking the brightness of the sky versus time (of the evening and also season) and direction (horizontal and vertical). I'll just talk about the equipment today, and will promise to show some results in next month's FLL.

For wide field astrophotography, a DSLR camera that can be focused at infinity, has the option for time exposure photos, and can be set to a high ISO speed setting is ideal. Many home cameras have this range of options. Exposures of a few seconds will not leave star trails, and can detect faint but interesting objects, such as Uranus and Neptune and many star clusters. Holding the camera still is necessary, though. If you wish to photograph fainter objects with longer exposures, you will need a tracking mount, which becomes expensive. Many CCAS members have beautiful wide field photos made with DSLR's, and I'll show some next month.

For iPhones, which have gotten more and more powerful with time, there are increasingly more apps, cameras, attachments, and options. There are many apps for identifying sky objects, which show both where they are (by pointing your phone) and give a nice description. I'm sure that you can learn all you need to know about these by going online. I'd like to concentrate on imaging with iPhones here. The iPhones' easiest option for inexpensive, non-large-telescope astronomy imaging is the purchase (online for about $20 USD) of an inexpensive kit that includes a *small* 20x telescope attachment (about 6" long) for the iPhone, a tripod, and even a fisheye lens, among other cellphone sized items. This system works surprisingly well, and is great for imaging the moon. You really don't need an expensive camera with a telephoto lens to get some nice pictures!

But what is *quantitative* about taking such a picture? Well, if you think of the picture not just as a pretty image (which, of course, it is) but also as data, there is a lot to learn. (And you have taken the data yourself, so you know its warts and wrinkles!) One simple example of what can be learned is the distribution of the sizes of craters on the moon, i.e. how many of them are there versus how large they are. I won't go into complete detail (for that see Buchlein's book "Astronomical Discoveries You Can Make, Too"), but in short form, try this. Take the diameter of the moon as 3475 km, and scale it to your image's size (e.g. 6 inches/3475 km). Now make the (not true, but not horrible either) assumption that all craters are circular. Craters are each some fraction of the image size in diameter, but distortion (due to the moon being a sphere) as you go away from the image's center turns the circles into ellipses. No matter – the long axis of the ellipse, perpendicular to the radial line from the center, is still the diameter! With these approximations, you can now "hand count" (tedious, but it works) the size of the craters in your image, and then make a plot of how many there are versus their size. Voila! Some simple science. Even more fun is to see where the errors in your data lie, and what the limits of your measurement are. I'll do this myself for next month, and I hope that someone gives it a try so that we might compare results. And finally, there is the deeper science that even this very simple measurement poses. *Why* does the distribution look like this?! A moment's thought leads one to suspect that the sizes and speeds of the asteroids that impact on the moon are a big part of the answer, a topic that Tony Stark talked about just a few weeks ago. Answering that innocent sounding question *in detail* could probably get you a PhD in planetary science!

Tracking the daily sunrise position with only your eyes (be careful, especially if it is a bit past sunrise!) and a plastic 180 degree compass is also a fun exercise, showing the movement of the sunrise position back and forth with the seasons. I did this from last December's winter solstice until the summer solstice this year (when the trees spouted enough leaves to obscure my local horizon), and will repeat the measurement again this year. Starting at the solstice (in just a few weeks) is a good idea, as it is one of the far ends of the motion. It is not a hugely accurate measurement (only good to within a degree or two), but the time series of this really does show how significant the movement is. The hardest part of this measurement is getting up early enough to catch the sunrise!

And finally, for those who might wish to get a light meter (again, a $20 USD item online), exploring how the background light varies over an evening, as the seasons progress, and versus horizontal and vertical sky position is an interesting and easy measurement as well. (Standard light meters aren't terribly directional, but are good enough to show some overall directional differences.) Incidentally, you might find out more about "light pollution" than you would care to, I will caution.

Again, I'm sure that you've noticed that I haven't shown pictures or data yet! This is not because they don't exist, but because I need something to show next month! And I'll also try to talk about more possible (inexpensive, easy, and fast) measurements that can be done. Amateur astronomy is often looked upon as expensive and time intensive, but there are really many, many things that can be done without super elaborate gear, and with only a modest time investment!

Last month's speaker

November 5, 2020

Dr. Larry Marschall, Emeritus Professor, Gettysburg College

Abstract: Though astronomers don't deal with the details of day to day meteorology, they do deal with global effects on the environment of planets. In this talk we'll take a long view, looking at other planets and our own, and asking questions like: "What astronomical conditions affect the climate of a planet?" and "How do we know that current climate change is caused by anthropogenic greenhouse gases and NOT caused by astronomical variations in the earth's orbit or the sun's radiation.".

Larry was kind enough to let his PowerPoint presentation be circulated, which I did to this list last month. If anyone didn't get it, or missed it, please just contact me at jlynch@whoi.edu and I will resend it to you. It was a great talk on an absolutely crucial topic.

This month's speaker

December 3, 2020

Dr. Frank Primini, Astrophysicist, HSCfA

Abstract: The Chandra Source Catalog (CSC) is the definitive catalog of X-ray sources detected by the Chandra X-ray Observatory. Version 2.0 (CSC2) is the second major release of the catalog, and represents a significant improvement with respect to version 1.1 in terms of sky coverage, sensitivity and capabilities. CSC2 includes measured properties for 317,167 unique compact and extended X-ray sources in the sky, allowing statistical analysis of large samples, as well as individual source studies. In this talk I'll describe some of the tabular data and data products available in CSC2 and demonstrate some of the ways users can access it.

Frank is an old friend of our club, and I hope you will be able to attend his talk (virtually, of course.)