MHAS-Observer

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

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President's Message

Greetings all,

We are fast approaching the end of 2020 and winter. Our observing projects are changing with the season. Sunset arrives earlier this time of year so nighttime observing of planets, the Moon and stars can be done without staying up late. However the Sun spends little time above the horizon. It just so happens
that we are noticing increased solar activity, which has nothing to do with the seasons on the Earth.

While most of our projects will be worked on indoors this year, some outdoor public observing is schedule for Feb 6, 2021 at The Hawk Wood Nature Center In Auburn Hills Mi. A link will be posted as soon as one is available. This event is a great way to learn how to use your telescope, weather its one that you've had around for a while or just got one for the holidays, so bring it out. During the pandemic, direct viewing through an eyepiece will not be possible because it would mean sharing contact with the eyepiece.

I am working on a way to see planets and the Moon through a telescope and having its image viewed on a monitor.

Work on the spectroheliograph in Tower 2 is pretty much on hold for the season, as the sun does not now rise above the treetops that surround the building. Not to fear! There are a number of winter projects we will be continuing with. We can align the grating and collimation lens down in the well beneath the operations pedestal using an artificial projected test image that will be shone on the input slit. This "artificial test image" will let us divide up the alignment tasks of this large instrument into smaller manageable pieces.

To sum up activity so far this year, we have installed and aligned a new diffraction grating donated by MHAS member Dave Groski and were able to see hundreds of absorption lines in the solar spectrum. This is an important first step. Next, we need to deal with stray light that's getting into the optical path and we'll be working on this over the winter too.

We are always looking for new members to help with various events and projects.

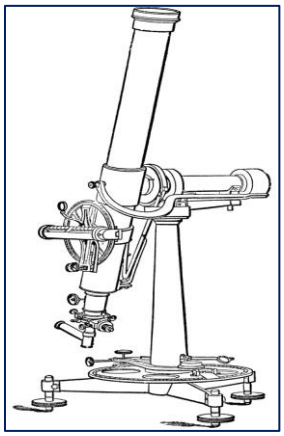
We also are in need of donations, please help us if you can. Donations are tax deductible.

Marty Kunz

Corona Virus Update

With the relaxation of social distancing restrictions, we can now allow our members back in to MHO. We can have up to ten people present at a time. And don't forget your mask and please maintain 6-foot social distancing.

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



Helen Dodson Prince w/ Mcmath Hulbert Observatory Staff - 1959

Helen Dodson Prince (1905 – 2002)

Helen Dodson Prince w/ Mcmath Hulbert Observatory Staff - 1959

History Corner—Jim Shedlowsky: Helen Dodson Prince—MHO's Premier Astronomer

The McMath Hulbert Observatory was created by three ***gentlemen*** amateur Astronomers and during its 59 years of active operation it was associated with many notable ***gentlemen*** professional Astronomers. However Its most prolific, productive and longest tenured Astronomer,….one noted for her many contributions to Solar Science,…was a ***lady***.

Helen Dodson Prince spent 29 years at the observatory, from 1947 until her retirement in 1976,…14 years as its Associate Director. She was a pioneer in the observation of Solar Flares, a pioneer in women's rise in the profession of astronomy and a mentor and educator of many future astronomers.

Helen Dodson was born on 31 December 1905, an era when women were not generally accepted as professional astronomers. She was a gifted student and was awarded a full scholarship in mathematics at Goucher College, where her interests turned to astronomy and graduated in 1927. She went on to study astronomy at the University of Michigan where she earned her Ph.D in 1933 under the direction of famed Astronomer Heber Doust Curtis, who was instrumental in the early development of the McMath Hulbert Observatory. She then taught astronomy at Wellesley College from 1933 until 1943,…and spent the last three years of World War II researching Radar at the MIT Radiation Laboratory.

In 1947 Helen came back to the University of Michigan both as a Professor of Astronomer and staff member of the McMath Hulbert Observatory. Her interest in solar astronomy, which became her life's specialty, began with her research in the summers of 1938 and 1939 at the Meudon Solar Observatory near Paris. She held that "solar behavior has a way of making people humble". Her career at MHO was marked by major advancements in solar measurement technology, many of which took place at MHO, which was an international center of Solar Astronomy.

Helen and her long time colleague at MHO, Emma Ruth Hedeman, became well known figures in the Solar Astronomy field. She published over 130 articles, mostly on her research specialty, solar flares. She oversaw MHO's participation in the International Flare Patrol from 1955 to 1964 in cooperation with 55 observatories from around the world. Among her most noted accomplishments was the "Comprehensive (Solar) Flare Index", a widely used measure of solar flare activity. She was a founding member of the Solar Physics Division of the American Astronomy Society in 1970 and was active in its affairs.

Helen retired in 1976 after a 43 year career as an educator, researcher, observer and scientific contributor in

the field of astronomy…..almost entirely **solar** astronomy. She received many awards over the years. In 1932 she held the Dean Van Meter Fellowship from Goucher College and in 1974 the University of Michigan honored her with its Facility Distinguished Achievement Award for her mentoring activities. In 1954 the American Astronomical Society bestowed its most coveted Annie Jump Cannon Award to Helen for her outstanding contributions to astronomical research. Shortly before her death in 2002, she was privileged by the AAS in having the Asteroid 71669 Dodson Prince, named in her honor.

She was known by her students and colleagues as a "marvelous woman" and a "real live wire". She was a kind and effective teacher, modest about her accomplishments and always generous with her tie and talents. During her years at the observatory she and her husband lived across Lake Angelus and she would often take pleasure in sailing to work. Helen was a major factor in the rise and success of the McMath Hulbert Observatory, even when, into the late 1950's, urban growth and weather conditions conspired to mitigate the technical advantages that had given prominence to the institution. She retired in 1976 and the U of M ceased operations and closed the observatory just two years later.

Helen spent her retirement years in Alexandria, Virginia and died on February 4, 2002, in Arlington, VA at the age of 97.

Introduction to Radio Astronomy—Amateur Pulsar Detection; Part 1

Probably the most difficult project an amateur radio astronomer can take on is the detection of objects called pulsars in the radio frequency range.

Pulsars are rapidly spinning neutron stars that emit plasma jets from their magnetic poles. When one of these poles happens to point at Earth as it rotates, a radio "blip" can be picked up at a very stable repetition rate.

Neutron stars are formed by the collapse of a massive supergiant star. These stars are 10 to 25 times the mass of the Sun. When one of these stars reach the end of their life, the star explodes into what's called a supernova. This massive explosion releases a huge amount of energy for a short period of time (days to months) when the supernova can be as bright as an entire galaxy during the event. It is thought that there may be upwards of a billion neutron stars in our galaxy, the Milky Way.

Neutron stars are the smallest and densest stellar objects, excluding black holes. Neutron stars have a radius on the order of 10 km and a mass of about 1.4 solar masses. (If the core remnant has a mass of 2 solar masses or more, the core collapses into a black hole).

Neutron stars get their names by the fact that they are composed almost entirely of neutrons. The electrons and protons present in normal matter combine to produce neutrons at the conditions in a neutron star. Neutron stars are partially supported against further collapse by neutron degeneracy pressure, which is a quantum effect that roughly states that no two particles can occupy the same space.

Neutron Star in Comparison to the NYC Metro Area (courtesy NASA)
Caution: do not place a neutron star anywhere near Earth!

Once the neutron star forms, it no longer generates heat, but instead slowly cools over time. Neutron stars will probably still be around in hundreds of billions of years, and are only destroyed by collisions with other neutron stars or black holes.

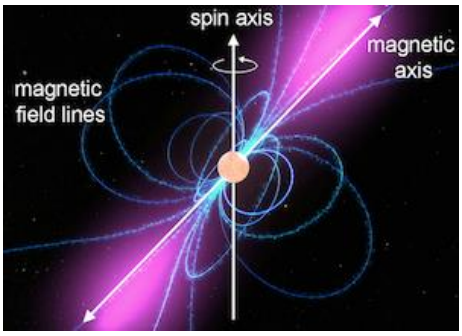
After the supernova explosion of a star with 10-25 times the mass of the sun, gravitational collapse occurs and the core is compressed to the density of an atomic nucleus. The collapse is stopped by a phenomenon called neutron degeneracy pressure. Protons and electrons are forced to combine at this density although 1%-5% of the particles are protons in a neutron star.

The density of a neutron star is incomprehensible in our everyday experience and to give an example, just 1 cubic centimeter of a neutron star has a mass of 300-400 million tons. Granite, for example, has a density of 2.7 grams/cm^3 at the earth's surface. 350 million tons of granite on the earth would occupy a cube of over 500 m on a side! If the earth were as dense as a neutron star, it would only be about 300 m in diameter!!

Because of the conservation of momentum, as the supernova core collapses, it spins faster and faster. Neutron stars rotate at spin rates as slow as 24 seconds per rotation to as fast as 716 rotations per second. At this fastest known speed, the surface of the neutron star at the equator is travelling at a quarter of the speed of light!

The magnetic fields on neutron stars are also quite strong, dwarfing that of the Earth, for example. These fields are on the order of 10^4 to 10^{11} Tesla (T). For comparison, the Earth's magnetic field is around 50 μT, or 50 *millionths* of a Tesla.

Another feature of neutron stars are the jets of plasma that are spewed out from the powerful magnetic fields at the magnetic poles of the neutron star.



Plasma Jets from Magnetic Poles of a Neutron Star (courtesy NASA)

Plasma from the neutron star is blasted from the magnetic poles and shoots outward in sweeping beams that spin around in a "lighthouse" effect. As a rule, the spin axis of the neutron star and the magnetic poles do not necessarily align. This is true in the case of the earth's spin axis and magnetic pole axis.
Here's a link to a NASA animation of a spinning neutron star:

Spinning Neutron Star

Another effect of the spinning gas jets of a neutron star is the emission of radio waves. If one of the beams happens to be oriented toward Earth, the beam sweeps by Earth every time the neutron star spins. If this signal is detected by radio astronomers, the neutron star is call a pulsar. When the radio signals of pulsars were first detected, it was not known at first that a neutron star was the cause of the radio signal. The pulsar signal is in the form of a "blip" of short duration that has a very regular repetition rate that is extremely regular and almost looks like it is artificially generated.

The first detection of a pulsar was in 1967 by a team at the Cambridge University's Mullard Radio Observatory near Cambridge England.

Next month we'll continue the discussion with how amateur radio astronomers are detecting pulsars with very modest equipment, but using very sophisticated signal processing techniques.

Remains of 4 Acre Antenna at Mullard Radio Observatory of Cambridge University That Was Used for the First Observation of a Pulsar

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.
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MHAS Officers

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Marty Kunz

Vice-President
Jim Shedlowsky

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Ken Redcap

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Dir-Communications & Website
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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

ALCOR
Austin Sabatino

Scheduled Meetings

All MHAS members are welcome to join us on Saturday Work Days and Board of Directors Meetings. We are temporarily unable to hold Open Houses for the public.

MHAS Board Monthly Meetings / Teleconferences:

1st Sunday of Each Month @ 2 PM

The next board meeting is scheduled for December 6, 2020 and will be via teleconference. MHAS paid members are invited to participate in this meeting. For an invitation, email us at info@mcmathhubert.org.

Space Pirates Radio!

MHAS President Marty Kunz hosts an astronomy internet show called “Space Pirates Radio" on the website www.astronomy.fm. The show airs every Wednesday night at 9 PM Eastern and features current information about space mission developments, astronomy news, and a “what’s in the sky today” report. Set your alarm today!

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
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Lake Angelus, Mi. 48326