MHAS-Observer

Newsletter of the McMath-Hulbert Astronomical Society, Lake Angelus, Michigan

Contents

President's Message

Greetings all;

The Month of June, to me, is the month of the Sun, as June 20 is this year's Summer solstice in the Northern hemisphere. It's the longest day of sunlight when the Sun reaches its highest altitude at noon. At the observatory we are continuing our efforts to improve our organization and the facilities under our care.

We have created several committees in order to determine and organize our needs. Board member Ken McKenzie has created a detailed Gantt chart for tracking projects.

General maintenance of the facilities, towers, scopes and grounds has slowed but not stopped because of limited ability to bring in people in bigger groups to work in teams. Still, individual board members are coming in to ensure things are kept safe, secure, and maintained.

We always encourage your support and participation in our activities—whether by becoming a member of the society, a volunteer, financial donor, or social media influencer.

In the coming months MHAS will be bringing you videos of our activities to provide a way to social distance. We have created our first video for a virtual maker conference called the "National Week of Making" sponsored by the Rochester Hills Public Library, May 11-17. See the schedule at:

https://rhpl.org/localhop-calendar#/events/

We will delve into the wonders and mysteries of this world-renowned historical observatory. Digging into the history of MHO is like opening up a treasure chest and digging deeply into its contents. Many amazing things are yet to be discovered here. We will also bring to you astronomical activities and related sciences that we hope to keep you interested in the universe that surrounds us. Thank you for being a part of all our efforts.

Marty Kunz

Corona Virus Update

With social distancing restrictions, MHAS has down-shifted on-site activities to be in compliance. This means meetings cannot take place so we have started using the Zoom teleconferencing app to conduct committee meetings and Board of Director meetings. Using Zoom without paying for it as we do allows us to conduct 40-minute meetings, which isn't necessarily a bad thing! Meetings tend to focus better with a hard deadline. The May general meeting was held this way and worked pretty well. We will continue this way until we're allowed to meet in person again.

Intro to Radio Astronomy

One of the easier things an amateur radio astronomer can observe are the radio emissions of neutral (unionized) hydrogen gas. Hydrogen is the most abundant element in our home galaxy, the Milky Way. With simple equipment the amateur can detect these emissions and can make out the rough structure of our galaxy.

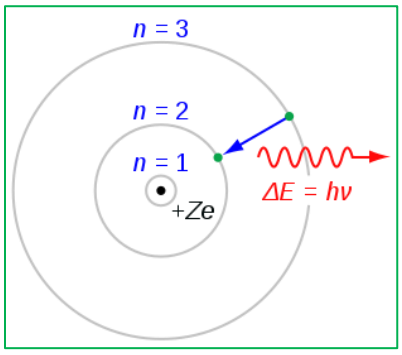
This emission line has a wavelength of 21 centimeters, or a frequency of 1.42 Gigahertz (GHz) and is commonly called HI (H-One) emission.

The explanation of why hydrogen emits electromagnetic radiation is understood by considering a bit of quantum mechanical theory.

Starting in the early 20th century, physicists such as Planck and Einstein determined that the energy carried by electromagnetic radiation occurs in packets of energy called photons which have discrete values. In other words, only certain values are allowed.

Bohr figured out that these discrete values are caused when the electron jumps between different levels in its orbit around the hydrogen nucleus. Only certain levels are available for the electron to orbit the nucleus, so the energy needed to move the electron up or down is set at a discrete value.

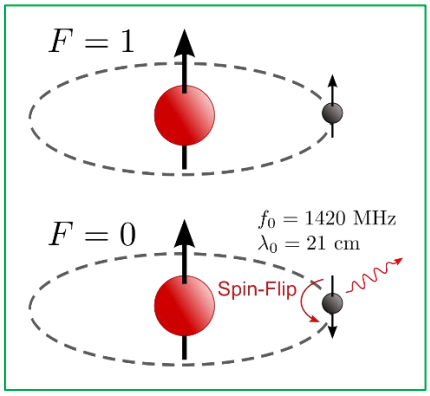
The well-known hydrogen alpha emission line in the visible light range is used to study the sun and other astronomical objects. This emission line occurs when the electron drops from the third orbit to the second orbit. When this happens, a photon with the energy corresponding to wavelength of 656.3 nanometer (nm) is emitted. When the atom absorbs the equivalent energy, the electron can jump back up from level 2 to level 3.



Hydrogen Atom: Electron Orbitals
By JabberWok, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=2639910

In optical solar astronomy, the hydrogen alpha emission is the brightest emission line that the atom emits in the visual range. At McMath-Hulbert, the astronomers used this emission line to study the fine detail of the sun. More on this in an upcoming issue of the *MHAS-Observer*!

There is secondary quantum effect of the hydrogen atom and this is caused by the orientation of the intrin-sic angular momentum spins of the single proton nucleus and the single orbiting electron.



Proton and Electron Spins of the Hydrogen Atom

When the spins are aligned in the same direction, the atom is in a high energy state and the low energy state occurs when the spins are anti-aligned. When the spin of the electron flips (which is much more probable because of the tiny mass of the electron compared to that of the proton) a photon of 21 cm wavelength is emitted or absorbed. This is how a single emission line is created.

HI Receive Horn Setup at MHO

Ed Hendry and Tom Hagen built a galvanized sheet metal horn that is tuned to 1.42 GHz for detecting the hydrogen emission from our home galaxy. This design is based on a horn used by a group searching for extra-terrestrial signals! A 32 dB preamp and a USB-dongle software defined radio connecting to a laptop running the GNU Radio application gives a detectable spike in the receive spectrum. The horn sits on an altitude-azimuth plywood mount and can be pointed toward any part of the sky. As the horn is swept across the galaxy differences in HI amplitude are seen as the different arms of the Milky Way are detected. Since the frequency of the emission is precisely known, the velo-cities of the gas clouds can be found and thus regions with similar velocities are inferred to be in the same locations. This is how the first maps of the Milky Way were made in the 1950's.

MHAS has taken this setup to different public events in the metro area for use in publicizing the MHAS. Events we have attended in recent years are the Detroit Maker Faire at the Henry Ford Museum in Dearborn and the Astronomy at the Beach event at Island Lake State Park near Brighton Michigan.

See Venus During the Day!

In May, the planet Venus is an evening star and it is very noticeable in to the naked eye at sunset. The magnitude is

a bright -4.7 and is only exceeded by the moon and the sun. Venus shows phases like the moon's and the present illumination is around 25%.

When Venus is this bright, it can even be seen by unaided eye during the day if you know exactly where to look. It's easy to spot with binoculars and with a telescope at higher magnification the crescent phase is seen.

Marty Kunz and Tom Hagen spotted Venus in Marty's 8" Celestron scope earlier this month.

Mary set up his scope in the parking lot and soon had Venus centered in the 25 mm eyepiece. It's difficult but possible to take a snap-shot through the eyepiece by holding a phone camera up to the eyepiece the same way you look through the eyepiece.

After some trial and error attempts, Tom made this phone camera shot of Venus and the crescent is clearly seen.

No, that's not the Moon! It's the same view Galileo saw through his early telescope that helped to confirm his theory that the earth and other planets orbit the sun.

Amateur Astronomers Accomplish Great Feats

Written by Jim Shedlowsky

Amateur astronomers almost universally love to share their fascination with the heavens. They like to share the wonders of the skies with the public in general…and especially to generate a mutual interest in others to join them in pursuing their hobby.

Thus, was the case of the three gentlemen pictured below, in 1930, standing beside their newly finished observatory dome in Lake Angeles, Michigan. Robert McMath had been introduced to astronomy by his father Francis and…. during summer visits in 1919 & 1920 to a northern Michigan retreat by a friend and business associate, Willard Pope. All three of these gentlemen were mechanical engineers, and interested

in the technical side of astronomy (i.e. telescopes & stuff). Robert, in particular, was also very interested in photography, and in particular movies which he thought would be useful for educational and outreach activities...

Henry Hulbert, Francis McMath, and Robert McMath, 1930

After some unsuccessful attempts to secure moving pictures of the Moon by "hand holding" his 16mm movie camera to various telescope/mount combinations, Robert concluded that success would require innovation and modification.

Near the McMath summer home at Deer Lake in Clarkston, MI, they built a small observatory…..and Robert began experimenting with various schemes for mounting and controlling the motions of a 4-inch Bausch & Lomb refractor. He redesigned an equatorial mount to use a synchronous electric motor. He was joined in these efforts by his father and another interested amateur, Judge Henry Hulbert, a longtime friend of his father through their mutual participation in the "McGregor Thursday Noon Group", an influential Civic group in SE Michigan. Judge Hulbert was a longtime amateur astronomer, having built his first observatory in 1887, near the Wayne State University in Detroit.
The judge was also a friend of Ralph Curtiss, the director of the Observatories of the University of Michigan. In 1927 Hulbert suggested to Curtiss that the McMaths, who owned a metal company, were amateur astronomers….as well as engineers, and might build parts for a 15 ½ inch telescope then under construction at the University. This proposal was accepted and shortly thereafter, in 1928, Henry Colliau, who was in charge of the UM's instrument shop,

during one of his visits to the McMath's shop, was shown a motion picture of shadow changes on the moon that had been made with the 4 ½ inch refractor. Colliau ask if he could show the film to Professor Curtis, and Robert assented. Professor Curtiss was impressed and quickly visited Robert to convince him that he and his father should undertake the development of astronomical time-lapse photography. Curtiss was convinced that this technique would have great educational value and could have scientific usefulness in the study of relatively rapid changes, such as changing shadows on the moon and active regions on the sun. Francis and Robert agreed to the undertaking and were joined later by Judge Hulbert.

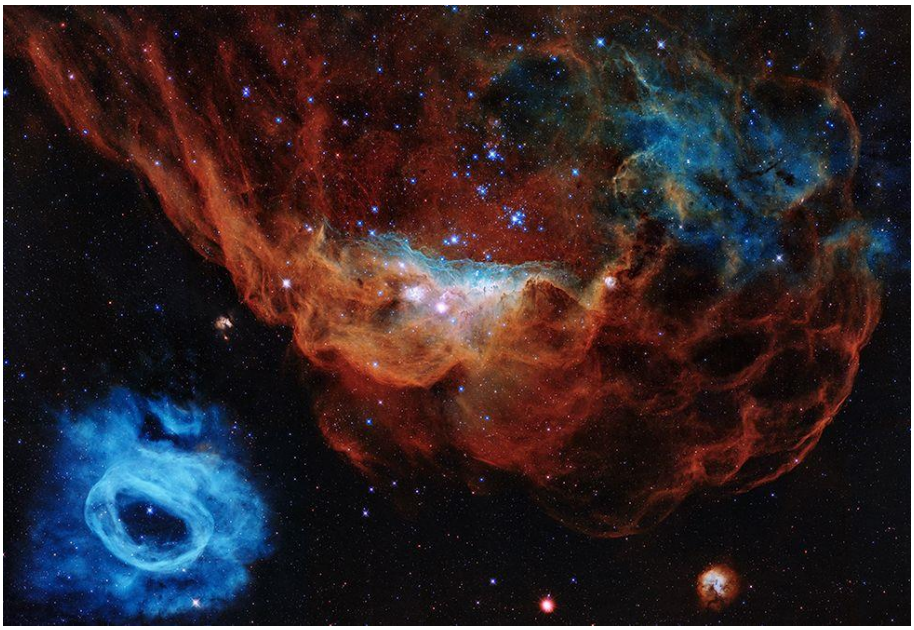
This event would transform the lives of these three gentlemen / amateur astronomers. Robert would go on to work with Detroit Edison to develop a new, precision electrical drive system (which would be copied by numerous major observatories) to control a new 10 ½ inch Cassegrain telescope at a new observatory on the north shore of Lake Angelus just north of the site of Judge Hulbert's personal observatory. They would go on to work with the University of Michigan to develop the McMath Hulbert Observatory into a major scientific institution with cutting edge research in Solar Astronomy. They would be named Honorary Curators of Astronomical Observation by the University of Michigan.

Robert McMath, with no formal education in astronomy, would go on to become a Professor of Astronomy at the U of Michigan President of the American Astronomical Society, member of the Royal Astronomical Society, Member of the American Philosophical Society, amongst many prestigious honors. Most importantly, by 1954 his status as an astronomer, his reputation for scientific innovation, and his connections to science, industry and government made him a natural choice to head the National Science Foundation's committee to locate, plan and organize the first U.S. National Observatory at Kitt Peak, AZ. He would also guide the MHO for 32 years, as its Director until his death in 1962.

Happy 30th Hubble!

Hubble telescope delivers stunning 30th birthday picture
By Jonathan Amos, BBC news science correspondent
[reprinted by kind permission of BBCnews.com]

It's 30 years ago to the day that the Hubble telescope was launched - and to celebrate its birthday, the veteran observatory has produced another astonishing image of the cosmos.

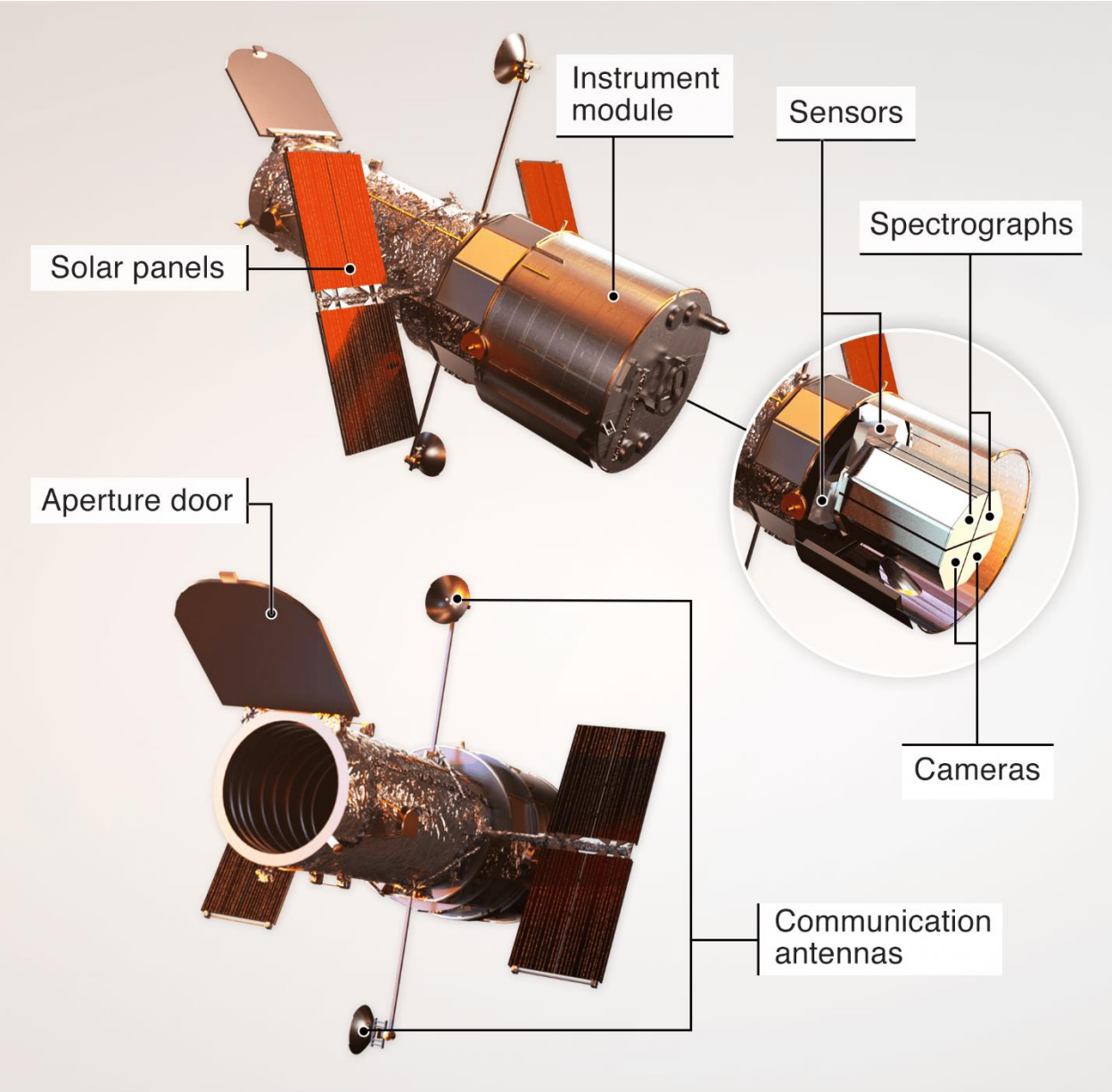


This one is of a star-forming region close to our Milky Way Galaxy, about 163,000 light-years from Earth. The larger object is the nebula NGC 2014; its companion is called NGC 2020. But astronomers have nicknamed the scene the "Cosmic Reef" because it resembles an undersea world.

Famously blighted by blurred vision at the outset of its mission in 1990, Hubble was eventually repaired and upgraded. The remarkable pictures it has taken of planets, stars, and galaxies have transformed our view of the cosmos. Indeed, there are those who think Hubble is the most important scientific tool ever built. It's still far from retirement. The US space agency (NASA), which runs the observatory in partnership with the European Space Agency (ESA), says operations will be funded for as long as they remain productive. Last year, its data resulted in almost 1,000 scientific papers being published - so it continues to stand at the forefront of discovery.

For its 25th birthday, Hubble imaged a giant cluster of stars called Westerlund 2

Engineers obviously keep a watching brief on the health of Hubble's various systems. Pleasingly, all four instruments onboard - the two imagers and two spectrographs - work at full tilt. In the past, the telescope's Achilles heel has been the six gyroscopes that help turn and point the facility, maintaining a rock-steady gaze at targets on the sky. These devices have periodically failed down the years, and during their final servicing mission in 2009 space shuttle astronauts were tasked with replacing all six. Three have subsequently shut down again, but NASA project scientist Dr Jennifer Wiseman says this is not yet an issue for serious concern. "Nominally, we need three gyroscopes, but we can operate on just one due to the ingenuity of the engineers," she asserted. There's a quiet confidence that Hubble can keep working well into the 2020s. It's supposed "successor" - the James Webb Space Telescope (JWST) - is due for launch next year, but the presence in orbit of this more modern observatory will in truth merely just extend capability; it won't make Hubble redundant. That's because the new facility has been designed to see the cosmos at longer wavelengths of light than Hubble. The duo will be complementary and will on occasion actually pursue targets together to get a fuller perspective. This is an exciting prospect for astronomers everywhere - but especially for those in Europe where Hubble has been such a rewarding endeavor, says ESA project scientist Dr Antonella Nota. "From the memorandum of understanding there was a guarantee that European astronomers would get 15% of observing time for the duration of the mission. If I look back at how much time European astronomers got - on average it's 22%. And it is a peer-reviewed process so we never needed to put a finger on the scales. European astronomers are creative; they're smart; they're doing leading-edge science," she told BBC News.



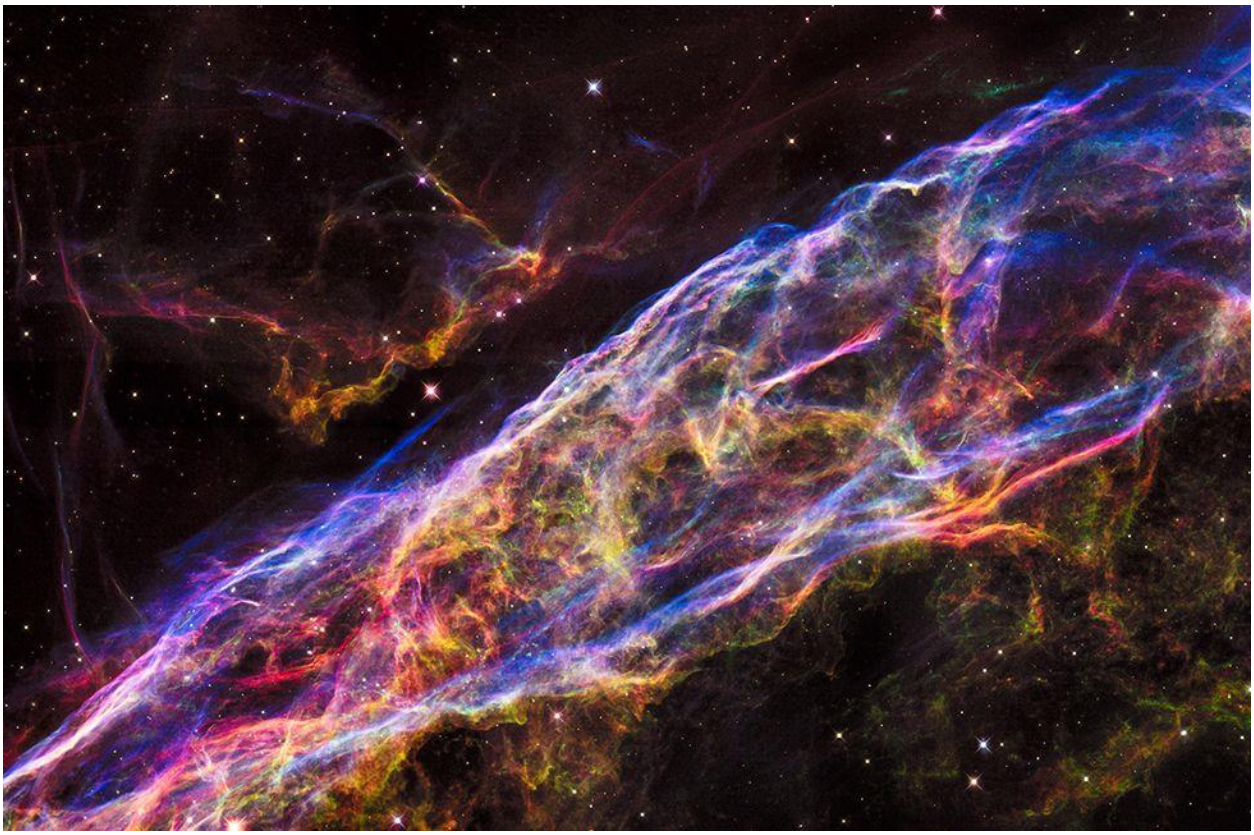
What has Hubble contributed to science?

It's a bit of a cliché, but Hubble has truly been a "discovery machine". Before the telescope launched in 1990, astronomers didn't know whether the Universe was 10 billion years old or 20 billion years old. Hubble's survey of pulsating stars narrowed the uncertainty, and we now know the age extremely well, at 13.8 billion.

The observatory played a central role in revealing the accelerating expansion of the cosmos - a Nobel Prize-winning breakthrough - and it provided the definitive evidence for the existence of super-massive black holes at the center of galaxies.

The Deep Field images require Hubble to stare at the same patch of sky for days on end

It's amazing to think that when Hubble launched, scientists had yet to detect the first exoplanet, the name given to a planet orbiting a star other than our Sun. Today, Hubble is pioneering the study of these far-off worlds, examining their atmospheres to try to gauge their nature. And although the sparkling eight-meter-class ground-based telescopes can now match - and even exceed - Hubble's skill in certain fields of study, the space telescope remains peerless in going super-deep. Its so-called Deep Field observations in which it stared at a small patch of sky for days on end to identify the existence of very distant, extremely faint galaxies are one of the towering achievements in astronomy. These studies have shown us what the Universe was like just a few hundred million years after the Big Bang. Only JWST, with its finely-tuned infrared detectors, will go deeper still.



A Hubble classic: The Veil Nebula is the expanding debris of an exploded star

Kathryn Sullivan was one of the astronauts onboard Space Shuttle Discovery when it released Hubble into its 612km-high orbit on 25 April, 1990 - a day she recounts in a recent book, Handprints On Hubble. "Hubble's scientific impact has just been immense. But what I had not really appreciated until I started writing my book was the extent to which Hubble - because of its gorgeous images and their mind-bending implications - has really permeated popular culture," she told BBC News. "I see Hubble on the side of U-Haul (rental) trailers, on tattoos, on lunchboxes, on shirts, in advertisements, almost ubiquitously. "And I think part of that is down to Hubble coming into service just as the internet was becoming the thing we now know it to be. That's put the pictures right in front of people."

JWST will study the Universe at longer wavelengths of light

MHAS Contact Information:

MHAS Website

http://www.mcmathhulbert.org/solar/

MHAS Facebook Page

Click on the button below to get to the MHAS Facebook Page.

Address:

McMath-Hulbert Astronomical Society
895 N. Lake Angelus Rd.
Lake Angelus MI 48326

Email: info@mcmathhulbert.org

Phone: 248-494-8256 (Google Voice, leave message if nobody picks up)

MHAS Officers

President
Marty Kunz

Vice-President
Jim Shedlowsky

Secretary
Ken Redcap

Treasurer
Tom Hagen

Appointed Positions

Dir-Membership
Ken Redcap

Dir-Communications & Website
Tom Hagen

Dir-Educational Activities
Tom Hagen

Dir-Finance
TBD

Dir-MHO Preservation
TBD

Dir-Buildings Security
TBD

Dir-Social Activities
Marty Kunz

Scheduled Meetings

All MHAS members are welcome to join us at Open Houses and Board of Directors Meetings. We are open to the public at the Open House Meetings.

MHAS Open House Meetings:
We schedule MHO Open House Days on the first Saturday of the month starting at 11 AM. The June 6, 2020 open house will occur if the pandemic isolation requirements allow us to hold the event. See the website for the latest information.

MHAS Board Monthly Meetings / Teleconferences:
1st Sunday of Each Month @ 1 PM
The next board meeting is scheduled for June 7, 2020 and will be via teleconference unless the isolation requirements have changed by then. MHAS paid members are invited to participate in this meeting.

MHAS Standing Committee Meetings:
These are internal meetings and are announced on Groups.io Calendar

Join MHAS!!

Membership in MHAS is $25/year. Join with us on our mission to preserve and promote the McMath-Hulbert Solar Observatory. Just drop us a line at info@mcmathhulbert.org and we'll get you signed up! Or use the application form on the next page, print it out, and return it to us via email or USPS.

McMath-Hulbert Astronomical Society

Membership Form

Name_____

Address_____

Email_____

Phone_____

Date_____

Dues_____Donation_____

Annual membership is $25. Checks should made out to “MHAS” or “McMath-Hulbert Astronomical Society”. You can also pay using PayPal on our website.

Bring to meeting or mail to:
MHAS
McMath-Hulbert Solar Observatory
895 N. Lake Angelus Rd.
Lake Angelus, Mi. 48326