

First Light Lite

February 1, 2022

Jim Lynch – Editor

Message from the CCAS President

Last month, the main topic heading was “Whither Goest Our Activites?” This pseudo-literate heading covered: lecture series, star parties, school activities and projects, and public outreach, including a planned (and delayed) “Day of Astronomy.”

The bottom line was: 1) we have done very well with our lecture series, 2) we were able to squeeze in one in-person star party at WSO before omicron, combined with winter, shut them down, 3) our school activities have been suspended the past two years, and 4) our public outreach program only squeezed in one in-person event before being shut down.

Having three of the four major areas our club covers shut down over an extended period is not a good situation, but it is the hand we have been dealt in the Covid era. We have maintained an optimistic attitude throughout, and continue to do so. And a good number of things have actually gone well for CCAS recently (finances, lecture program, equipment inventory, etc.), so we remain hopeful that the core activities that have been disrupted can be restored, and even improved upon. So, let’s talk about that. I’ll follow a similar format to last time.

Lecture series

We have some great speakers interested in giving in-person talks (as we promised them), and will be continuing our book give-away program for any students attending via Zoom. But, live lectures look unlikely until after March, given information we have obtained from local libraries and other venues. So, Zoom continues for now. Given that, we need speakers for March and possibly April, with a good possibility that they would be Zoom talks. (February is covered, as I will discuss below.) I have included a poster soliciting CCAS speakers with this newsletter, and ask that anyone who is part of or near an institution that has an

astronomy program please post one of these (with proper permission, of course). These posters have actually been effective in the past!

Also, we have had a very happy collaboration with the Phoenix Astronomical Society (PAS), which has invited us to their talks (also first Thursday of the month), and has been invited to ours. (I have created a Zoom invitation to this month's talks for both clubs, which will be sent separately very soon.)

And finally, as to our February talk... this month, we will have a CCAS review of where we are and where we are heading. This will include the club, the WS Observatory, and our website. After two years of "altered operation," we need to consider how we proceed from here. As mentioned, there are some good reasons for optimism, but we also need to be careful as we "reboot the system." Jim Lynch, Charlie Burke, and Mike Hunter will share the podium (OK, computer screen.)

Star Parties (updated)

An edited repeat of last month here. "As to the full resumption of Star Parties, the cold weather/Covid combo is currently the controlling factor. We can't allow people into the WSO to warm up yet, and January and February evening weather is very often 10-30 degrees (plus wind chill). We don't want to freeze our guests (or our staff), so instead we will work on getting our equipment and Observatory in great shape for the Spring. The dates for further 2021 Star Parties which were posted on the CCAS website, www.capecodastronomy.org, were removed and we will update that site with 2022 Star Party dates as soon as they become possible."

School Projects and Activities

At this point in time, we are still discussing with the local schools (DYHS, BHS, Sturgis) what is possible and what is not this winter and spring. The schools have been more than slightly distracted with trying to operate during this latest Covid wave, and so negotiations have been slow.

Public Outreach

We have some very exciting plans coming together with the Camp Edwards base folks, the Upper Cape Cod Regional Technical School (and its adult education component), and the Cape Cod National Seashore. While these will be happening in the warmer weather, they are fairly concrete, and so there is future activity in this arena. The first two will be springtime, and the latter in September.

Day of Astronomy

We are still planning a Day of Astronomy event at the Werner Schmidt Observatory (WSO) for the public and our club members and friends. However, it also will have to wait for the warmer weather. May 7th is a national “Astronomy Day,” and perhaps that will be our choice. We will send out notices (email and other) when the date for this solidifies, as well as post it on our web calendar.

Speakers

Last Month’s Speaker

January 6th, 2021

Mr. Charles Law, Harvard Smithsonian Center for Astrophysics

Title:

A New View on the Universe: the James Webb Space Telescope

Abstract:

The launch of the James Webb Space Telescope (JWST) will herald a new era of astronomical discovery. Astronomers will see the very first galaxies and stars formed in the universe, detect molecules in the atmospheres of planets around other stars, reveal supernovae explosions in unprecedented detail, and much more. In this talk, I will provide some historical context to how JWST was conceived, designed, and built, and what exactly makes it so uniquely powerful for modern astronomy. I will outline a few of the major science goals that JWST will address in the coming years, with a particular focus on what JWST will be able to tell us about the chemistry of planet formation and what we will soon learn about how our own solar system came to be and the origins of life as we know it.

PRECIS:

All of our CCAS talks over the years have been very, very good. Charles' talk was no exception and might have even pushed that bar slightly higher, as evidenced by several messages I received about it from our friends and members. Charles was gracious enough to provide a Dropbox link to his PowerPoint presentation for those interested in obtaining it. It is a large file, so regular email was not an optimal route. If you wish to get a copy of this talk, send an email to me at jlynch@whoi.edu and I will send you the link.

Turning to the subject matter of his talk, the James Webb Space Telescope (JWST) is the latest super-high-profile triumph in space science. LIGO, the EHT, the Mars Rover and the JWST have all made front page news in the past few years. During a time when we all need a little good news, space science has provided it with a bevy of new eyes and ears on the Solar System and Universe.

Charles' talk started out describing the impressive fleet of space vehicles and instruments that have explored the Solar System and beyond, and stressing the main telescopes that have looked from the infrared part of the electromagnetic spectrum to the x-ray. Each wavelength has its own advantages in exploring the Universe, and Webb's emphasis in the infrared gives it an advantage in penetrating the clouds of gas and dust which can obscure interesting objects behind it, as well as helping to emphasize features that are most pronounced in that band. He then gave examples of how things can look very different in different spectral regions.

One large motivation for the JWST was to enable studies of how the first stars and galaxies formed, shortly after the period of "reionization," a time called the "dark ages." The first stars were likely monsters that glowed brightly in the ultraviolet, but due to the expansion of the universe shifting UV light from that era into lower frequencies today, we need a telescope that looks in the infrared to study them. The same goes for the earliest galaxies. Hubble's Ultra Deep Field picture could see down to 800 MYr after the Big Bang, but the JWST hold the promise of seeing back to 200 MYr after the Big Bang. The "dark ages" (just lit by the afterglow of the Big Bang, but not by stars) began roughly 380,000 years after the Big Bang, so the idea is to get as close to that time (or equivalently, redshift or distance) as possible. With that capability, as well as the greater resolution of the JWST, an important current area of astronomy and astrophysics can proceed with good data. And not just ancient star formation can be studied, but also modern star formation. Charles showed forming stars in the well-known "Pillars of Creation" as an example.

Another area that the JWST will enable to go much further is exoplanet studies, and in particular planetary system formation. We already have some wonderful optical images of star and planetary systems forming, and the JWST will provide the next generation of images, again with greater resolution and less interference from gas and dust possibly hiding features. Multispectral images of such processes will undoubtedly be amazing. And the JWST spectra will also allow us to look much more closely at the atmospheres of exoplanets that we see. We can even make movies of their orbital motion.

And Charles noted that this was just the beginning. Black holes, solar system planets, supernovae, chemistry of interstellar medium, stellar physics, cosmology, large-scale structure and more will be fair game for this new instrument.

The next part of Charles' talk was about the instrument itself, which is best described as "unconventional." The sunshade, mirrors and instruments were of special interest.

To achieve its end of working in the infrared, the JWST needs to work at a frosty 7 degrees K. The multilayer sunshield, which was a miracle of design and deployment, gets it down to 40 K. The scope also needs (and has) internal cryogenic cooling, as even Webb's own internally generated heat would be too much!

As to the 6.6m mirror (as opposed to Hubble's 2.3m), it is composed of 18 gold coated beryllium hexagons, some of which had to be unfolded as part of the deployment. The path of light from a source through the JWST will not seem so unusual to amateur astronomers, being essentially what is called a "Gregorian" design. Light reflects off the main mirror to a secondary mirror, which then reflects it back to the center of the main mirror where the sensor packages are located. One "cute" piece of this overall design is that all eighteen of the mirrors have to be individually focused and coordinated with the rest to give an overall image.

There are (if I got it right) five different instruments at the focal point measuring different wavelengths and with different resolutions. These are currently expected to operated over 10-20 years, in line with Hubble's duration.

The last part of the talk concerned how the JWST unfolded and how it orbits the Earth-Sun L2 Lagrange point. When the talk was given, the scope was still unfolding and in-transit, but as we happily know, it is now at the L2 point (with fuel to spare) and completely unfolded. For the next six months, it will be focused and tested, after which it will “go operational.” A happy ending note was that Charles is part of a team that has a good chance to get observing time on the JWST to study exoplanets. We wish Charles the best with that!!

OH! By the way, NASA (as usual) has a great web site for the JWST. You can find all the latest news about the Webb at www.jwst.nasa.gov.

This Month’s Speaker(s)

February 3rd, 2022

**Dr. Jim Lynch, Mr. Charlie Burke, and Dr. Mike Hunter - CCAS
“CCAS: Current Status and Future Plans.”**

Abstract: As mentioned above, we are in a transitional period where we envision being able to ramp up club activities again. We will address this in three parts: general club activities (club president Jim Lynch), the Werner Schmidt Observatory and observing programs (WSO director Charlie Burke), and the CCAS website (webmaster Mike Hunter). We are hoping for a highly interactive session with our members and friends. Please link in, and join the conversation!

Upcoming 2022 Possibilities

Dr. Alyssa Goodman of Harvard University, whose work on the "Radcliffe Wave" discovery has been prominent in the news, has agreed to talk to CCAS this coming year. We had promised Dr. Goodman some direct contact with the local students, but until the latest Covid variants are under control, that is not yet possible. Her exact topic/title is TBD.

Dr. Francesca Fornasini of Stonehill College has also agreed to talk to us. She specializes in early star and galaxy formation, and her exact topic will be announced in the near future. Her husband, Dr. Garrett Keating, is also interested in visiting and talking to us. Now, if we could just get rid of bleeding Covid!