First Light Lite

May 2, 2022

Jim Lynch – Editor

Message from the CCAS President

Cape Cod Astronomical Society (CCAS) is back "live" again (and with Zoom as well) 😊

At 730 PM on May 5th, CCAS will "go live" again at the Falmouth Public Library, as well as being on Zoom if you can't attend live. CCAS will first host a dinner at a local Falmouth restaurant, the Peking Palace, starting at 530 PM. This will be followed by a "Two Part Invention" (apologies to JS Bach) astronomy talk by CCAS President Jim Lynch. The first part of the talk will be on amateur astronomy in general, and what you might want to (and can) do as an amateur. We'll have some equipment and a small demonstration or two on hand, as well. The second part of the talk will be a review of Dr. Katie Mack's acclaimed popular book, "The End of Everything (Astrophysically Speaking)" which is a cheerful and informative look at ways the Universe might end (really – this is a NYT acclaimed, very entertaining book, as well as a painless introduction to cosmology). We also will be giving out free copies of this book, as well as some of the other wonderful books that our speakers over the past two years have written, to any HS students who might attend the talk.

We hope we can see you either at dinner or at the talk or both. It will be *very* nice to get back to some personal contact!

DETAILS

Dinner attendees pay for their own dinner, unless they are speakers from 2020 and 2021, who will be guests of CCAS. (We previously had invited all of our speakers to dinner, but couldn't do so in 2020-21 due to Covid.) Peking Palace is located on Main Street, as is the FPL. Its address is: 452 Main Street.

The Falmouth Public Library is located at 300 Main Street. Entrance to the lecture room is via the back entrance meeting room doors. There is copious public parking next to the Library, so don't worry about that detail.

The Zoom link will be posted separately to anyone interested. Contact Jim Lynch at jlynchwhoi@gmail.com by 12 PM May 4th and he will send you the link. (Those already on the CCAS mailing list will receive it automatically.)

NEXT MONTH WE'LL BE BACK AT DENNIS-YARMOUTH H.S. 😊

Next month, Dr. Larry Marschall will talk about increasing astronomical light pollution due to satellites. His abstract is to be found below. We will also have an afternoon open house at our Werner Schmidt Observatory and dinner at the Hearth and Kettle, Stay tuned for updated details! (Via email and on our website.)

Star Parties

As we've just signed a one-year extension of the existing contract between the Cape Cod Astronomical Foundation (CCAF, our non-profit organization legal component) and the Dennis-Yarmouth Regional School District (DYRSD), in order to allow time for long-term negotiations, we also will have use of the Werner Schmidt Observatory (WSO) this coming year, and so will be planning star parties there in the not-too-distant future. We are still talking about safety rules, but once we have that detail ironed out, the weather is starting to become more agreeable, and we're as eager as anyone to be back outside and doing a little observing! Again, stay tuned!

School Projects and Activities

With our contract extension in place, we will be talking to the DYHS teachers soon about projects with their students for next fall. The same goes for other schools that we have interacted with. This spring semester is already well underway, so that next fall looks like the best bet.

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. The first two are planned for springtime and summer, and the latter likely in September. We will keep you informed as these programs solidify and more detail becomes available.

Day of Astronomy

We are *still* planning a full "Day of Astronomy" event at the Werner Schmidt Observatory (WSO) for the public and our club members and friends. However, it will have to wait for the warmer weather. Our guess right now is for a

mid-summer event. Getting our usual pre-covid activities back on track is our priority at this time!

Speakers

Last Month's Speaker

April 7th, 2022

Dr. Hugh H. Crowl, Bennington College

Biography: Hugh Crowl is an astronomer interested in the evolution of galaxies, particularly in the local universe. He received his undergraduate degree from Wesleyan University and his PhD from Yale University. He is a member of the faculty in Physics & Astronomy at Bennington College.

Title: How Do Galaxies Lose Their Gas? Galaxy Transformation in the Virgo Cluster

Abstract: Galaxy morphology -- the appearance and shape of galaxies -- changes as the universe evolves. Star formation in galaxies peaked nearly 10 billion years ago and has declined since that time. In galaxies like our own Milky Way, star formation continues at a more or less constant rate to this day. However, in the nearby Virgo Cluster, we see evidence that star formation rate and, therefore, galaxy morphology, is profoundly affected by the dense cluster environment. I will show examples of galaxies currently being stripped of their star-forming gas in the Virgo cluster, discuss how we can use the remaining stars to understand their history, and describe what we think these events mean for the future of galaxies in the Virgo Cluster.

PRECIS:

As amateur astronomers, we all admire seeing galaxy pictures (and making them!), and we also know that the stars in those galaxies are made from hydrogen gas. Our speaker, Hugh Crowl, studies both galaxies and their star forming gas distributions, with a concentration on large, nearby clusters of galaxies (e.g. the Virgo Cluster.)

He started his talk with a Wikipedia definition of a galaxy, just to put us all on the same page. He then went to one of our favorite images, the Hubble Ultra Deep Field image, showing that there are plenty of galaxies to study, but you really

can't see much fine detail in such distant ones, and that imaging them is VERY time consuming. In contrast, nearer galaxies can show detail and be imaged quickly. (Even at our own WSO, we can produce some detailed galaxy images within minutes!) So, to study detailed galaxy evolution, nearer is in many ways better!

Hugh showed an image of eight nearby galaxies as an "in-class quiz" to see what detail people could pick out, and how the galaxies differed. Shapes, dust lane content, and general color dominated the mix, and indeed these were prime clues that working astronomers study. The distinction between low gas lenticular galaxies and gas (and new star) laden spirals was of particular interest.

In dense galaxy clusters like the Virgo Cluster, one sees a lot of low gas galaxies, but in sparser regions, one sees more spirals with young stars and gas. The obvious question is: why?

To answer that question, Hugh showed some pictures of the Virgo Cluster – one a "standard" picture of the stars that we've all likely seen before, and one a less common picture of the gas in the cluster, mainly in a big blob in the center of the cluster. This gas, especially in the center, was the "likely suspect" for stripping gas out of the cluster's members.

A prime mechanism discussed was "ram pressure stripping" due to the galaxies falling through the gas in the center and feeling a "wind" from that gas as they pass through. A nice analogy is sticking your hand out the car window as you are moving. (Just ask your dog.)

The dust in a galaxy can be used as a proxy for gas movement (as both are pushed around by the "wind"), and Hugh showed some nice pictures of dust lanes, that we often see in galaxies, being pushed out of the galaxies by the inter-cluster gas. We can also image gas by spectroscopy, the 21 cm line that radio astronomers use to image hydrogen being a famous case. Images of the gas also showed this effect.

There are many questions that can be asked about this process. First off, how fast is it? A computer simulation showed that it is on the order of 10-100 kYr. Useful, but we don't have 10 kYr to do observations! So we do a "stellar census," i.e. use statistics of many objects at one point in time to counter the fact that we don't have a long time to look at one object. The trick to that is to use our knowledge of stellar evolution – big, massive stars "live fast and die young" (order a few million years) whereas lower mass stars live slowly and to a ripe old age (order billions of years). Also, massive stars are bluish, whereas small mass stars are reddish. So, sorting by color and luminosity (the Hertzprung-Russel diagram) gives us a handle on age! Look for the most massive star that hasn't died, and you've got some idea of age. Doing this for star clusters is particularly useful, as the stars were all born at pretty much the same time. (And globular clusters were

generally born at the same time as their parent galaxies, so you get a galaxy's worth of age information there!)

One kicker is that we can't see individual stars (other than a few red giants) outside of our own galaxy, so this trick is limited. BUT, we can look at the light from regions of distant galaxies, including at the spectral level (individual colors/wavelengths). Using hydrogen absorption lines, astronomers can carve up regions of a given galaxy to see how much hydrogen gas is in different parts, and thus how galaxies are stripped of gas "differentially."

Two nice examples, NGC 4522 and NGC 4402, show galaxies where the gas is stripped entirely all at once (4522) and in multiple events (4402). Given such data, the question becomes: how? One hypothesis is that the galaxies fall near/through the cluster center multiple times, maybe at different distance and through different cluster gas concentrations. Reconstructing this process is one area of active research.

One or two last questions were about what happens to the stripped gas. It seems that it can form stars as well, which become "intergalaxy-wanderers" and contribute to the ambient light between galaxies.

This Month's Speaker

Dr. Jim Lynch, CCAS

May 5th, 2022 at Falmouth Public Library at 7:30 PM

"A Two-Part Invention"

The big news this month was/is that we are going back to live talks/meetings, starting with one at the Falmouth Public Library (which has been a venue for our talks a few times before, even though DYHS is our home base). The talk(s) to be given are described above. It was made a Two-Part Invention (again, apologies to JSB) because I thought that a brief introduction to our club and what such clubs do would be appropriate after such a long in-person absence due to covid. I'm hoping that this will interest some people both in amateur astronomy and in our club. And the second part (discussion of Dr. Katie Mack's book) was included because a good part of what amateurs do is try to keep current, at least at a layman's level, with what is going on in one of the most active areas of modern science. I may go 10-15 minutes over an hour doing this, for which I'll ask pre-forgiveness!

Next Month's Speaker

Dr Larry Marschall

Professor of Physics, Emeritus, Gettysburg College
June 2, 2022

Title: The Astronomer's Disappearing Sky

Since the dawn of the space age in 1957, tens of thousands of satellites have been launched into orbit around our planet, and though most of them fell back to earth as their orbits decayed, many remained in orbit, and others fragmented, littering our neighborhood with an estimated million bits of space debris larger than a centimeter in size. This population is about to increase significantly with the launch of "satellite constellations" that promise to provide cheap and global wireless internet service. SpaceX, already operative in its early stages, plans to deploy as many as 42,000 satellites when it is complete, and competitors from several other US, European, and Chinese firms will soon join the growing swarm. These satellites, while representing an important advance in communications and industry, present a unique challenge to astronomy, in some cases threating cutting-edge research at the world's largest telescopes. I'll present a description of how these new satellites will affect the darkness of the night sky, and describe the measures astronomers and satellite operators are developing to mitigate their effects.

ZOOM Link for this month's CCAS talk

James Lynch is inviting you to a scheduled Zoom meeting.

Topic: CCAS FPL Zoom Meeting May 5th
Time: May 5, 2022 07:30 PM Eastern Time (US and Canada)

Join Zoom Meeting
https://us06web.zoom.us/j/86590770552?pwd=OVhzUTBjZXpLb1NtMm5wM051bUQ5dz09

Meeting ID: 865 9077 0552
Passcode: 784347
One tap mobile
+13017158592,,86590770552#,,,,*784347# US (Washington DC)
+13126266799,,86590770552#,,,,*784347# US (Chicago)

Dial by your location
+1 301 715 8592 US (Washington DC)
+1 312 626 6799 US (Chicago)
+1 646 558 8656 US (New York)
+1 253 215 8782 US (Tacoma)
+1 346 248 7799 US (Houston)
+1 720 707 2699 US (Denver)
Meeting ID: 865 9077 0552
Passcode: 784347
Find your local number: https://us06web.zoom.us/u/kcAstELJmF

Phoenix Astronomical Society Speaker for May 5th

Again, our thanks to PAS for inviting us to listen to their talks!

Phoenix Astronomical Society Meeting

Thursday May 5, 2022

Guest Speaker Ted Blank

Presentation Title: "Mankind's 'Wright Brothers Moment' on Mars"

Ted Blank, Phoenix Astronomical Society Member and NASA Solar System Ambassador, is giving an in-depth look at the design, deployment and flights of the Mars Ingenuity helicopter, the first aircraft to ever fly on another planet. After hitching a ride to Mars underneath the Perseverance rover, this twin-blade rotorcraft is proving itself an able "scout" for the rover drivers back on Earth, exploring areas unreachable by the wheeled rover and enabling unattended drives longer than any attempted before.

Ted Blank had "first contact" with Phoenix Astronomical Society during the 2012 Transit of Venus. He found he loved Arizona so much he moved here in 2014. His astronomy interests include studying the shape and composition of asteroids via the technique of stellar occultations, both from his backyard observatory and by doing mobile deployments to the occultation paths. Outreach to the public is his passion, and he was the first to receive the 250 hour award pin for public outreach from the Sidewalk Astronomers of America. Ted enjoys speaking on topics ranging from solar system exploration to gravitational waves, and dreams of someday exploring Mars in person. He has a BA degree in Computer Science from SUNY Oswego

and a MS degree in Aquatic Ecology from the University of California Berkeley. He worked for 25 years for IBM and another 12 for Oracle before retiring in 2019.

The Zoom meeting login starts at 7:00 PM Phoenix time (10:00 PM EDT) with the meeting starting at 7:30 PM (10:30 PM EDT). The Zoom meeting link is in the calendar entry for Thursday May 5, 2022 on the Phoenix Astronomical Society website, https://www.pasaz.org/

or click on this link:

https://us02web.zoom.us/j/81032563398?pwd=UWpSOEZWRS96S3NTL3BDbCtFaGlPQT09