# MHAS-Observer

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

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## President's Message

Greetings all,

Moving into the month of September, the month of another equinox and a change of seasons, this summer has seen a great increase in progress for M.H.A.S. Since I became President in March, we have advanced our presences on social media, updated our website, added a monthly newsletter, and focused on our goal of fundraising for the society. Our PayPal button is working now. We continue to partner with other organizations in Oakland County, Mi. such as the Oakland County Historical Center. In July we had an exhibit at its yearly Summer Social Event. We brought out artifacts from the observatory's collection of unique equipment and we displayed them to the public during their drive through event.

We have recently joined The Great Lakes Association of Astronomy Clubs, which holds the annual Astronomy At The Beach event (virtual this year) https://www.glaac.org/.

This year it will be online Sept 25 & 26 2020, free to the public. We will be giving a radio astronomy talk and demonstration as part of the program. Check us out from the convenience of your home!

A recent donation of almost 400 astronomy and science books will help fill our library shelves.

We are collaborating with the Rochester Hills Public Library on a Python coding class which will be offered online for the four Thursdays in September. This will be a new experience for us as we have offered the class at the RHPL maker space in person for the last couple of years.

In the radio astronomy area, we are working with Hillsdale College on a project to detect fast radio bursts using data from a number of radio telescopes scattered around the United States. See the radio astronomy article in this issue for more information.

New members are bringing their interest and skills to the observatory as we hope to start recoating telescope mirrors, thus aiding the effort of obtaining an image of the Sun in Tower 2. We now have a modern diffraction grating courtesy of a recently joined member.

And please mark your calendar for this month's open house on Saturday, Sept 5, 2020 starting at 11:00am until about 3:00pm. Still, masks required please.

*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

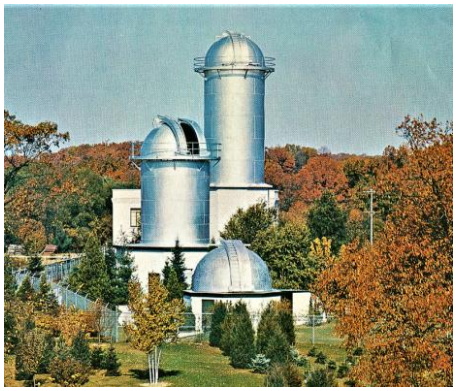
info@mcmathhulbert.org.

Note that members may come out any Saturday at 10 AM to work on MHAS projects.

**History Corner—Jim Shedlowsky**

# A summer job at MHO inspires a 51 year productive career in Solar Astronomy

Sarah F. Martin (1957)



MHO in the Early 1950's

It was Thanksgiving holiday break and Sarah Martin was home in Pontiac from her studies at Northern Michigan Technical University in 1959, when her brother noticed an article in the Pontiac Press about the McMath – Hulbert Solar observatory and decided to try and find it.

*"The article only described its location as "at Lake Angelus", a little north of the city. We borrowed the family car the next day, and drove out to find this intriguing place. We took a gravel road off the main highway in what we thought was the right direction, past a few small country houses and into a stretch with woods close on both sides of the road. There were no signs, but we spotted a little one lane dirt road that went off to the left through a small ravine and disappeared into the trees in our estimated direction of the hidden lake. Coming up out of the ravine, we came into a parking lot with chain link fence on three sides and a big oak tree in the middle. There was an academic-looking, concrete, two-story building to the east, a large grassy lawn to the west. To the south was a small observatory dome on a tower sticking up a little higher than the surrounding trees! We had found it!"* (from her memoir: "Questioning Many Mysteries")

Sarah was a sophomore, studying Physics at MI Tech and in need of a summer job to supplement her meager finances. After being given a tour of the telescopes, Sarah inquired about the possibility of a summer internship and was informed by Dr. Prince (Helen Dodson Prince) that they only hired students from the University of Michigan. Undaunted she applied by mail at the Christmas break and was again politely rebuffed. During the Spring break period she again visited the observatory, this time talking to Dr. Mohler (Professor Owen Mohler) who informed her of a recent opening. She thus was hired and became, for two summers, the only student assistant to Dr. Prince, who was one of the famous solar astronomers of that time. Her tenacity had paid off.

Her experiences during those two summers left an indelible mark on this young woman who had earlier decided to pursue scientific research as a career at a time when this was primarily a man's domain. She was exposed to, and worked with, a number of respected woman astronomers including Dr. Prince and Ruth Hedeman….at a scientific facility which, though almost unknown locally, had a worldwide reputation. Her work there exposed her to a field of science, Solar Research, which would become her lifelong passion.

Sarah's subsequent career in Solar Research would span some 51 years working at a number of noted Solar Observatories and educational institutions and contributing to the development of the techniques and instrumentation used therein. She became very familiar with the solar science community and its connections to the greater astronomy world and became well known as a successful

grant writer for various solar science enterprises. Her name is on some 176 published papers in scientific journals.

Sarah, who had met Robert McMath at MHO in 1959, spent some time in the 1970's at the McMath- Pierce National Solar Observatory at Kitt Peak, Arizona, and maintained her contacts with MHO in MI. In 1979 she hired William Marquette from MHO, at the recommendation of Dr. Prince, when she found out that MHO was being closed by the University of Michigan.

In 1995 Sarah "retired" from her Caltech faculty position, but created another solar research entity, a nonprofit named Helio Research, which used new technology to…of all things,… ***take movies of solar phenomena,***….a feat first accomplished by Robert McMath more than 60 years earlier. Her husband, a retired optical designer, had built her a customized 25cm solar telescope and she used this instrument with other new technology to promote a collaborative effort with other solar research groups to study solar eruptive events. This collaboration, called PROM (Prominence Research Observations and Models), had annual meetings, conducted workshops and did research connected to NASA's SOHO program. These "retirement" activities, resulted in a number of research reports and papers which occupied her time until her final real retirement in 2012.

Robert McMath would have been proud of one of his proteges, Sarah Martin.

MHO Staff—1959

## Introduction to Radio Astronomy— Fast Radio Bursts

An area of great interest these days in radio astronomy are Fast Radio Bursts (FRB's). Astronomy in general is moving toward the study of transient events as this area has not been emphasized in the past so much. This is partly due to the fact that huge amounts of data must be accumulated over extended time periods to catch transient events at all. See the 2010 Decadal Survey Planning Document for more information.

The detection of gravity waves is getting a lot of attention these days with the LIGO and VIRGO projects. Gravity waves are examples of astronomical transient events.

Another notable instrument operating in the optical spectrum is the Vera C. Rubin telescope soon to start operations in Chile. This 8.4-meter telescope will be pursuing the Legacy Survey of Space and Time (LSST) program for 10 years starting in 2021. This telescope uses the largest CCD camera ever built with a 3.6 Gigapixels. The yearly data output will be around 200,000 pictures resulting in around 20 terabytes of data daily. The processing computer will run at around 100 teraflops and will have a memory of 15 petabytes. Managing and processing this huge amount of data is the most technically challenging part of the project.

In the radio astronomy realm, there are significant efforts to detect what are known as fast radio bursts (FRB) and Lorimer bursts. Astronomer Duncan Lorimer in 2007 made the first detection of an FRB when analyzing some pulsar data that was gathered by a radio telescope.

The causes of FRB's are not fully known, but speculation centers on black holes, neutron stars, magnetars (neutron stars with very high magnetic fields), gravitational collapses, gamma ray bursts, supernova core collapses, and more. These bursts last for VERY short periods of time, usually for a few milliseconds (1/1000 of a second) or so. This makes determining where in the sky the FRB comes from a very difficult problem.

There is even an example of an FRB that repeats at regular intervals. A series of FRB's were detected for 90 days then stopped for a period of 67 days. The same start-and-stop pattern then repeated every 157 days. The discoverers speculate that the cycle is caused by an eclipsing orbiting binary pair of objects. The presence of a regular sequence in the burst activity could imply that the powerful bursts are linked to the orbital motion of a massive star, a neutron star or a black hole. One of the objects passes in front of the emitting object. This discovery provides an important clue to identifying the origin of these enigmatic bursts, which come from a dwarf galaxy that's some 3 billion light-years away from Earth.

This discovery was made by researchers at the historic Lovell 76m radio telescope at the Jodrell Bank Observatory in England, operated by the University of Manchester.

Lovell Radio Telescope at Jodrell Bank Observatory

Mike Peel; Jodrell Bank Centre for Astrophysics, University of Manchester. (https://commons.wikimedia.org/wiki/File:Lovell_Telescope_5.jpg), https://creativecommons.org/licenses/by-sa/4.0/legalcode

Another program that investigates FRB's in the low frequency range of 10-88 MHz is the Low Frequency All Sky Monitor (LoFASM). This program uses a phased array of 12 crossed dipole antennas. This range is of great interest to astronomers because it has been little investigated in the past.

Hillsdale College LoFASM Array

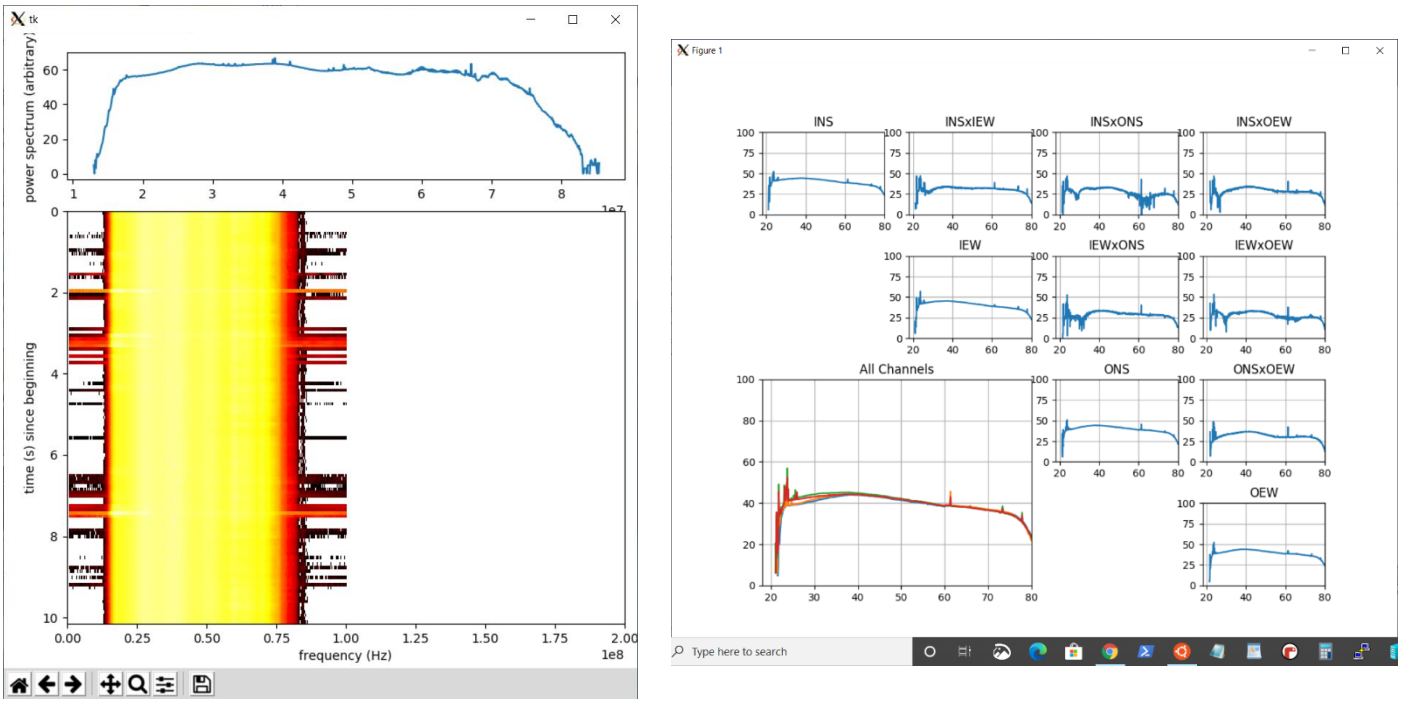
At present there are 5 LoFASM arrays scattered across the continental USA. When an FRB occurs, the different stations will detect the pulse more or less simultaneously and if there is local interference at one station, it can be eliminated from the aggregate data because the other stations will not be interfered with by it.

Because the LoFASM stations are running 24/7 they generate a lot of data, about 33 Gigabytes each day. The data are broken up into 5-minute blocks for a total of 288 files per day. Each one of these files has to be examined manually to see if an event has been detected.

These files present an opportunity for a citizen science project, and this may be an opportunity for MHAS to organize a project using local students to download and scan the data for events. There are a number of tools that have been developed by Louis Dartez of the LoFASM team and are ready to go on his GitHub site. We have tested the tools and have found that they work well and are easy to use. We should be able to organize a project that students can participate in to do some "real" science.

The figures below show some output from LoFASM test files that were provided on the GitHub site. The first

diagram shows a waterfall display of a 5-minute run. The vertical axis shows time and the horizontal axis shows frequency of 10-80 MHz. Signal strength is indicated by color and the top graph of the diagram. The second diagram shows an animated display of all 10 output signals for a five-minute period of time. Observers can look at teyse types of displays and may be able to visually spot FRB's in this frequency range.




Graphical Output from LoFASM Display Tools

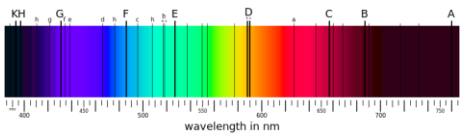
## Ongoing Restoration Work in Second Tower

An enthusiastic group of MHAS volunteers has been working on restoring Tower 2 as a functioning imaging solar telescope. Tower 2 was built in 1935 and is a scanning spectroheliograph. This is a mechanically complex system that essentially fills the entire tower from 40 feet above ground to 30 feet below ground. The maximum optical path is around 100 feet and the instrument is designed specifically to make images of the sun in very narrow slices of the optical spectrum.

Because of the tremendous brightness of the sun, it is advantageous to use techniques that reduce the brightness so details of the solar atmosphere are visible. Otherwise, details of the sun such as prominences, filaments, and sunspot detail are lost in the sun's overwhelming glare.

One way to get good images of the sun is to take advantage of the absorption lines in the sun's spectrum. These lines are caused by quantum effects of the various elements on the sun.

In order to use these lines, a diffraction grating is used to split the sun's white light into the rainbow spectrum.




Then the spectrohelioscope is aligned to look at the sun "through" one of the absorption lines.

At this time, we're aligning the optics of the system to allow us to precisely select an absorption line and use it for imaging. In the photo below we have an image of the sun aligned on the input slit of the spectrohelioscope and we look for the desired absorption line through the eyepiece centered on the output slit.

# 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