

First Light Lite

April 1, 2021

Jim Lynch – Editor

Message from the CCAS President

The dark months of winter are fading behind us, and warmth and longer daylight hours are arriving. Sadly, the bright stars and constellations of winter are dipping below the horizon, but for the galaxy lovers among us, the spring constellations are a fair replacement. Each season has its attractions!

Also, with the arrival of the large-scale vaccination effort, a return to “almost-normal” life looks to be a real possibility this summer. Given that, the officers of CCAS and board of CCAF are working to ramp our in-person programs back up, gradually and safely, of course, and following local and state guidelines. Our speaker program will “go live” when the schools and public facilities open up (late summer?), although we will still keep the Zoom format available, as we can get some wonderful speakers “from afar” with Zoom! Our star parties are looking towards “socially distanced” but live events in early summer, transitioning to our usual format by fall. And our school interactions should be live by next fall, with interaction directly in the classrooms and at our Observatory. Again, these are not hard-and-fast schedules, but they are looking increasingly possible.

In the meantime, we have a *great* lineup of speakers on Zoom this spring and summer! I’ll describe them in our “Upcoming Speakers” section shortly. But, since I have hit that topic, let me make a brief diversion to thank all the amazing speakers that we have had, not only this year, but over the past few years.

This year, the speaker program was nothing short of a lifesaver for CCAS. With our live star parties and school interactions halted, the only part of our program that survived robustly was our lecture series. Thanks to the generosity of some very busy and well-known people, we have had an amazing series of talks on a wide variety of topics astronomical. We thank these speakers warmly and profusely! And, of course, we happily extend a rain check to them for the wonderful H&K dinners that they missed!! (Our humble enticement to get them back!!)

I've also enclosed a list of our speakers from 2016 to the present, and wish to thank this entire list for their generous contributions of time and effort. It takes real work to put together an interesting hour-long lecture, and then deliver it, and all these folks have done that for us. Again, our warm thanks!

This Month's Speaker(s)

As mentioned, Dr. Emily Levesque, <https://www.emlevesque.com/>, will be giving our April 1st talk on her book "The Last Stargazers." Emily having been an MIT undergraduate, and a lover of (and participant in) the pranks ("hacks") MIT undergrads are famous for (read "Nightwork" by MIT press if you are interested) has indicated that, in addition to a great talk, there might be an online hack (of the fun variety) for April Fool's Day. Emily's talk will also be part of our "student book program" this Spring, so local HS students (from BHS, DYHS, or Sturgis) attending will get a signed copy of her book as long as they inform their teacher that they attended. Her abstract is below:

Abstract: A bird that mimicked a black hole. The astronomer that discovered microwave ovens. A telescope that got shot. The science of astronomy is filled with true stories (and tall tales) of the adventures and misadventures that accompany our exploration of the universe. Join Dr. Emily Levesque, author of the new popular science book *The Last Stargazers*, to take a behind-the-scenes tour of life as a professional astronomer. We'll learn about some of the most powerful telescopes in the world, meet the people who run them, and explore the crucial role of human curiosity in the past, present, and future of scientific discovery.

We will also have a second "Club Guest Speaker" from CCAS after Emily, Mr. George Silvis, talk about some *very* nice observations of exoplanet transits that he made from his home observatory just after last month's CCAS meeting. We will extend the meeting past its usual 1- 1 ½ hours to two hours to accommodate this extra helping of astronomy! His abstract and brief bio are below.

"Exoplanet Transit Observing for the Amateur"

Abstract: A review of what is happening on the Exoplanet scene. Amateurs can play and are needed! A look at information sources and techniques. And the experience of one guy with a telescope.

George Silvis is a resident of Bourne and a member of the CCAS for the past several years. A retired software engineer with a passion for astronomical observing, data and equipment. Not an astronomer, but the next best thing! Hails from Detroit. Came to Boston to attend MIT and never got back home save for visits. Never studied astronomy but I worked my undergraduate years at the MIT Planetary Astronomy Laboratory building instruments and supporting observing teams bound for Hawaii and Chile. Now an active volunteer with the AAVSO and the AAVSONet. The latter is a network of some 9 telescopes around the world which are maintained for use by the AAVSO membership and scientists everywhere.

Upcoming Speakers

May 2021

Thanks to CCAS member Marinna Martini, we have a LIGO project guest speaker in May, Dr. Keith Thorne (who is not related to Kip, but occasionally gets some of his mail...) Let me post parts of an email he sent me:

“Dr. Keith Thorne is a group leader at the LIGO Livingston Observatory. His duties include the real-time control and data acquisition systems for their laser interferometers. These are the most sensitive scientific instruments yet devised, making the first ever detections of gravitational waves from colliding black holes and neutron stars in 2015. He has been with the LIGO project since 2003 after his initial particle physics research at Fermilab.”

Keith mentioned “I even gave a TedEx talk back in the day at Corning Glass”

<https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjzuJ2kutHuAhVDeKwKHRPgDAQQwqsBMAB6BAgFEAg&url=https://www.youtube.com/watch?v=oB0KYSluetw&usg=AOvVaw0NwZ9aY6z5J0DIvwFcqwA6>

June 2021

On June 3rd, I get a birthday present in the form of a talk by Dr. Daniel Davis of Stonybrook University. He will be talking about amateur astronomy projects that we all can do. Details are still being worked out, but we will be both giving out books to participating students as well as well as some inexpensive observing tools. The book is, as you might know from Brother Guy Consolmagno's talk, "Turn Left at Orion," of which Dan is co-author. I'm working on getting bookplate autographs from both authors, but I goofed a little in that Brother Guy has recently slipped back to the Vatican, and I'm not sure how long mail will take from there these days!

July 2021

Thanks to CCAS member Paul Fucile, we have one his Stellafane colleagues talking to us in July, Dr. Paul Spirock. His talk will be on "Lucky Imaging Results Using the 13" Schupmann Telescope at Stellafane and the 6" Warmer and Swasey Refractor at Mount Wilson." Anyone interested in planetary imaging should be sure to attend this talk!

August 2021

Dr. Alyssa Goodman, whose work on the "Radcliffe Wave" discovery has been prominent in the news this last year, has also agreed to talk to CCAS this summer. We are hoping that her talk will be live, as August is when we project meeting restrictions should be lifted.

September 2021

Dr. Jim Head, who has given us two excellent talks on Lunar Exploration and the Chinese Space Program, has offered to talk this September about the latest news from Mars, which should be exciting. Perseverance and a number of other rovers and orbiting craft are making Mars a busy place these days, and there should be plenty to relate and synthesize!

Last month's speaker

A little over a year ago, Dr. Jim Gates of Brown University was scheduled to come to the Cape from his home in Providence and give a talk to our local high school students and the Y-Achievers club. Jim devotes a lot of his time and effort as a high-profile scientist and media figure to promoting STEM education to young people, and this was another chance to do so. His “price” for doing this was to ask us to distribute some of his books free to the students, so that they could read about the world of science, and see both its interest and its very human side. We gladly agreed to this, which has been the genesis of our “book program” for students this spring. (These books are signed by both Jim and co-author Cathie Pelletier, and our thanks to them both!)

As we all know, mid-March 2020 was when the Covid pandemic reached our area, and so Jim's March 16th talk was cancelled. Very graciously, Jim said he would give us a rain check on his talk, and last month we were able to cash it, almost a year later. The talk was very well attended, and perhaps most importantly, 37 students from the local schools listened in to a great talk and discussion period. And the autographed books have been distributed, even though Jim was not able to do so in person. So, before getting to the “precis”, let me thank Jim and the teachers involved for their efforts to make this a very nice event, even if it was of necessity a Covid-era Zoom event.

Precis:

Jim's talk started out with a juxtaposition of a passage from Rachmaninoff's 2nd piano concerto and the equations of General Relativity (GR). The point was both the beauty and the amazing, virtuosic intricacy of both things, though in entirely different fields. These two masterpieces are among the highest of human achievements in both areas, and absolutely deserve to be put on a pedestal. Both are the works of great geniuses, and you would probably think the point of such a slide is: “admire, but don't touch, as this is forever beyond your grasp.” But, you would be wrong, and as Jim's talk went on, using Einstein's great achievement of

GR as a concrete example from the world of STEM, he proved his point. One of the main thrusts of the talk was that, yes, this is “hard stuff,” but with some talent and hard work, you can participate and even make significant contributions as well – the masterpieces of science (or music, or art, or many things) aren’t just for the great geniuses, but are available to us all. (Side note: for classical music lovers, there is a wonderful YouTube recording of Russian pianist Anna Fedorova playing the “Rach 2” <https://www.youtube.com/watch?v=9CPvRblZ53U> available, which I’d recommend you listen to!)

There are two main threads that Jim pursued in his talk. The first, of course, was the life and career trajectory of Albert Einstein, a story that many, many people are familiar with at this point in time. And second, and really the central thesis of the book, was the team of astronomers who over the course of a decade accomplished the experimental observations of solar eclipses that “made Einstein *Einstein*.” This second story thread is relatively unknown to most people, with perhaps the exclusion of science historians and some scientists (both professional and amateur).

Einstein’s early career track through university and the Swiss patent office in Bern is now a matter of legend, and it almost seems a matter of luck that he wound up, in 1902, in a position where he could spend hours pondering his chosen field of physics without the burdens that would have come with the academic positions he desired. However, when in 1905 he published four papers that rocked the academic foundations of physics (two on special relativity, one on Brownian motion, and one on the photoelectric effect), his life as an academic didn’t just become possible, but was all but assured. His paper on the photoelectric effect (and not relativity!) won him the Nobel prize in 1921.

This much of Einstein’s story is fairly common knowledge. What came next provided the main tie-in to what is regarded as Einstein’s greatest achievement, and to astronomy, which is our interest, after all! General Relativity, with all of its gloriously gory looking mathematics, would make Einstein not just another well-known scientist, but the quintessential “science genius,” who the public worshipped from afar, and the scientists loved from close by.

Even before he had completed his GR theory in 1915, Einstein had published a paper in 1911 predicting that light would bend as it came close to the Sun, though due to the solar glare this would only be observable during a total solar eclipse. The number he came up with, 0.85 arcseconds of angular deviation, was in agreement with Newton's estimates from 200 years ago, which seems like another instance of "great minds think alike." But, it suffered from two "slight" defects. First, Newton *had* gotten there first as regards that prediction, so it was a bit ho-hum. And, second, it was *wrong*! The number he would eventually come up with using his full theory was twice that size! But, not knowing this latter fact in 1911, Einstein went shopping around in the science community for an astronomer who would measure the light deflection. Enter the astronomers and solar eclipse expeditions, who are the main characters in "Proving Einstein Right" (PER).

At this point, Jim flashed up a map of total solar eclipse trajectories around the globe from 1900 to 1922. These eclipses crossed all over the earth, to areas both familiar and forbidding, and it is to these locations that the astronomers had to travel, and also transport their delicate telescopes and instruments. The race to get the needed data was on!

Though 1912 had two total eclipses available, only one was really suitable, in Brazil. Two expeditions were on hand to view and photograph it, and one in particular, led by Charles Dillon Perrine, was focused on measuring the deflection of starlight. If you associate Brazil and rain forests, you can guess what happened. A heavy deluge soaked both expeditions, and Perrine sent a one word telegram out to the world. "Rain." Astronomy on Earth is weather limited, and the weather doesn't care much about how much effort you went to in preparation, or what is riding on your measurements. The first efforts to verify Einstein's predictions had, *luckily* for him, failed.

The next good shot at data was the August, 1914 eclipse, which would have the longest duration of totality just north of Minsk, Russia. This was a much simpler destination to reach, and a number of expeditions set their sights on "being there or being square." But, as some of us might remember from our history class, June 28, 1914 changed the world mightily, with the assassination of Archduke Ferdinand and his wife. War was in the air. Still, as a number of international

teams had already arrived in Russia, they continued to set up their expeditionary instruments and hoped for the best. But, between war and bad weather, no good measurements of starlight deflection were made in 1914. Moreover, a number of scientists and their unique and invaluable instruments were taken prisoner and impounded for the duration of the war. The race to measure Einstein's prediction had taken yet another unfortunate (though fortunate for Einstein) turn.

Many of the main characters in PER, such as Perrine, Sir Arthur Eddington, Frank Dyson, and Erwin Freundlich, were largely sidelined over the next few years due to the war, funding, and personal matters. Moreover, much valuable equipment had been lost and impounded in 1914. So, scientific experimental efforts had, as is often the case in wartime, stalled and been postponed. But, Einstein, being a theorist, was not so hampered. In 1915, he started writing his now famous field equations out, and had a very nice initial success in explaining a long-standing mystery, the precession of the perihelion of Mercury. With this under his belt, he then re-examined the deflection of starlight, and found that his previous prediction was a factor of two too small. He now had a prediction that was his and his alone, was larger and thus more easily measurable, and most importantly was correct. He was ecstatic, and launched his GR theory in a series of lectures in 1915.

The 1919 expeditions to the Portuguese island of Principe, a beautiful island with an immensely sad history of slavery, and to Sobral in northern Brazil, would prove to be the ones to break the string of experimental failures to date. Led by Arthur Eddington and Edwin Cottingham in Principe, and Andrew Crommelin and Charles Davidson in Brazil, these expeditions finally brought back plates that, after being independently examined by impartial observers, showed the deflection of light that Einstein's theory predicted. On November 6, 1919, Dyson announced to a well-attended special meeting of the Royal Society that trustable results were in hand, and that they indeed supported Einstein. The audience was by and large convinced, and appreciative of the importance of the result.

But scientists are, of necessity, a skeptical lot, and so in 1922 a number of eclipse expeditions converged on Australia to make further measurements. One was led by William Wallace Campbell (later to become the President of the Univ. of CA–Berkeley and Jim's "favorite" character of the book). To quote Sir Frank

Dyson: “From very accordant results, they found a value of 1.72 for the displacement near the Sun’s limb, confirming the results and conclusions of British observers in 1919.” The story of the quest for verification of GR had concluded, at least for then. Attempts to find shortcomings in Einstein’s GR theory still continue to this day, but in very different ways and with much more advanced instruments. But that is another story.

Perhaps just as enjoyable as the talk itself was the conversation and questions that came after it. Jim let himself be fair game for questions from all angles, with career path being one of the big topics. Jim described his experiences as a young 1950’s kid who loved science and science fiction. He even had a clip from “Spaceways” available, which evoked some discussion of which 1950’s SF movies were the best and which were the cheesiest. (More than a few of the CCAS members remembered some of these, and I suspect that the young students listening were pretty amused at the proceedings.) A more serious thread evolved concerning Jim’s eventual journey to MIT, which wouldn’t have been possible as a high-schooler in 1964, but became so by the time he was old enough to apply. Jim is a strong advocate for minorities in STEM, and his own personal experiences are an integral part of it. One of Jim’s strong themes is that STEM has a lot of room in it for people who are interested, have some talent for it, and are willing to work hard. But the doors of opportunity have to be open to them, as well, and there is a *lot* of work to do in that regard.

Moon crater size distribution answer

Given that we had only one entrant, Mr. Jim Mitchell of DYHS, who is a geologist by training, I will declare him the winner!

The explanation for the decrease in the number of craters at smaller sizes that is seen in my Moon map is, unfortunately, a hard one, and depends on the rate of creation of such craters by impacts compared to their destruction by larger impacts, vulcanism, and other processes. These processes can be local, time dependent, etc. Crater size also depends on the mass, speed, and impact angle of the object hitting it, all of which vary. And, lastly, the listing on the map I used could be biased and incomplete. So, my seemingly innocent question turns out to be a harder one than I thought, as I realized going through a few journal articles on

the topic! I will send Jim the extra maps I have, and also see if I can get a bit more information on this. And next time, I'll try to find a simpler question...

Phoenix Astronomical Society talk invitation

From Paul Facuna, VP of PAS

"The next Phoenix Astronomical Society monthly meeting is Thursday April 1, 2021. Zoom meeting login opens about 7:00 PM PDT with the meeting starting at 7:30 PM PDT or 10:00 and 10:30 PM EST. The information about the speaker, Professor Danny Jacobs, and topic, CubeSats, along with the link to the meeting are in the attached document. I hope you and some of your members can attend."

Speaker: Professor Danny Jacobs

Topic: "Cubesats as Mini Space Telescopes and Beyond"

Space is everyday becoming more accessible. The cubesat form factor makes it possible for anyone to build a satellite and get it into space. At Arizona State University, students are building them as club projects and research groups are using them for high risk/high reward science. Recent developments have made it possible for a university to build custom space telescopes or send instruments to the moon.

Professor Jacobs will describe the basics of building a cubesat, getting it to space, and tell you about recent projects including ASU's first cubesat, Phoenix, which was recently deployed, LunahMap which will look for water on the moon, and SPARCS which will monitor m-dwarf flares in the UV. Cubesat activities at ASU are supported by the Interplanetary Initiative Laboratory, a "space maker-space" which opened last year and continues to add new capabilities.

Professor Danny Jacobs is a physicist with a wide range of interdisciplinary projects in the areas of low frequency radio cosmology, cubesats, and a long tail of seemingly unrelated projects. As a professor at ASU he teaches Astronomy, electronics, systems design in the School for Earth and Space Exploration and is an Associate Director of the Interplanetary Initiative where he leads the laboratory unit. Notable projects include the Hydrogen Epoch of Reionization Array where he is Project Scientist, the SPARCS cubesat serving as spacecraft lead, the ECHO radio drone calibrator (PI)

and the Deployable Optical Receiver Array (DORA, also PI). HERA is a pre-cursor to the proposed lunar Cosmic Dawn Mapper, the Square Kilometer Array, and several proposed orbiters.

The meeting will be held virtually over Zoom. (Times are PDT)

The Zoom login opens about 7:00 PM. President Mike Marron will open the meeting at 7:30 PM with a few brief announcements. The Guest Speaker will start his presentation about 7:35 PM. The link for the Zoom meeting is:

: <https://us02web.zoom.us/j/86077408863?pwd=bU9xTXhRYW5Za3lPdTkrcN4NWtBZz09>

Committees

On February 5th, at 7:00 PM Eastern, we had a 1 ½ hour long kickoff meeting of three newly formed CCAS committees: 1) Programs/Content, 2) Membership/Outreach, and 3) Communications. On February 16th, at the same time in the evening, we had the first regular, monthly meeting of those committees, along with a newly formed “Invited Speakers” committee.

We now have a small core group for each committee, but (again) we really, *really* could use additional members. This is a once-a-month, half hour Zoom session commitment, though with a bit of interesting homework also involved. We sincerely need people to sign on and help with these to get our program(s) back in good order. To do this, just drop me an email at jlynch@who.edu saying “I’m interested” or, if you’re logged into our meetings, stay around for the club meeting portion and tell me in (virtual) person. I’ll send you a link to the next CCAS committees meeting, as well as minutes of the last meeting and an upcoming meeting agenda, as soon as I get an expression of interest!