

First Light Lite

December, 2019 Edition

Jim Lynch – Editor

This past month has been busy for CCAS on many fronts, so hunker down in an armchair with a mug of your favorite beverage and get ready to read a LOT of news and discussion!

DOME REPAIR AND AUTOMATION PROJECT

Climbing up higher on the radar screen is the dome repair and automation project. We now have a very active fundraising committee, and even before they sent out formal requests for business donations, we received \$2750 in initial funds and \$1,000 pledged in matching funds. This is towards the ~\$10,000 we estimate that the initial phase of the project will take. Letters asking for small donations from CCAS members and friends will also be sent out and any amount we get, however small, is helpful, especially as we do have some matching funds. The technical committee for the dome automation will be meeting soon, as well. So, this project is becoming very real!

OLD SCOPE SOLD

For those who have used the old 16” Meade scope, you will have to visit it at the University of Nebraska in the future, as they recently bought it from CCAS. The purchase money goes to the CCAF, which will use it for (among another things) a new CMOS color camera for the PlaneWave scope. More on the new camera soon!

STAR PARTIES

This is a repeat paragraph from last month. Our star parties are doing well, aside from the usual Cape weather, but we really could use a little more help with

them from our members. Please contact WSO director Charlie Burke if you think you can come and help, even on an irregular basis. For members not as familiar with the equipment, the regular WSO observatory crew are very good at showing you the ropes in very little time. The new scope is a lot easier to work with than the old scope, and it is fun to see operate!

TRANSIT OF MERCURY

An outcome of the Barnstable HS visit to the CCAS meeting by Mike Gyra and his students last month was a collaboration of BHS and CCAS on viewing the transit of Mercury on November 11th. CCAS brought some solar viewing equipment and personnel to the event, hosted by BHS in Barnstable at the Cobb Astro Park. It is estimated 175-200 people attended the event throughout the day, a pretty good number! The Cape Cod Times covered the event, and you can find some pictures at

<https://www.capecodtimes.com/photogallery/CC/20191111/PHOTOGALLERY/111109997/PH/1>. Due to restrictions on publishing pictures of young people without express permission, I'll just leave things at posting this link. Two things more are worth mentioning. First, Gus got a great still picture of a jet passing in front of the Sun with Mercury in transit to the side. The BHS students got a video of the same. Second, while this was great publicity for CCAS, I feel that the students, who worked hard staffing the event, could have gotten a bit more of the publicity focus. Something to keep in mind in the future.

STEM EVENTS AT DYHS

Closer to home, things have been active at the DYHS, as well. The DYHS held a "STEM Week" the 21-25 of October. Department Chair Amy Chausse and the science teachers organized two days of seminars that included an entomologist, an astronomer, a biomedical researcher, and a marine archeologist. I got to be the token "astronomer" (by virtue of being with CCAS), and gave two talks that I hope didn't totally discourage the students from considering a STEM career. Having such "career weeks" is a great idea, and I'm happy that we could have some CCAS representation at this one. Hopefully, there will be more such events in the future.

Our student honors projects program is also coming along well this fall, and I'm hopeful that the students will be able to show their completed projects to CCAS in the spring at one of our meetings.

FALMOUTH LIBRARY TALK/MEETING IN JANUARY

In order to mix things up a little bit, and see if we can attract a few more members from the western part of the Cape (which is the center of mass of our membership, in fact) we are planning to have our January lecture and meeting at the Falmouth Public Library. The address is 300 Main Street Falmouth. You go in the "meeting room entrance" across from Mullen Hall School, next to the Municipal Parking Lot (which gives us PLENTY of parking, similar to the DYHS lot). The library is right on Route 28 (which is called Main Street in Falmouth), so it is not very hard to find. Jim Lynch will be the speaker. While we're hoping attendance is good, this IS the day after New Year's Day, so many people might be "otherwise occupied" during this time. But, we'll try the experiment and see how things go!

SOME POSSIBLE FUTURE DIRECTIONS

One use of the new scope I'd like to see implemented (beyond star parties) is obtaining a serious library of FITS files, imaging objects that we can see well at our latitude. WSO can potentially supply high-quality data for all club members and students to play around with, using the free processing software that has been made available to the DYHS students.

In the future, I'd also like to see our spectroscopic gratings and RSpec software put to use. We have the basic hardware and software to do this, and have done spectroscopy (using smaller scopes) for student projects. As a start, CCAS member Ian Wojtowicz will be on Cape during his winter college inter-session, and we're planning to try to get a diffraction grating set up for the new scope. We have an 1 ¼ → 2" adapter for the gratings, so hopefully this will be easy. The RSpec software is proprietary (we own school and club computer copies), but we might be able to find some freeware spectral analysis packages for outside users.

Another direction I'd like to see is our "Projects Initiative" come to life. (See the FLL from June, 2019) That might be a way down the road, but it would get people engaged in hands-on astronomy, just like the photography and spectroscopy described above. Club member engagement is a big part of the directions noted above!

On a broader scale, another thought that has crossed my mind (inspired by the Mercury transit event) is to see if we can't work more on a collaborative basis with all of the HS programs on the Cape. (To begin with, HS is a good level.) There exists a good pool of people and resources Cape-wide, and it would certainly be worth exploring possible collaborations over star parties, lectures and events.

I should say that the above thoughts are my view of possibilities for CCAS, but I am just one person, and it's important to get the opinion of everyone interested!

Upcoming Speakers

Note: We currently have CCAS First Thursday speakers lined up through February. We now are looking for speakers for the 2020 schedule. If you are interested in giving a talk, or know someone who would be a good speaker, please contact Jim Lynch at jlynch@whoi.edu. Thanks!

December 5th – Mr. Gary Walker, CCAS

Topic: Is sCMOS the next Imaging Revolution

Abstract: The world of Astro Imaging has seen several technology changes. The Author has experienced Tri-X film, push processing, Fuji 400, hyper sensitizing, CCD monochrome, colored filters, and now sCMOS. Many CCD chip manufacturers have shut down their factories--many to make space for new CMOS fab lines. Leveraging from the computer chip industry fabrication technology, CMOS chips offer small pixels, high speed, low noise, high dynamic range and most important, lower cost. While this works well for DSLR's, cell phone cameras, security cameras, and machine vision applications, how does this affect Astro Imaging? At the 2016 NEAIC, the word from vendors was that for the point

and stare application of long exposures common to Astronomy, the CCD was still the detector of choice. The evolution of the CMOS technology may have closed the gap. The author investigates how CMOS can best be used for the point and stare applications that Astro Imagers need.

January 2nd, 2020 (At Falmouth Public Library)

Dr. Jim Lynch, CCAS

Topic: Basics of Optics for Amateur Astronomers

February 6th, 2020

Dr. Ken Brink, CCAS

Topic: Oceans in Space

Last Month's Speaker

November 7th – Dr. Mark Reid, HSCfA

Topic: Mapping the Milky Way: the BeSSeL Survey

Abstract: Over 2000 years ago, Hipparchus measured the distance to the Moon by triangulating from two locations across the Mediterranean Sea. However, determining distances to stars proved much more difficult. Many of the best scientists of the 16th through 18th centuries attempted to measure stellar parallax, not only to determine the scale of the cosmos but also to test Heliocentric cosmologies. While these efforts failed, along the way they led to many discoveries, including atmospheric refraction, precession, and aberration of light. It was not until the 19th century that Bessel measured the first stellar parallax.

Distance measurement in astronomy remained a difficult problem even into the early 20th century, when the nature of "spiral nebulae" was still debated. While we now know the distances of galaxies at the edge

of the Universe, we have only just begun to measure distances accurately throughout the Milky Way. Using the Very Long Baseline Array at radio wavelengths, we now can achieve parallax accuracies of 10 micro-arcseconds! I will present new results on parallaxes and motions of star forming regions from the BeSSeL Survey. These measurements address the nature of the spiral structure, size, rotation speed, and mass of the Milky Way.

Mark Reid started off his lecture with a topic that most amateur astronomers (and professionals as well, it seems) love – the history of astronomy and, in particular, the history of his topic, parallax. Starting with Hipparchus' measurement of the distance to the nearby moon using parallax (384,000 km vs 400,000 true distance – not bad!), he then jumped further to the measurement of the parallax of the stars, a much harder problem. He detailed the many brave attempts to obtain stellar parallax, culminating in Bessel's successful attempt to get that of 61 Cygni. He also highly recommended the book by Alan Hirschfeld called "Parallax: Race to Measure the Cosmos." A fun "physics fact" from this is that the shift against the background stars that was measured had two components – one being the real parallax component, and the other being stellar aberration, caused by the vector addition of the earth's orbital velocity and the speed of light. Luckily, they are out of phase by 90 degrees, and so could eventually be distinguished. (Which is lucky, as aberration would swamp parallax!)

Fast forward to modern technology and the HIPPARCOS and GAIA satellites, along with the VLBA (Very Long Baseline Array, in the radio regime). The latter can resolve 10 μ arc-seconds using an earth sized array (as we saw in Tony Stark's talk about the Event Horizon Telescope). So, we are now seriously in business, as far as making some good parallax measurements.

The first "test cases" of these technologies were made on star clusters and star forming regions, with interesting results. The distance to the well-known Pleiades, as measured by HIPPARCOS, was found to have significant error compared to ground-based techniques. This was good news for ground-based techniques and stellar structure models, but rather upsetting to the HIPPARCOS folks. The next test case, the Orion Nebula, was also shown to have a serious

distance anomaly. An interesting sidelight to these techniques is that by co-measuring the difference between a given star's parallax and a very distant quasar's, the accuracy of the parallax technique can be significantly improved.

To reach farther than the (relatively nearby) Orion Nebula, a stronger signal is needed, which happily is supplied by astronomical masers. (Microwave Amplification by Stimulated Emission of Radiation, the predecessor technology to the laser.) Radiation from young stars creates "population inversions" in the energy levels of molecular clouds, and these molecules can then emit a very bright, coherent cascade of radiation when they are hit with photons matching the energy level difference between the excited level and the lower level. Water and methanol are two common molecules that "mase" in these clouds in the microwave/radio band.

Using the bright young star induced masers, source W3OH was mapped out to 6400 light years, and SgB2 (a star forming region near the center of the galaxy) was mapped out to 25,000 light years. These long-distance results show that this technique can be used as a sensitive way to map out the spiral arm structure of the entire galaxy, which would otherwise be obscured at optical wavelengths.

The (approximately) last slide Mark showed had "missing data" on its left side. This "missing data" is the part of the Milky Way galaxy that is seen from the Southern Hemisphere, and which Mark will be working to map over the next few years! He has promised to come back to show us his map when completed, and it will be exciting to see a "real data" map of the entire Milky Way's arm structure replacing the artists conceptions that we now see. Artwork is very nice, but reality is much better and more interesting!

November Meeting Minutes and CCAS Business

The meeting portion of the evening consisted of a discussion of many of the usual items (status of the new telescope, the dome upgrade drive, the STEM activities at DYHS, etc). In addition, logistics for participating in the Mercury transit event were discussed.

Star Parties

After August until mid-June, we will (generally) have two regularly scheduled Star Parties each month taking place at 7:30 -10:30pm on the *Saturday* closest to the date of First Quarter Moon (about 7 days old). This is an increase from our old schedule of one per month in the fall, winter, and spring.

From June through August, we have three regularly scheduled Star Parties each month taking place on *Thursdays* at 8:30-10:30pm.

When the moon is near its First Quarter, the terminator (the line dividing light from dark) is favorable for viewing sunlight or shadow on the sides of craters. This time is also favorable for observing the dark side of the moon occult (visually cover) stars in the sky as the moon moves in its orbit. Depending upon the calendar, we may also be able to observe planets and other celestial objects.

Here is the schedule for “Star Parties” up to January, 2020; **the public is cordially invited!**

December 7th

POSSIBLE CANCELLATIONS for Star Parties: Cancellations will be very rare since we have lots to do "inside" as well as outside. Even if the forecast is "iffy"; the Staff Leader for the night may elect not to cancel in spite of possible clouds. If clouds arrive after staff and guests have convened, a virtual Star Party will usually take place indoors to include overviews of the sky for that night using computer simulations with our big screen TV, videos of interesting sky events recorded previously, demonstrations and/or training on the use of scopes and other equipment, and consultation/discussions on things astronomical, etc.

However, sometimes a solid forecast for overcast or rain or a storm will result in cancellation of a given Star Party. **IF IN DOUBT ABOUT THE WEATHER AND THE STATUS OF A STAR PARTY, CALL THE OBSERVATORY AT 508-398-4765 AFTER 7:45 pm.** No answer means the event has been cancelled.

Directions to Dennis Yarmouth HS and Schmidt Observatory

For information on the location of our Dome behind Dennis-Yarmouth High School, click on the purple button "Old Website" and once there, click on "Meeting

Location" viewing the two maps that are there: external for the Dome, and internal to locate the high school library where meetings are held.

For meetings, drive in the south entrance road and go around behind the main building. Park in the lot about halfway down the building and go in the back door and turn down the hall to your left to find the library.

For Star Parties at the Dome, drive in the north entrance road all the way past the north side of the main high school building, through a gate, and on to park near our Dome.

H&K directions

Please be reminded that Gus Romano or his delegate host a dinner gathering for members and friends each CCAS meeting night (before the meeting) at the South Yarmouth Hearth & Kettle restaurant at 5:45pm; (the meetings begin at 7:30 at D-Y.) The speaker for each meeting is always invited. Please join the group to dine and talk about all things interesting, including astronomy, each month before our meeting. The H&K is at 1196 Rt 28, South Yarmouth, about a half mile west of the Station Avenue/Main Street intersection with Rt 28 (stop light).