First Light Lite

September 7, 2025

Jim Lynch – Editor

Events – August

If July was relatively quiet, August was its opposite – lots going on! Since one speaker, Dr. Loeb from HSCfA, postponed a month, we had *two* speakers from HSCfA in August, the other being CCAS' old friend Dr. Antony Stark. And while we didn't have our traditional star party at WSO in August, we had an even bigger star party (800+ attendees) at the Cape Cod National Seashore's (CCNS) Marconi Beach under even darker skies. In addition, Observatory Director Charlie Burke and his crew have completed the dome upgrade, so that the dome and scope slew together, and operations can be handled completely from the downstairs terminal (a much more comfortable and warmer place!) Finally, we elected the newest member to the CCAF board, Mr. Gerry Grenier. So, all in all, an active month!

CCNS Lectures and Star Party

Given that the Dark Skies events at CCNS typically have drawn crowds in the hundreds from all over the Cape, we switched our regular WSO star party to the CCNS event, which consisted of three lectures on Friday August 29th and a "rain date" star party on Saturday, August 30th.

The Friday afternoon lectures by Jim Head, Frank Isik, and Jim Lynch, were all excellent, but sadly underattended perhaps due to, as Frank Isik guessed, perfect beach weather on the last "big weekend" of the summer. Also, we were probably a bit late in arranging these. (So next year we will arrange things earlier and order cold, overcast weather…)

Jim Head started the talks off by giving an update of his reports on the Chinese space program, with which he has close contact. The Chinese program has come from small beginnings only a few decades ago to being perhaps the premier one worldwide due to China investing heavily and consistently in space science.

Frank Isik followed with a very public oriented talk about astrophotography, and showed some of the equipment he has used through the years. What he pointed

out at the end was striking - that very small, comparatively inexpensive modern equipment (like the Seestar and Unistellar scopes) can compete rather nicely with the larger, harder to handle, and more expensive scopes of only a decade ago. Imaging now can be done with a very small learning curve and comparatively little outlay. Of course, larger scopes still have some aperture advantages, but for someone just coming into the field, the game has changed!

Jim Lynch finished the trio of talks by talking about amateur astronomy in the context of dark skies ala the NPS Dark Skies program. In doing this he thanks Dr. Larry Marschal for the use of some of his slides which discussed the same topic a few years ago. Sadly, light pollution and satellite tracks have not decreased over those years but rather have gotten worse for the most part. Those who came to Marconi Beach the next night saw the dark skies difference, with all the constellations shining brightly and the Milky Way glowing overhead and easily visible.

The star party event the next night was far better attended than we had anticipated. Instead of 300-400 people, the crowd was more like 800-900 people. Thankfully, the National Park Service rangers had created a safe and efficient "viewing corridor" set up where people could walk through a row of scopes, binoculars, and CCAS members to see the added beauty of a dark, clear night sky when viewed through amateur instruments. Judging from the reactions we got, and the extra hour we stayed to accommodate the bigger crowd, the night was a real success. We especially thank the NPS rangers for their hard work in coordinating and shepherding this event. It also was a great example of how our National Park system is a treasure for the people of this country.

Fig 1. Setting up on Marconi Beach for the Dark Skies star party

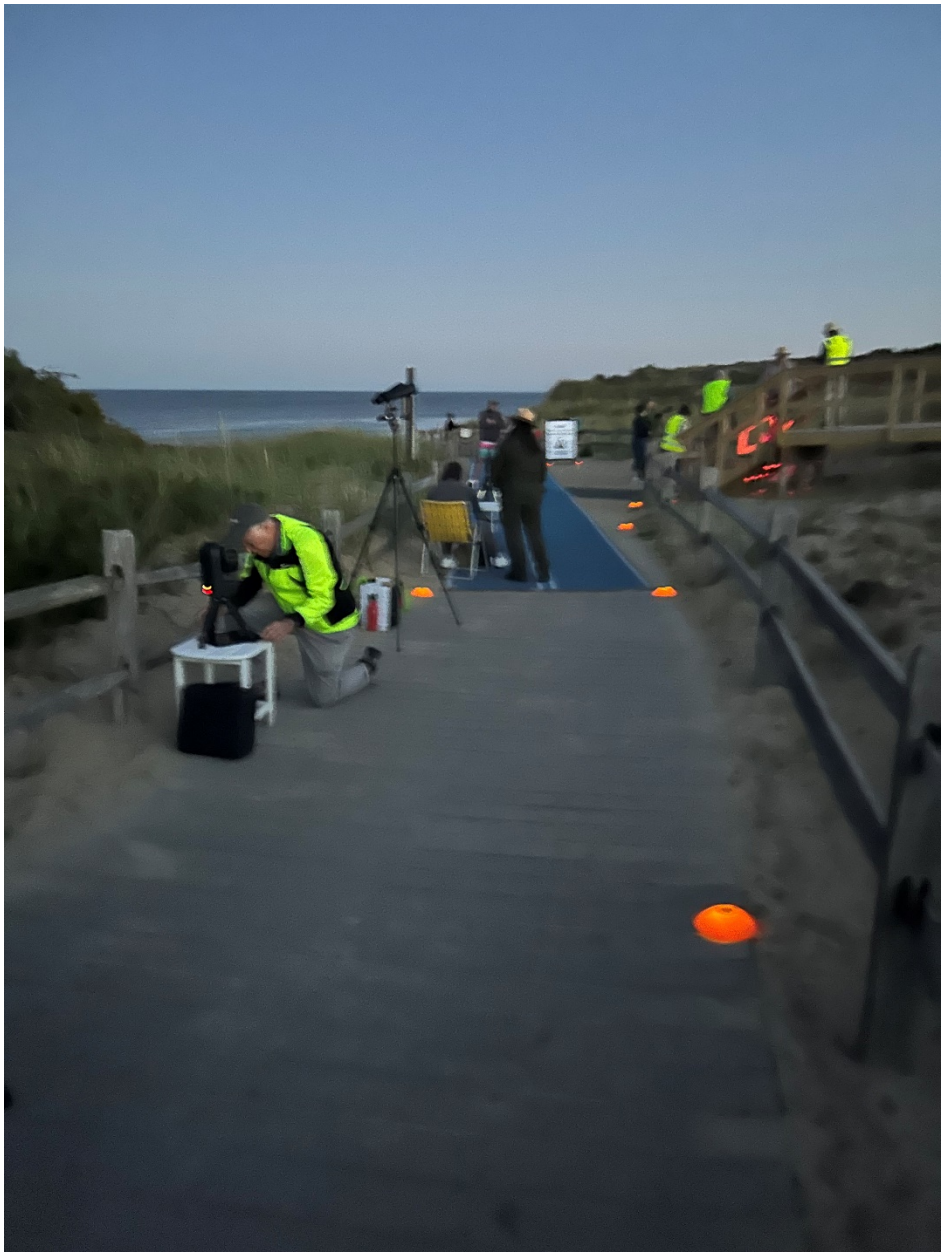


Fig. 2. The Eagle Nebula (M16) was a popular showpiece at the CCNS star party, as it shows beautiful detail after just one minute of exposure.

Elections

The current CCAS officers will stay another year in office, specifically: Jim Lynch, President; Frank Isik, Vice-President; Chris Lynch, Secretary; and Ken Brink, Treasurer.

Nobody initially volunteered for the open position on the CCAF Board, to replace previous Secretary Jonathan Hatch. We needed someone for this position, and Gerry Grenier stepped up afterwards. His appointment was approved by the CCAF Board and also a member vote, so we now welcome Gerry to our Board officers!

Events September

Our star party week will be September 22-26.

We also have a fair number of public outreach events scheduled with schools and Cape organizations over the next few months and have been asking for more volunteers to run them. If you are interested and haven't been contacted already, please email jlynchwhoi@gmail.com. We thank those who have already volunteered for some of these events!

Dues

Our CCAS dues policy is rather relaxed and flexible, as our outlays for events are comparatively small

After some discussion, we've come to the agreement that our dues will be light and voluntary unless you want to use/borrow equipment owned by the club. Dues this year (which were due the end of July but can be paid anytime) are $15 per member or family of members, and free for students. This small amount is used solely for club activities, and not for equipment, which is CCAF's province. We appreciate the contributions from people who enjoy our activities, but as our expenditure *is* generally small, we don't insist on dues to enjoy them.

Dues can be paid at our "in person" DYHS meetings or via mail to: Dr. Ken Brink, 16 Greengate Road, Falmouth, MA 02540. Please do not send them to the DYHS or to the Observatory, as this can delay receipt substantially.

August's Speakers (with apologies for the late writeups)

August 7th – Dr. Tony Stark, HSCfA. (An old friend of CCAS)

Venue: DYHS and on Zoom

Bio: Antony Stark is a pioneer of Antarctic Astronomy and is a founder and designer of the South Pole Telelescope (SPT), which is among the most important instruments for observational cosmology. He is PI and designer of the Parallel Imager for Southern Cosmology Observations (PISCO), a photometric camera on the Magellan Clay telescope for taking fast simultaneous g, r, i, and z band images. PISCO is being used to take the first images of galaxy clusters discovered by the SPT to determine their mass by gravitational lensing analysis. PISCO is also in use by several groups from Magellan consortium institutions to study asteroids, galaxy formation, exoplanets, and X-ray sources. Stark is a member of the STO and GUSTO balloon-borne telescope teams for Milky Way and Magellanic Cloud TeraHertz spectroscopy surveys of the dominant cooling lines of the interstellar medium.

As a personal note, this is Tony's fifth talk to our club. He comes down to the Cape each summer, and CCAS is one of his regular stops when here. He has been our "Current Astronomy 101" teacher, and I hope that people can join him and his wife Ellen for dinner with us when he comes here! Thank you, Tony!

Topic: "The Shapes of Galaxies Past and Present"

Abstract: When we could only see nearby galaxies at low redshift, astronomers were concerned with understanding the shapes of galaxies as a result of the physical processes within them: ellipticals, spirals, and "irregulars". I'll discuss a project I did on this topic a half-century ago, at the suggestion of two great names: Martin Schwarzscild and S. Chandrasekhar. New, powerful telescopes are now showing us the formation of galaxies back in time at high redshift --- they're very different, and there are aspects we don't understand, but are working on as active research.

Precis: A brief overview of what Tony did is best gotten from his first slide, which I reproduce here.

"The century-long history of human discoveries about galaxy evolution goes backwards, from highly-evolved and organized galaxies now, to the small, chaotic early galaxies of 13 billion years ago.

First a bit of the physics behind galactic structure.

Then this talk will follow the thread of human discoveries, going further out in distance, redshift, and time as the science progresses.

With a digression about the creation of a journal article I wrote half a century ago, and a digression from that digression about polytropes.

Finally, a discussion about ongoing current research about the earliest galaxies that touches on some scientific mysteries."

The galactic physics part of Tony's talk would take a separate newsletter to describe decently, so let me just make a few observations: 1) if anyone is interested, Tony has approved a limited distribution of his PPT slides, so you can email me requesting them, 2) Wikipedia has brilliant basic descriptions of topics like this if you need a quick look, and 3) Tony finished this part of his talk by describing basic galaxy shapes (spiral, irregular, elliptical, and lenticular), one of which began his career in publishing in the peer reviewed literature (elliptical, triaxial) and which set up the next topic.

The next part of his talk was a digression into his article on triaxial galaxies, which I have attached to the email that contains this newsletter. The project he wrote on was posed by astronomy giant Subramaniam Chandrasekhar: "in general, what are the isophotes of an arbitrarily-oriented triaxial elliptical galaxy; in particular can the isophotes exhibit "twist?" If this sounds somewhat esoteric, it is but even if you're not a professional scientist, you can get a sense of what Tony did by scanning his paper. In doing this work in the 1970's (the same time I was in grad school), Tony provided a very amusing and interesting digression into what research looked like "way back then," which I'll reproduce here.

"The context of doing Astrophysics in the 1970s . . .There were two "mainframe" computers on the Princeton campus: an IBM 360/91, to which you could submit your FORTRAN program as a box of punched cards, and a DEC 10, to which you could "login" with an ASCII terminal and run BASIC programs. There were no graphical outputs.

Scientific papers were written out in longhand on paper and typed for submission to the journals. Data was graphed by hand on graph paper. The publication process would take a year or more. You could write a postcard to the corresponding author asking to be mailed a xeroxed preprint.

"High redshift" objects were quasars at $z \sim 0.2$, Steady-state cosmology was still a viable theory, and so galaxies were thought to be long-term, stable objects.

CCDs were still a lab curiosity, intended as a kind of computer memory. But (new thing!) photographic plates could be digitized, the data stored on magnetic tape, and analyzed by FORTRAN program.

An exciting new result of digitized images of galaxies were isophotal "twists"."

I'd love to add my own comments about that era to this, but I won't. The end result of Tony's work became lovingly known as the "bullet through the watermelon theorem." Read the paper, and again, if you'd like a copy of the PPT, I can forward it!

Another digression that Tony made in talking about his work on isophotes was about the so called "polytropic model" of stellar structure and luminosity, which gives a simplification of the full stellar structure equations. If you look up "polytropic model" and "Lane Emden Equations" in Wikipedia (or elsewhere) you will find plenty of material, as these are standard textbook topics in astronomy courses. Before today's sophisticated, numerically integrating models were available, simplifications like the Lane Emden equations provided some good approximate answers and also insight into the physics.

Tony ended his talk by addressing current work on high redshift galaxies. As Tony mentioned, "back in the day" redshifts of 0.2 were state of the art and even Steady State Cosmology was considered viable (until the CMB was discovered). Today, galaxies with redshifts of 14+ are being observed, and look like small red smudges or "little red dots" in photographs due to cosmic expansion. And the early galaxies look nothing like our modern spirals. Understanding galaxy evolution over time means having to understand these early objects, and Tony is staying on the forefront of that part of galaxy studies and cosmology. We hope to hear his talk about the latest advances again next year!

Aug 21st (via Zoom)

Speaker: Dr. Avi Loeb, Harvard University

Bio: Abraham (Avi) Loeb is the *Frank B. Baird, Jr., Professor of Science* at Harvard University and a bestselling author (in lists of the New York Times, Wall Street Journal, Publishers Weekly, Die Zeit, Der Spiegel, L'Express and more). He received a PhD in Physics from the Hebrew University of Jerusalem in Israel at age 24 (1980-1986), led the first international project supported by the Strategic Defense Initiative (1983-1988), and was subsequently a long-term member of the Institute for Advanced Study at Princeton (1988-1993). Loeb has written 9 books, including most recently, *Extraterrestrial* and *Interstellar*, as well

as over a thousand scientific papers (with h-index of 131 and i10-index of 614) on a wide range of topics, including black holes, the first stars, the search for extraterrestrial life and the future of the Universe. Loeb is the Director of the Institute for Theory and Computation (2007-present) within the Harvard-Smithsonian Center for Astrophysics, and also serves as the Head of the Galileo Project (2021-present). He had been the longest serving Chair of Harvard's Department of Astronomy (2011-2020) and the Founding Director of Harvard's Black Hole Initiative (2016-2021). He is an elected fellow of the American Academy of Arts & Sciences, the American Physical Society, and the International Academy of Astronautics. Loeb is a former member of the President's Council of Advisors on Science and Technology (PCAST) at the White House, a former chair of the Board on Physics and Astronomy of the National Academies (2018-2021) and a current member of the Advisory Board for "Einstein: Visualize the Impossible" of the Hebrew University. He chaired the Advisory Committee for the Breakthrough Starshot Initiative (2015-2024) and served as the Science Theory Director for all Initiatives of the Breakthrough Prize Foundation. Click here for Loeb's essays on innovation.

Title: The Search for Interstellar Objects of Technological Origin

Abstract: Over the past decade, the first four interstellar objects were discovered. They include the interstellar meteor, IM1, detected on January 8, 2014, `Oumuamua detected on October 19, 2017, and Borisov detected on August 29, 2019. Among these, the first two appeared anomalous relative to known solar-system rocks whereas the fourth appeared to be a familiar comet. IM1 exhibited the highest material strength among all meteorites in the CNEOS catalog of NASA, `Oumuamua exhibited a flat shape and non-gravitational acceleration with no detectable cometary evaporation. In June 2023 we recovered 850 spherules from the Pacific Ocean site IM1. A tenth of these submillimeter meteoritic spherules displayed a unique chemical composition, different from familiar solar system materials. Currently, new Galileo Project Observatories are monitoring millions of objects near Earth in the infrared, optical, radio and audio and analyzing their nature with machine-learning software. Are any of them Unidentified Anomalous Phenomena? Forthcoming data from the Rubin Observatory in Chile will offer additional clues on interstellar objects. Is space trash from extraterrestrial technological civilizations lurking among the natural interstellar rocks?

Precis: Just as asking about the origins of the universe is considered a grand question in astronomy, so is the question “are we alone in the universe?” However,

while asking the first question will get you recognition as a serious thinker, asking the second question risks getting you labeled as a chaser of "little green men" and as someone who is pursuing a less than serious scientific question. Yet we know that finding evidence of extraterrestrial life will totally change our view of the universe and that it has vast ramifications. So, it is a question that needs pursuit, but only very few pursue it given the risk it would pose to their reputation. Into this fray steps Harvard professor Avi Loeb, who has a stellar reputation in the astrophysics community, but is also not afraid to ask questions he thinks are valid, no matter if they seem "embarrassing" or not.

Dr. Loeb was first inspired to pursue this direction by the (seeming) asteroid Oumuamua in 2017, which was an extrasolar object, but which also exhibited very unusual characteristics in its orbital behavior, shape, reflectivity, material composition, and other categories. This seemed to be an "un-natural" object whose explanation could be more easily explained by being a lightsail type of device, which could perhaps be used as an exploratory probe. In his book "Extraterrestrial", Dr. Loeb made this case in a very plausible, scientifically rigorous manner. Even if you don't subscribe to that hypothesis, which he admitted needed more data to support to a high degree of confidence, the arguments are compelling, and it is a worthwhile read.

This case is made even more compelling by his discussions of possible methods a race might use to explore the vastness of interstellar space. Small packages using lightsail propulsion can be sent out in large numbers cheaply and efficiently, and if we want to "look around" the galaxy, this would actually be a good way to do it.

But Oumuamua only was visible for a relatively short time, and so where did that leave the problem? Thinking things over, Dr. Loeb reasoned in his sequel book "Interstellar" that if extraterrestrial civilizations were producing probes or other "space junk" (much as the human race produces megatons of waste material), some of it could hit the earth. In recent years, we've been increasingly able to identify "extra-Solar System" objects falling into the Solar System, and these are more and more looking like common occurrences, and not anomalies. If some of this material hits the earth, it should be identifiable by its angle of collision with the Earth's atmosphere and the pieces recoverable and identifiable. So, maybe we don't have to even leave the Earth to find evidence of extra-Solar life. (Which, by the way, could be long extinct, given the time scales of the galaxy.)

To do this, Dr. Loeb initiated a project he called Galileo, in honor of the great Italian scientist who made a claim that was not believed in its time but later turned out to be a bedrock astronomical truth. Sensors (e.g. an all-sky camera)

were made with graduate student support which could classify objects in the sky using artificial intelligence, which also was of great interest to the Department of Defense. These relatively inexpensive sensor suites could be deployed worldwide, providing a tracking system for both "space junk" arrivals and also other objects hitting the earth.

In addition to developing this classification/tracking system, Dr. Loeb next set out to track down what could be identified as interstellar meteors, using archival data from the U.S. Space Command. A particularly promising candidate, called IM1, fell into the Pacific Ocean in 2014, and using some trajectory estimates, was able to scope out a search area off Papua, New Guinea.

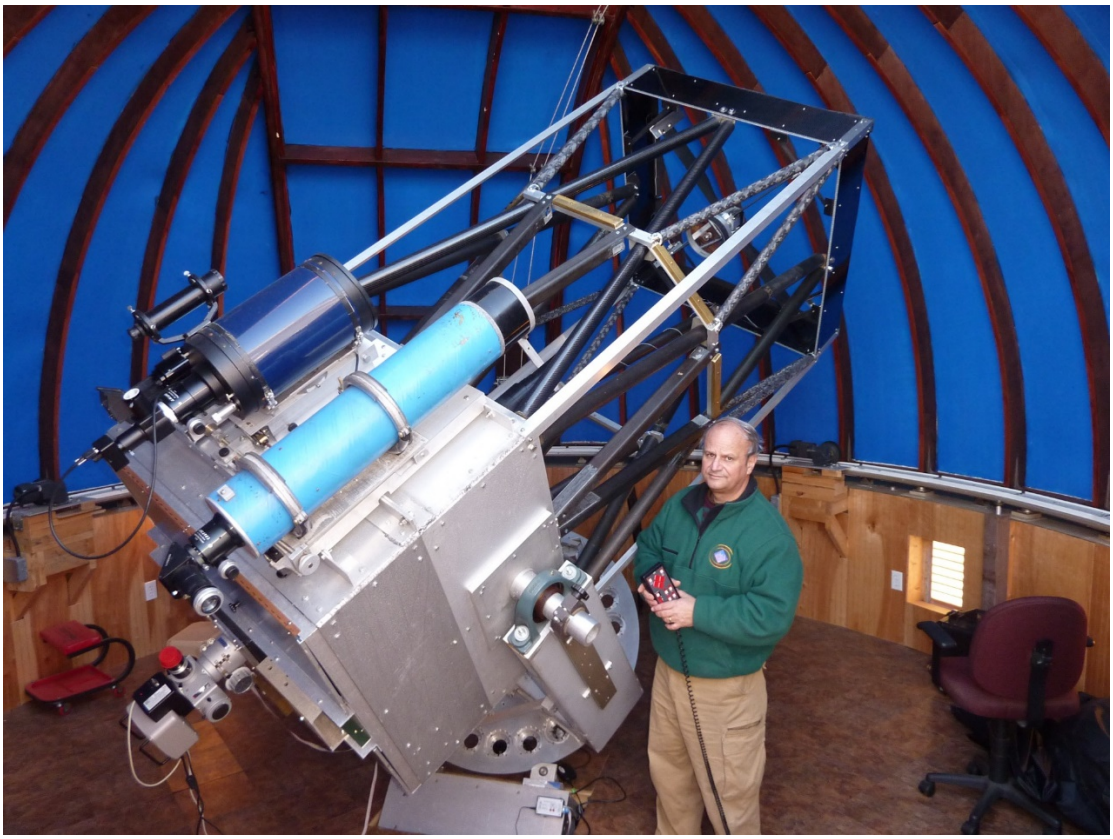
The next part of Dr. Loeb's talk looked very familiar to the oceanographers in the audience (and CCAS has a few). Using a magnetic detector sled and bottom material samples, Dr. Loeb and his team did a seagoing "lawnmower" search pattern of the suspected debris field from the meteor, looking for unusual materials that would belie an extrasolar origin.

The talk ended with a picture of a sunset at sea and the Vera Rubin Observatory, stressing two earthbound ways we might detect signs of life that is not of this earth. We wish Dr. Loeb success in this quest and also thank him again for a great talk to our club and its friends.

Last Month's Speaker

This month's speaker: Dr. Mario Motta
Date: September 4th at 7:30 PM
Place: Live at DYHS (with H&K dinner before at 5:30 PM). Also, on Zoom.

CV: Mario is well known as an astronomer. Working with the American Association of Variable Star Observers, Harvard–Smithsonian Center for Astrophysics, and MIT, he has numerous observations and publications. In 2013, the International Astronomical Union named an asteroid in his honor. (asteroid *133537mariomotta)* In the astronomical community, Dr. Motta is well known for his large and completely homemade telescope and observatory including the optics, a 32-inch f6 telescope.



Dr. Motta had been in practice at North Shore Medical Center in Salem, Massachusetts, since 1983, recently retiring in 2022. He is a graduate of Boston College, with a BS in physics and biology, and of Tufts Medical School. He is board certified in Internal medicine and Cariology and is a fellow of the American College of Cardiology, and of the American Society of Nuclear Cardiology. He is an associate professor of medicine at Tufts University School of Medicine. Dr. Motta has long been active in organized medicine, both in the American Medical Association (AMA) and in the Massachusetts Medical Society (MMS), holding a number of posts through the years. He is a past President of the MMS. He was elected and served 8 years on the AMA council of Science and Public Health, and then was elected to the Board of Trustees of the AMA in 2018, recently completing his term. In May of 2023 at its annual meeting, the MMS awarded Dr Motta its highest honor, the “Award for Distinguished Service.”

Dr Motta also has a lifelong interest in astronomy, and has hand built a number of telescopes and observatories through the years to do astronomical research, including his entirely homemade 32-inch F6 relay telescope located in Gloucester, MA. He has been awarded several national awards in astronomy, including the Las Cumbras award from the Astronomical Society of the Pacific in 2003, and also the Walter Scott Houston award from the northeast section of the Astronomical

League, and in 2017 the Henry Olcott Award from the American Association of Variable star Observers (AAVSO). He has served as a president of the ATM's of Boston and has served as a council member of the AAVSO, and is a past president as well. He has also served on the Board of the IDA. He has worked on light pollution issues and published several white papers on LP as a member of the AMA council of science and public health. He served on a UN committee (COPUOS) representing the AMA on light pollution for a worldwide effort to control LP and satellite proliferation. Finally, several years ago the International Astronomical Union awarded Dr Motta an asteroid in part for his work on light pollution as well as amateur research, asteroid 133537MarioMotta.

https://www.mariomottamd.com/

Title: Constructing the 32-inch relay telescope

Abstract: In 2004 my wife and I decided to move to Gloucester MA. and we obtained a plot of land overlooking Wingaersheek beach. This satisfied my wife's desire to live next to a beach, and my desire for a dark sky site and still be able to commute to work. Having made 2 prior observatories, and a previous 32-inch Newtonian F4, I resolved that the next telescope and observatory would be part of the home itself for ease of observing, no more midwinter shoveling of snow to observe.

I was planning another "better" Newtonian telescope, but Scott Milligan, an optical designer, convinced me to make a "relay' telescope with a spherical primary, and 5 correctors, rather than a difficult to make parabolic mirror. (Similar to the Hubble fix, of which he was a consultant). His design was inspired by Donald Dillworth, who built a 16 inch 'relay" telescope back in 1977 (S&T November 1977). Following his prescription closely, and with his help 6 optical elements were made which encompassed 11optical surfaces, as well as 680 mechanical parts on my lathe and milling machine. I had considerable help from the combined expertise of many members of the ATMOB in designing and building this telescope and observatory, but it was entirely homemade.

Precis: As Mario's abstract covered his talk material well, let me just try to add a few asides to augment his writeup, based on the comments and discussion during his talk.

One fun question asked of him early in the talk was: why did you choose a medical career over one in astronomy, as you are good at both and work hard at both? His answer was that it was a coin toss, but the medical school acceptance came earlier, so he went with that. As a high-level medical career could finance astronomy as a secondary career, things worked out well.

A second thing that came out in the talk was that Dr. Motta was quite good at locating less expensive "surplus" materials and also at identifying people who had the skill sets that he needed to help him complete his project(s). Some of the help he enlisted was from the Amateur Telescope Makers of Boston, an organization he was a former president of. (Amateur belies their very considerable skill level.)

Relating to skill sets in the astronomy and telescope making area, Dr. Motta boasts of many that were displayed in his talk. Building design and construction, carpentry, machining, optical design, large mirror grinding and polishing, and general astronomy knowledge would just be a start.

The photographic portion of the talk was spectacular. With dark skies, a 32" scope, an on-axis guider and a good camera, and expert processing, Dr. Motta has produced "Hubble Quality" images, which he displayed and discussed scientifically.

Though this was formally a telescope making talk, Dr. Motta's involvement with the science also came through clearly. If you've read his bio, Dr. Motta was a former president of AAVSO, has been awarded numerous honors in both medicine and astronomy, and even has an asteroid names for him!

Next Month's Speaker: Wanying Kang, MIT

Date: October 2, 2025 Live and on Zoom

Title: Deciphering the icy satellites: from the ice shell geometry to the ocean dynamics

Bio: Wanying Kang is the Homer A. Burnell Career Development Pofessor and an Assitant Professor at the MIT Department of Earth and Planetary Sciences. Her primary research areas are the planets and climate. She investigates large scale atmospheric and oceanic dynamics and their effects on the climate of Earth and other planetary bodies.

Abstract: Icy moon oceans are prime targets in the search for extraterrestrial life, but their hidden dynamics are difficult to probe; instead, the overlying ice shells provide observable clues to the ocean below. Using Enceladus and Europa as

examples, I will show how interactions between ice thickness variations and ocean circulation can explain their contrasting shell geometries and reveal how heat is partitioned between the ice and rocky interior.

Directions to Dennis Yarmouth HS and Werner 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 along 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. You can (and should) park on the grass there.

H&K directions

CCAS hosts a dinner gathering for the speaker (if available), members and friends on meeting nights (just before the meeting) at the South Yarmouth Hearth & Kettle restaurant at 5:30 PM; (the meetings begin at 7:30 at D-Y.) Please join the group to dine and talk about all things interesting, especially astronomy, 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). **NOTE:** Since Covid, we have a mix of fully remote and hybrid in-person+ remote meetings. Check the newsletter and/or website to see what the format is each month! There are no dinners when the meeting is fully remote.