MHAS-Observer

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

Contents

President's Message

Greetings all,

Good news, we have found that a window through the tree branches has allowed us to see a clear view of the Sun from Tower 2. This means we are once again moving forward towards achieving our goal of getting an image of the Sun using Tower 2. A donation of a previously owned diffraction grating is making this possible.

As of this writing we are preparing to participate in the Oakland History Center's Bicentennial Summer Social held on July 25 – 26, 2020. The Oakland History Center is located at the Pine Grove historical site on Cesar Chavez Blvd. in Pontiac next door to Wisner Stadium. This is a drive-through event so we are bringing some of our historical equipment to show off on a table display. Items such as a Cathode Ray tube tester and an old electronic signal generator are just two of the unique objects (mostly limited by the size of the items that we can carry) that we will have on display. We are focusing on the historical aspects of our observatory for this event. I hope that you will be able to attend this event.

The last weeks of July bring comet Neowise into the evening sky. If you missed it in the morning there it still a chance to see in the evening after sunset. Don't forget the famed Perseid Meteor shower that will be peaking around August 11, 2020.

One of the many functions of the M.H.A.S. is to present the historical achievements of the observatory to the general public. When it was brought to fruition the McMath-Hulbert Observatory achieved worldwide fame for its work in solar research. Only with your support can this facility be saved from the effects of 90 years of weather as time marches on. Only with your support can we make everyone aware of the importance of what this place has to offer to future generations.

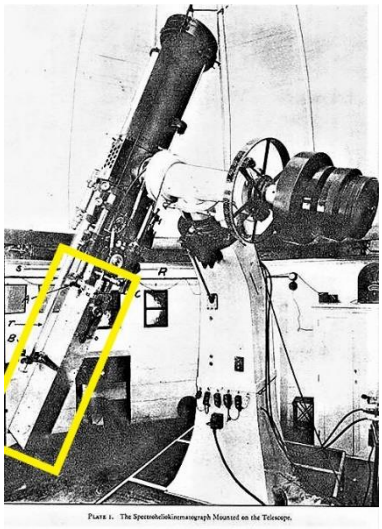
Join us as we venture forward to make this place something to be proud of, and you can say that you were a part of its restoration. Become a member, make any sized donation, even through one of our free donation programs. Come out and get your hands on one of the many restoration projects in need of volunteers. Help us find grant writers, philanthropists, advisors etc. This will always be a team effort.

Marty Kunz

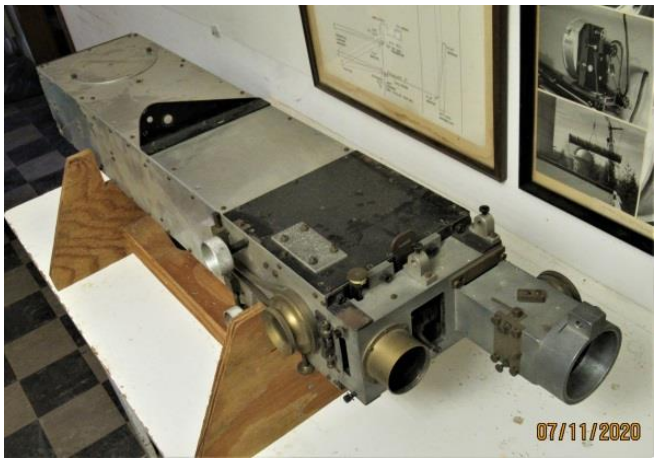
Corona Virus Update

With the relaxation of social distancing restrictions, we can now allow our members and members of the public back in to MHO. We can have up to ten people present at our events. And don't forget your mask and please maintain 6-foot social distancing. Our next open house is on Saturday, August 1 at 11 AM! Please let us know if you want to attend by RSVP at info@mcmathhulbert.org.

Note that members can come out any Saturday at 10 AM.



Spetroheliokinematograph Installed on 10.5" Cassegrain in 1931 (Tower 1)



Spetroheliokinematograph in 2020 on Display in Main Building

History Corner—Jim Shedlowsky

The Spectroheliokinematograph: A Marvelous Historical Tongue Twister

If you google "spectroheliograph", you will find a definition under Wikipedia that reads:

"The **spectroheliograph** is an instrument used in astronomy which captures a photographic image of the Sun at a single wavelength of light, a monochromatic image. The wavelength is usually chosen to coincide with a spectral wavelength of one of the chemical elements present in the Sun.

It was developed independently by George Ellery Hale and Henri-Alexandre Deslandres in the 1890's and "further refined in 1932 by Robert R. McMath to take motion pictures."

This device was given the name **Spectroheliokinematograph** by Dr. Heber Curtis, the Director of the Astronomy Department at the University of Michigan. It became the talk of the world of Solar Astronomy when in 1934 it recorded, for the first time, a time lapse movie of a 10-minute-long storm (eruptive prominence) on the surface of the sun.

This instrument, the only one ever built, still exists at the McMath Hulbert Solar Observatory along with many fascinating "technical relics" from those days before computers, microchips, CCD's and the like. Robert McMath, it seems, was a man who rarely shied away from a technical challenge. He and his two partners (Francis McMath and Henry Hulbert) had been successfully experimenting with obtaining time lapse movies of celestial objects like the Moon and Planets for educational purposes. When they opened their observatory in 1930 and shared some of these movies with Dr Curtis at the U of Michigan, it began a long association with that institution of nearly 50 years .

In 1931 Dr Curtis, it seems, challenged Robert McMath to, for scientific purposes,… extend his time lapse movie making, to the Sun, a much more difficult task,….which had ever been done before. Mcmath consulted Dr Keivin Burns of the Allegheny Observatory, a noted expert in optical design and McMath proceeded to design a compact, sophisticated electrical-mechanical-optical device which would combine the complex hardware and precise procedures required.

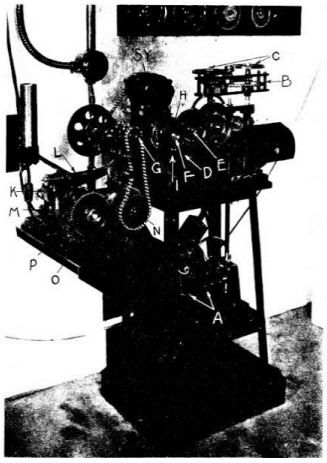
The 42inch long device was mounted to the rear end of the 10.5" Cassegrain telescope in the original observatory dome (Tower 1). The performance of the instrument required it to receive an optical signal from the telescope and then pass it through a rotating prism while bouncing its beam off of a precisely aligned grating surface. A second rotating prism, locked with the input prism, is positioned in front of the output slit. Its performance required precision tracking of the telescope and careful operation of the camera which were accomplished by an auxiliary device – "controller" (see photo) which used gears, pulleys and motors to provide precise control. The control of all these functions, which today would be done by a microchip, were performed by complex electromechanical devices. Figuring out how to accomplish this was Robert McMath's "strong suite".

The successful operation of such a compact, complex device was a testimony to McMath's ingenuity and intellect. He had learned a lot about the challenges of Solar Astronomy by creating the Spectroheliokinematograph, and….It was an incentive for

him to dream of bigger and better approaches to solving these problems.

Thus was born the incentive for him and his partners to contemplate the construction of a new facility, exclusively dedicated to solar astronomy. This unique facility became a reality a few years later (in 1936) in the form of the 50 foot "Tower 2" Solar Telescope.

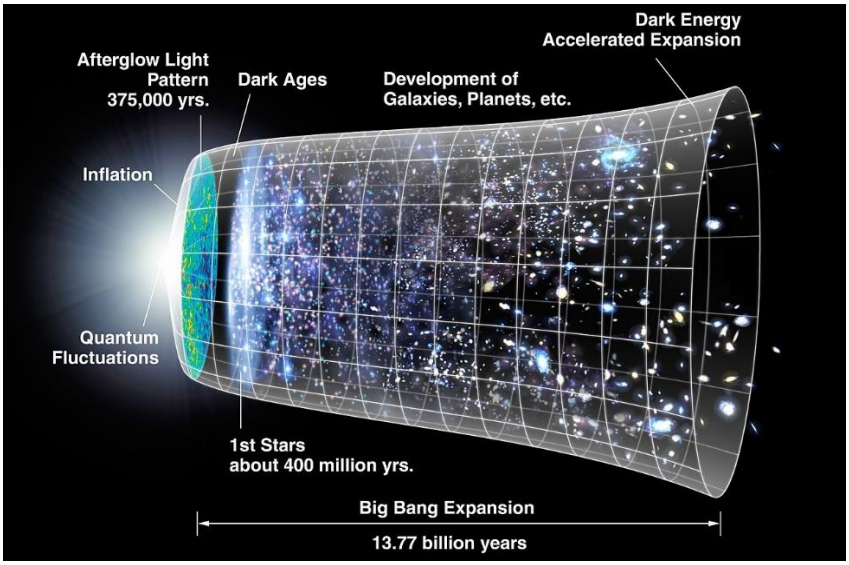
So….It seems that the creation of the only **Spectroheliokinematograph** ever built, changed the mission of the newly formed McMath – Hulbert Observatory from one of "three amateur astronomers creating educational movies about general astronomy",….to that of becoming a world famous professional solar research observatory.



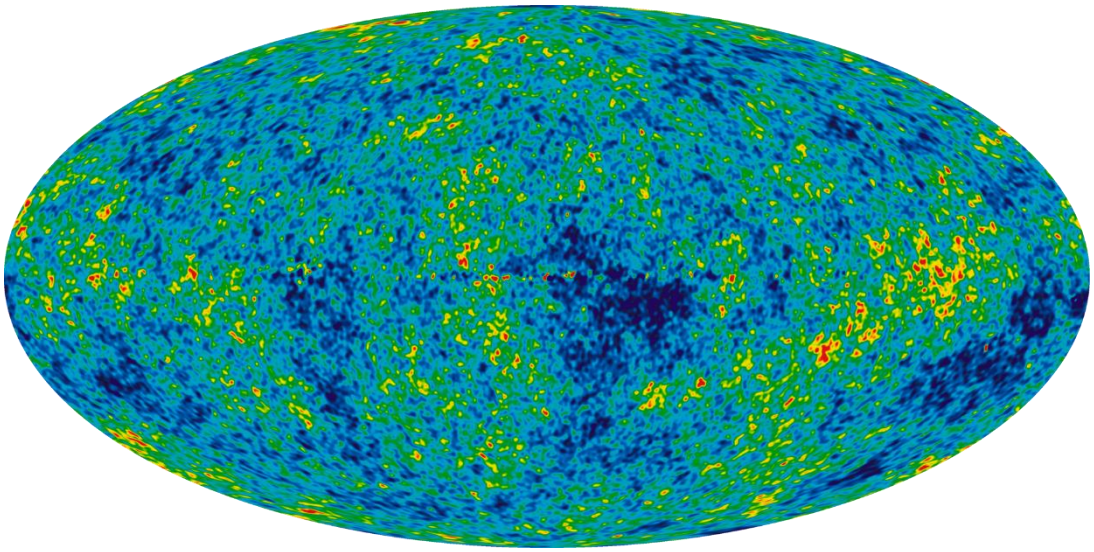
"The Controller"

Introduction to Radio Astronomy— Cosmic Microwave Background

Last month we talked about blackbody radiation and the biggest example of this phenomenon that we know about is what's called the Cosmic Microwave Background Radiation (CMB). The CMB is the "afterglow" radiation effect of the Big Bang event that started our universe. The CMB is only detectable in radio wavelengths and is apparently the same brightness no matter which direction you look in the universe. With finer resolution, the afterglow does exhibit variations in brightness

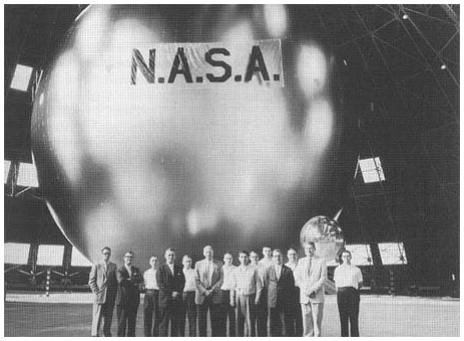


The Big Bang Timeline of the Universe; Courtesy NASA

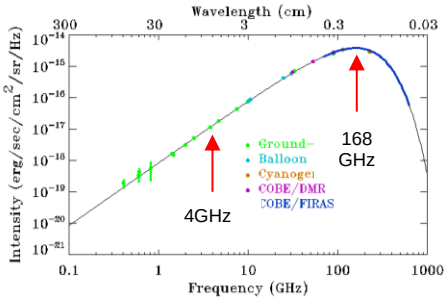


Variations in the CMB as imaged by Wilkinson Anisotropy Probe (WMAP); Courtesy NASA

on tiny micro-variations as seen in the figure above. The detailed, all-sky picture of the infant universe created from seven years of WMAP data. The image reveals 13.7-billion-year-old temperature fluctuations (shown as color differences) that correspond to the seeds that grew to become the galaxies. The signal from our Galaxy was subtracted using the multi-frequency data. This image shows a temperature range of ± 200 micro-Kelvin.

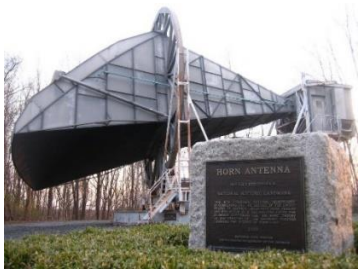


Project Echo Satellite



Blackbody Curve of the CMB
Courtesy NASA

So how was this radiation that is the remnant of the Big Bang first detected? It was in 1964 that two Bell Laboratories engineers Arno Penzias and Robert Wilson were working on a horn antenna that was designed as part of a satellite communication system (Project Echo). The "Holmdel Horn Antenna" (Holmdel Township, NJ).



Holmdel Horn

Technology moved on; the project was discontinued and that was when Penzias and Wilson started their investigations into noise sources in the cosmos. The frequency of their system was around 4 GHz. But when they started using it, there was a constant radio noise coming from every direction they pointed the antenna. This was a problem in that it set the lower limit of signal levels they could actually detect. The noise had a consistent black-body temperature of about 3K. Eventually they determined that this background radiation is the remnant of the Big Bang event that started our Universe.

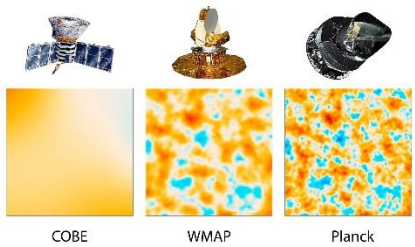
The blackbody curve of the CMB shows a peak brightness at a frequency of 168 GHz or a wavelength of about 1.78 mm. One interesting thing about the CMB is that it is the most perfect example of a blackbody radiation curve ever found in nature!

Penzias and Wilson were able to detect the brightness of the CMB at 4 GHz with their very low noise receiving equipment, even though the brightness at 4 GHz is about a thousand times lower in brightness than the peak at 168 GHz.

Penzias and Wilson were awarded the Nobel Prize in 1978 for their discovery and the subject of the CMB and the Big Bang have been subjects of intense study over the last half century and more.

There have been successful attempts by amateur radio astronomers to detect the CMB, but the work is very technical and is well beyond the capability of most amateurs.

Satellites such as the Wilkinson Anisotropic Probe (WMAP), its predecessor Cosmic Background Explorer (COBE), and the next generation Planck satellites give increasing resolutions as seen in the figure below.



Relative CMB Resolutions by Various CMB Satellites

By NASA/JPL-Caltech/ESA - http://photojournal.jpl.nasa.gov/catalog/PIA16874 (direct link), Public Domain, https://commons.wikimedia.org/w/index.php?curid=25226768

The significance of the variations in the CMB show that the fluctuations in density contrast arose when the early universe became capable of transmitting electromagnetic energy (including light). The fluctuations are believed to have produced the universe as we know it today with clusters of galaxies and vast regions devoid of galaxies.

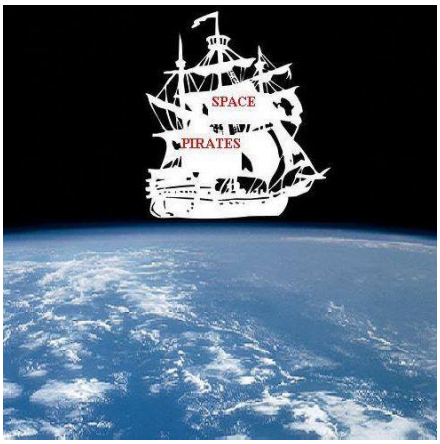
The discovery of the CMB ranks as one of the great discoveries of astrophysics and is intensely studied to this day.

Did You Know? MHAS President Has His Own Internet Radio Show!

Marty Kunz, MHAS President, hosts an astronomy radio show that airs every week on Wednesdays at 9 PM EDT. Listen for it at:

www.astronomy.fm

Marty's program is called "Space Pirate Radio" and features current information about space mission developments, astronomy news, and a "what's-in-the-sky today" report. Set you alarm for Wednesdays at 9 PM!



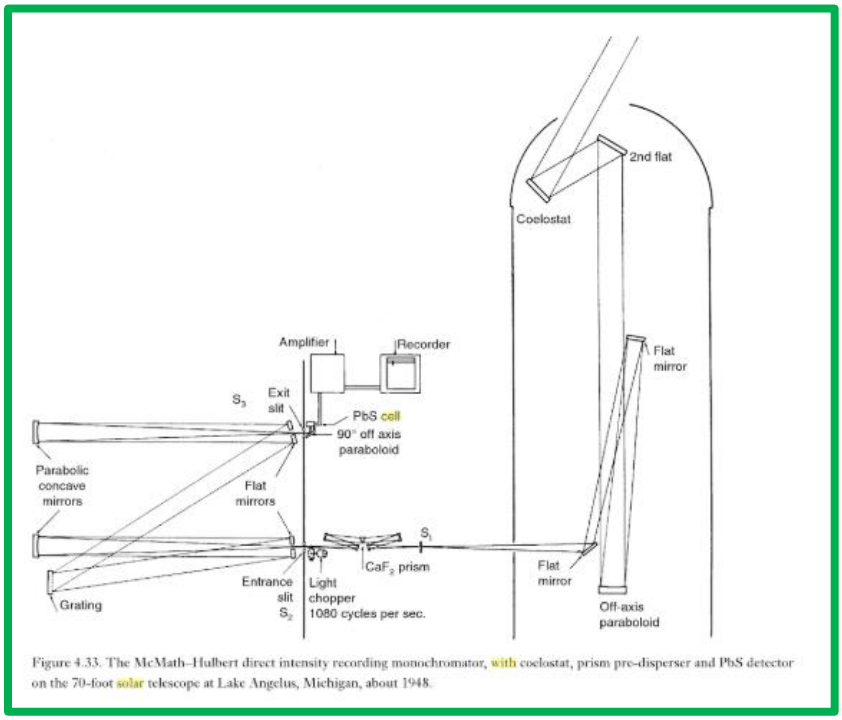


Figure 4.33. The McMath–Hulbert direct intensity recording monochromator, with coelostat, prism pre-disperser and PbS detector on the 70-foot solar telescope at Lake Angelus, Michigan, about 1948.

Tower 3 Optical Path Diagram, 1948

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

Dir-History
Jim Shedlowsky

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 11AM. The August 1, 2020 open house will be held with social distancing in effect. Please wear a mask and maintain 6 foot distancing.

MHAS Board Monthly Meetings / Teleconferences:
1st Sunday of Each Month @ 1 PM
The next board meeting is scheduled for August 2, 2020 and will be via teleconference. MHAS paid members are invited to participate in this meeting.

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/Donation 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