SkyWAAtch

Andromeda Galaxy

Olivier Prache captured this image of M31, the great galaxy in Andromeda, at the Medomak Star Party in Maine. The final picture is the result of a 32 x 60s live stack with Olivier's new mobile setup (Borg101, AVX mount and ASI 1600MC one-shot color). Notes Olivier: I focused manually, and the burnt core comes from lack of experience with the camera where the gain setting was obviously too high. Nonetheless, getting that much data in 32 minutes is a testimony to the quality of Maine's dark skies.

In This Issue . . .

Events for September

WAA September Lecture

"WAA Members' Night"
Friday September 14th, 7:30pm
Lienhard Hall, 3rd floor
Pace University, Pleasantville, NY

We start off the fall season with one of our most popular events, Members' Night. WAA members present brief talks and demonstrations on a wide range of astronomical topics. We particularly want to hear about astronomical trips, imaging, new equipment, observations and even research. The Members' Night is a great way to meet your fellow club members and see the range of interests in the club. This year, we have a large number of valuable and fun door prizes, including several useful pieces of astronomical equipment. Free and open to the public. Directions and Map.

Upcoming Lectures

Leinhard Lecture Hall
Pace University, Pleasantville, NY

On October 5th, Satya Nitta of IBM will present on Artificial Intelligence and Astronomy. On November 2nd our speaker will be Jon Morse, CEO of the BoldyGo Institute and former Director of Astrophysics in the Science Mission Directorate at NASA. On December 7th: Andrew MacFadyen of NYU will discuss Gravitational Waves. Free and open to the public.

Starway to Heaven

Saturday September 8th, Dusk.
Ward Pound Ridge Reservation,
Cross River, NY

This is our scheduled Starway to Heaven observing date for September, weather permitting. Free and open to the public. The rain/cloud date is September 15th. **Important Note**: By attending our star parties you are subject to our rules and expectations as described here. Directions and Map.

New Members. . .

Renato Bojanovich - White Plains
Christopher Plourde - New Rochelle
Laura Zapata - Mohegan Lake
Craig Rothman - Yonkers
Penny Kelly - Wappingers Falls

Renewing Members. . .

Andrea Anthony - Yorktown Heights
Roger Woolcott - Brewster
Gene Lewis - Katonah
George & Susan Lewis - Mamaroneck
Cat Hannan - Lincolndale
Jan Wauters - Larchmont
Kristina Newland - White Plains
Joe Geller - Hartsdale
Jose E. Castillo - Pelham Manor

Above are two images of Jupiter taken by John Paladini through an 8" Schmidt Cassegrainian. The topmost shows the full planetary disk while below is a closeup on the Red Spot.

Call: 1-877-456-5778 (toll free) for announcements, weather cancellations, or questions. Also, don't forget to visit the WAA website.

Westchester Amateur Astronomers

ALMANAC
For September 2018 by Bob Kelly


Sep 3 Sep 9 Sep 16 Sep 25

As sunset moves past 7pm EDT, our planets parade in a more proper part of the evening for viewing. The show is moving on deeper into the southwestern sky. Mars and Saturn are up half the night, but Venus and Jupiter depart quickly. Jupiter sets when Mars is highest in the south and Venus is gone before twilight ends.

Mars is still outstanding in the southern sky, looking smaller but moving northward a bit. It still looks larger than it was at our last close pass two years ago for most of the month but becomes dimmer than Jupiter by the second week of September. The dust storm is clearing, so it's worth a good look in a telescope. In late September, Mars' most striking dark area, Syrtis Major, and brightest desert, Hellas, will be visible, showing the greatest amount of contrast visible in a telescope. Like most of our planets this month, it's best to catch Mars right after dark.

As we move from left to right across our evening sky, Saturn is at quadrature this month; striking a pose that lets us see a slice of the planet's shadow on the rings, increasing the WOW factor for our most outstanding ringed planet. It's largest moon, Titan, is always hanging out nearby. Iapetus is dimming from +10.2 to +11.9 magnitude, passing north of Saturn on the 18th. Find Titan on the 12th and look for dimmer Iapetus just twice Titan's apparent distance in the same direction out from Saturn.

Jupiter is falling into the southwestern horizon. Catch it soon, in twilight if possible. It's amazing how much detail we can see on Jupiter in the bright sky. The jumbo planet's brightness in a dark sky can overwhelm the eye and make fine details harder to see.

Venus, first to set, does the trick of being brighter and larger while its phase shrinks from half-lit to a crescent. You'll need a clear view of your southwestern horizon left of the setting sun - start looking right after sunset. If you don't have a clear view, find a place! A telescope or some binoculars will show the changing phases. It's hard to believe Venus is forty degrees east of the Sun. View it higher in the sky in mid-afternoon when the Sun is level with Venus. Block out the Sun with a solid, fixed object and aim four fist-widths left from where the Sun would be.

The Abrams Planetarium Calendar notes the distance from Venus to Mars across our sky is less than 90 degrees across, closest on the 24th.

September is a great month for the Milky Way, stretched across the sky in our Prime Time as the sky gets dark after 9pm early in the month and by 8pm by October 1st.

The outer ice giants, Neptune and Uranus, are back. Neptune, at opposition on the 7th, needs binoculars to find and a telescope to spy a disk. Get a chart to pick out the eight planet in Aquarius. Uranus rises in the middle of the night in Pisces.

Our sun is at the equinox on the 22nd at 9:54pm EDT. Despite the solar minimum, aurora can still develop, especially near the equinoxes. While rarely seen this far south, it's worth keeping an eye out for solar mass ejections that might induce auroras in our geomagnetic realm.

Comets are popping up into the range of good binoculars. Periodic comet 21P Giacobini-Zinner has been hanging out in our northern skies, just off of Perseus. Later this month, 38P Stephan-Oterma appears like it's about to be hit by Orion's club in the pre-dawn sky. C/2017 S3 PanSTARRS seems to have fallen apart as it passed closest to the sun last month.

The International Space Station makes its appearance in the morning sky through the 18th and then in the evening skies into mid-October.

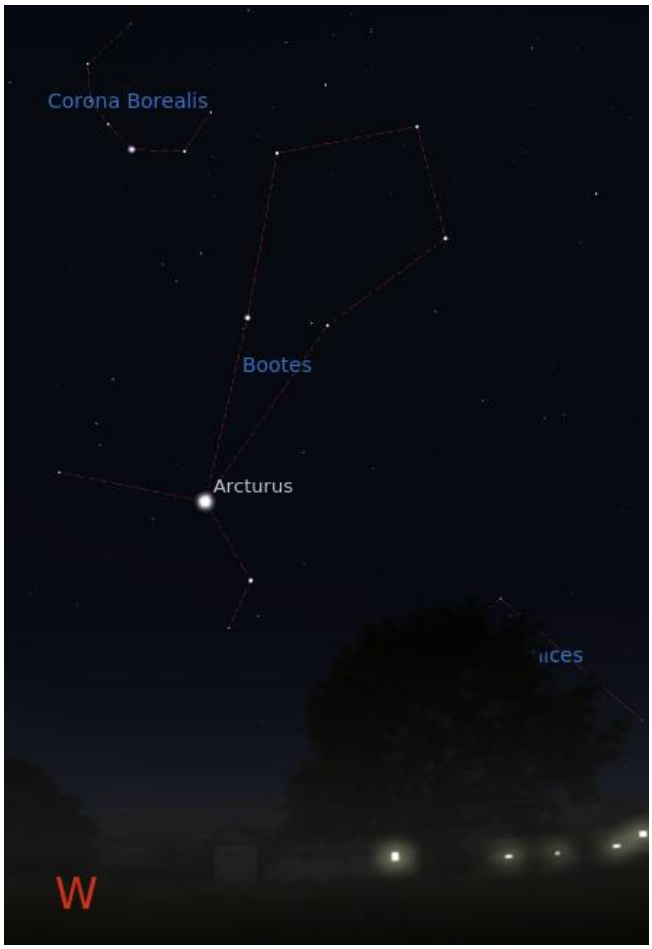
Westchester
Amateur Astronomers

In The Naked Eye Sky

For September 2018: The Northern Crown

by Scott Levine

A couple of weeks ago, after the last of the sleeping bags were packed away, the Cheetos and birthday cake crumbs swept up, and the house was ours again, I sat outside with my daughter and watched Venus set into the night. Right around the time the Perseids come along, there's a moment every August when it starts to feel like things are changing. The air gets a little softer and less angry. What seemed like dinner in the middle of the afternoon just a few weeks ago needs to be brightened up by the flame of a citronella candle. You start to realize that the time when there's no more s'mores left and no more cannonballs to do is coming.



We didn't see any meteors, but, off to the west, as some bats ducked, dipped and dived overhead I noticed **Corona Borealis** peeking out from behind some oak branches.

The Northern Crown is only the 73rd biggest of the official 88 constellations, but for my dime it's the best of the small. I check in on it most spring and summer nights. Even when I have the bright lights of fall and winter to distract me, it feels like there's something missing when it's not there. In late August and September, when it crossed the sky and is hanging on just after dark, it's a spectacular sight not far from **Arcturus** (α Boo) in neighboring **Boötes**. It's this time of year when I can see it in the backdrop of my backyard, playing among the leaves as we sit outside, or when I have a beer before bed.

Aphecca (α CrB) is a second-magnitude eclipsing binary about 75 light years away. It's interesting sight because it's so much brighter than the rest of the Crown's naked-eye stars that circle around it. Those other six are mostly fourth magnitude, which makes Alphecca really stand out as the bright jewel of the crown. Against our bright suburban skies, those dimmer lights are a little more subdued, and it's easy to imagine the crown sitting on top of a queen or princess's head. In fact, I remember, years ago, on that very spot where I was sitting with my daughter, trying to line it up just so, so it looked like it was on her head.

It's fun to pair Alphecca along with the old, giant Arcturus, which is the fourth brightest in the entire sky and the second brightest visible in the north. The two are sharply different but come back from their winter vacation around the same time. For years, watching all these stars cross the black, little by little, night by night, has been part of the quiet undercurrent of the sky; part of the unspoken language us sky fans have. From the minute the Spring Triangle appears in a late winter sky, watching these stars cross the sky and then vanish months later every year is like watching time itself, pass.

And there we sat, she, still glowing from her birthday party, and me feeling like I just got away with something. We watched the stars come out for a while when I noticed last night's leftover bag of marshmallows just inside the door. So, I flipped on the grill. It's still summer after all. Time for one more last s'mores.

The Great Refractor at Yerkes Observatory

Larry Faltz

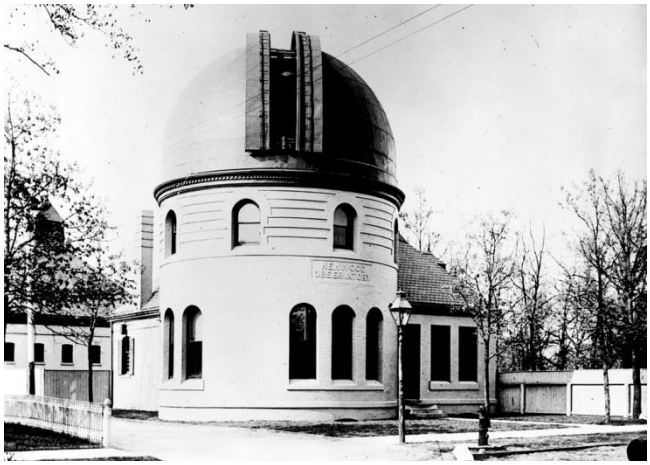
It may very well be that the world's largest refractor owes its existence to Mrs. O'Leary's cow.

This is, of course, if the cow story was actually true. The Great Chicago Fire of October 10, 1871 started in Mrs. O'Leary's barn. Popular lore has the cow kicking over a candle while Mrs. O'Leary milked her, setting fire to the hay and starting a conflagration that destroyed 3.3 square miles of the city and killed 300 people. The O'Learys were actually in bed when the fire started, probably from an ember spewed from a nearby chimney. The story of the cow was made up by reporters, but it took hold of popular imagination and was later depicted in the 1937 movie *In Old Chicago*. Although the official inquiry vindicated her, Mrs. O'Leary's life was ruined by the story and she lived as a recluse until her death in 1895.

Cow or not, from the ashes of old Chicago a new city arose. Brick and steel buildings replaced the older wooden structures, the elevated railway was built and the city flourished. There was money to be made. The fortunes generated by two particular individuals ultimately financed the construction of the world's largest refractor and set George Ellery Hale on the path to creating the next three "world's largest" telescopes.

William Ellery Hale, George Ellery Hale, Charles T. Yerkes

William Ellery Hale manufactured and installed elevators in the buildings that rose, Phoenix-like, from the ruins of the burnt city. He made a substantial fortune and lavished much of it on his children, the eldest of whom was his precocious, curious and studious son George. George Ellery Hale received a broad education in both the arts and the sciences, and from an early age was given scientific equipment. His first instrument was a microscope and he equipped a home laboratory to do experiments. At age 14 he built a small telescope. Soon after, his father gifted him a fine a 4" Clark refractor and he set up a backyard observatory at 4545 Drexel Boulevard in the Chicago's Kenwood neighborhood. Hale wasn't just a science geek: he was well-rounded, well-educated and interested in a vast range of subjects, although he never got (nor apparently needed) an advanced degree in astronomy. Like many important figures in space science of a hundred years ago, he found inspiration in the novels of Jules Verne. His life is testimony to what the combination of a rich imagination, a fine education, wealth, seemingly boundless energy, a gregarious personality and the ability to focus could bring to one's future. Hale went off to be educated at MIT and the Harvard College Observatory. In 1890 he returned to Chicago to set up the Kenwood Observatory on the family's property, with a 12 inch equatorially mounted refractor financed by his father. He installed a spectroheliograph, a device he invented while an undergraduate, and began serious study of the sun.



Kenwood Observatory (University of Chicago archives)

That same year the University of Chicago was founded with money donated by oil magnate John D. Rockefeller on land just a mile south of the Hale family property provided by Chicago entrepreneur Marshall Field. Desiring to become a competitive research institution, the university wanted an astronomy deparmtent. U of C President William Rainey Harper couldn't miss seeing the rather substantial observatory not far from campus.

Harper offered a faculty position to Hale, but the latter realized that what Harper really wanted was the observatory itself, and he declined. A year later, the offer was tendered again, and this time Hale accepted, apparently on the strength of the faculty that had been recruited in

the interim, including. physicist Albert Michelson, known for his accurate measurement of the speed of light and later for the famous Michelson-Morley experiment that debunked the notion of the ether. Michelson was the first American to win the Nobel Prize (1907). Hale was appointed Associate Professor of Astro-Physics (*sic*) and Director of the Observatory, with no salary but with a promise that within 3 years Harper would raise $250,000, a princely sum in those days, for a larger observatory.

Hale's appointment was approved by the university's Board on July 26, 1892. Six weeks later Hale gave a talk at the American Association for the Advancement of Science meeting in Rochester, NY. Telescope maker Alvan Clark was also at the conference and over drinks one evening he told Hale about a pair of 42" lens blanks that he had in his shop. They had been ordered by the University of Southern California for a telescope to be sited on Mt. Wilson, above Pasadena. The donor, USC Trustee Edwin Spence, had run into financial difficulty and withdrew his pledge for the money. Hale could get the blanks for $16,000.

Hale returned to Chicago and told Harper that the blanks could be made into a 40" telescope that would be the largest in the world. Harper and Hale arranged to meet Chicago financier Charles T. Yerkes in the first week of October.

Yerkes had made a fortune financing the Chicago elevated railway system, the famous "L" that today still runs on some of Yerkes' original tracks. Later in life he was substantially responsible for financing the London Underground. However, his previous dealings were not always successful. While serving as financial agent for the city of Philadelphia, he made a large-scale stock speculation that went bust after the Chicago fire. He was convicted of larceny and sentenced to 33 months in prison. Maneuvering to stay out of jail, Yerkes tried to bribe two Pennsylvania politicians. Although the attempt failed, information about the politicians became public, prompting worries by President Ulysses Grant that the scandal would affect results of the 1876 elections. Yerkes was offered a pardon if he denied the allegations, and he did so. Nevertheless, his reputation was tainted.

Donating money to support an academic research observatory would send just the signal of beneficence and generosity that Yerkes needed to soften his image. "I don't care what the cost, send me the bill!" he announced, even suggesting he'd donate a million dollars to have the biggest telescope in the world bear his name. He was going to "lick the Lick," a reference to the then-world's largest functional telescope, the 36" refractor on Mt. Hamilton in California. Yerkes had originally wanted only to bankroll the telescope and at times seems to have gotten cold feet about the whole project, but he finally agreed, after a good bit of coaxing by Hale and Harper, to fund the entire observatory at a cost of $300,000.

One stipulation of the University was that the telescope had to be within one hundred miles of the Chicago campus. Throughout 1893 a large number of local sites were evaluated. Ultimately, Williams Bay, Wisconsin, 73 miles distant, was chosen. The town is on the northwestern edge of Lake Geneva, an 8.17 square mile lake that was already a major resort area and thus unlikely to be industrialized, meaning there would be no local source of smoke. A flat parcel of 77 acres was obtained. Chicago architect Henry Ives Cobb was hired to design the building. Cobb was responsible for much of the new University of Chicago campus as well as other edifices in Chicago, many of which are still standing today.

The telescope mount and tube, minus the optics, were exhibited at Chicago's famous 1893 World's Columbian Exposition, marking the city's resurgence. The grinding and polishing of the lens was completed a couple of years later, and the telescope saw first light in 1897. But by that time Hale was already planning an even larger telescope, the 60-inch reflector at Mt. Wilson, and he moved to California in 1904.

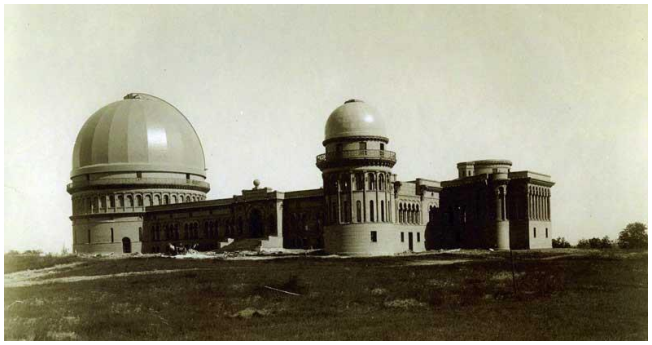
Yerkes Observatory (Google Earth)

Chicago is well-served from Westchester County Airport by both American and United Airlines. Williams Bay is about an hour and a half from O'Hare. We decided to stay in the Abbey Resort in Fontana, a quiet resort town, on the western edge of Lake Geneva just 8

minutes from the observatory. From the hotel we could just make out the top of the 40" telescope's dome poking above the trees.

In the morning, we drove over to the Yerkes Observatory. The observatory building first became visible from the road across a large lawn on the west side of the property, and we pulled over for some photos. From the Google Earth view, the arrangement of trees on that side of the observatory shows that at some point in the past a golf course had been laid out, but it wasn't obvious at ground level.

We drove around to the entrance on the northern side. The property is spacious, with large well-kept lawns and many groves of trees. Close to the building itself a few large trees have grown up as evidenced by their absence in early photos.



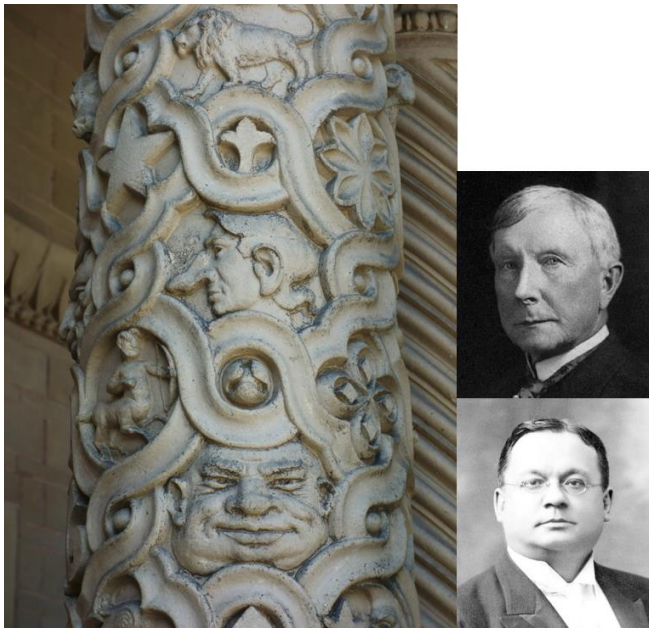
The observatory on June 4, 1897, from the southeast. Photo by E.E. Barnard (Vanderbilt University Library)

The observatory on June 29, 2018, from the southwest (LF)

We had some time to walk around the property and examine the building from all of its angles. There are three domes on the main building. The giant enclosure of the 40" refractor is on the western end. There are a couple of smaller, independent domes at the south edge of the property. The main instruments on the site are:

- 40-inch (102 cm) Clark refractor
- 40-inch (102 cm) Ritchey–Chrétien reflector (commonly called the "41 inch" to distinguish it from the refractor)
- 24-inch (61 cm) Cassegrain reflector
- 10-inch (25 cm) Cassegrain reflector
- 7-inch (18 cm) Schmidt camera

The building itself is rich in detail, with traditional design elements like architraves, colonnades, parapets and friezes, ornamented with many decorative details. It is a true palace of astronomy and an avatar of an architectural style, called Beaux-Arts, that no longer exists. The Bauhaus style has won: modern edifices, whether buildings or observatories, may be beautiful and sometimes even clever, but they are impersonal and unadorned compared to the Beaux-Arts panache.



A column on the entrance portico, showing caricatures of John D. Rockefeller (center) and William Rainey Harper (bottom) (LF)

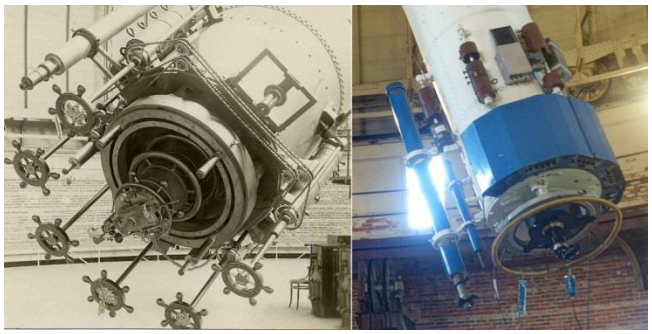
Architect Henry Ives Cobb must have been a playful fellow. Columns supporting the porticos over the entrances of the observatory are festooned with designs, astronomical references, symbols, animals, and faces. Among them are caricatures of John D. Rockefeller and William Rainey Harper, rather bold of the architect considering both were rather serious gentlemen. The figure of the prominent-nosed Rockefeller originally had a hornet stinging his proboscis, but in 1900 Hale asked that the bug be removed to avoid the suggestion that Rockefeller had been "stung" for money. Above the entrance doorways are reliefs depicting the sun god Apollo in his chariot as well niches housing a peculiar

gnome surrounded by fruits and vegetables, holding an hourglass and an ear of corn. This may refer to local agriculture (there are cornfields everywhere) but also might be a Masonic reference.

Architectural details (LF)

Entering the building through the richly decorated portico brings you to a central hall that is also full of figurative architectural elements. On the east side a corridor has some framed images with information about recent astronomical discoveries. The corridor has the appearance of any turn-of-the-century college hallway, with simple wooden moldings and doorframes. To the west, past a gift shop, is a wide stairway leading directly up to the 40" refractor.

After a thorough discussion of the history of the building and its architectural and figurative elements, our knowledgeable docent Richard Dreiser, a now-retired observatory employee who has been doing these tours for many years, took us up the stairs to the Clark refractor. The dome is spacious but Spartan. Typical of large refractors, the entire floor, which doesn't touch the mount, can be moved up and down using motors and cables mounted just under the dome's tracks, although we weren't offered this experience. The floor was at its lowest position, allowing full view of the massive pier and the spiral staircase that reaches to the equatorial mount. The pier of course goes far underground for stability. There's an upper parapet just under the dome set at the highest level that the moveable floor can reach. The mount has gigantic setting circles. At the eyepiece end of the giant, white optical tube, modern electronic controls and equipment replaced the original chain-driven mechanisms. The telescope operates at f/19.0, focal length 19,357 mm.



The eyepiece end of the telescope in its original configuration (Vanderbilt University Library archives) and today (LF)

The Yerkes Observatory was the University of Chicago's main astronomy research facility for many years. It has a rich history of discovery, and many famous astronomers worked there. Here is a short list of the most important astronomers and their research achievements:

Edward E. Barnard	Mapped dust clouds in the Milky Way
Sherburne W. Burnham	Binary star orbits and masses
Otto Struve	Stellar spectroscopy, Milky Way gas
Gerard Kuiper	CO_2 in Martian atmosphere; moons of Uranus and Neptune; infrared astronomy
W. Albert Hiltner	Polarization by interstellar dust; Milky Way magnetic field
Subrahmanyan Chandrasekhar	Physics of white dwarfs
William W. Morgan	First maps of the spiral structure of the Milky Way
Frank Schlesinger	Stellar parallax

Edwin Hubble got his PhD at the University of Chicago and did some of his early research at Yerkes before moving out to Mt. Wilson in 1919.

Yerkes is a working research facility with particular emphasis on the development of astronomical equipment such as spectrographs, photometers and even early adaptive optics systems, which were installed on the 40-inch Ritchey–Chrétien reflector. But the telescopes themselves, particularly the two 40-inch class instruments, became outdated as competitive research

instruments. Their location, elevation, aperture and the limited number of clear nights in Wisconsin made them insufficiently productive.

As the value of the telescopes for research waned, the amount of student education and public outreach increased. A wide variety of STEM programs are tailored to different student groups. For example, a "Girls Who Code" program seeks to develop interest in computer programming among middle school girls. The Skynet Jr. Scholars program facilitates the use of an international network of robotic telescopes (the "41-inch" RC scope is in the network) by middle school students and 4H Club members. The McQuown Scholars program engages high school students interested in a variety of projects in science, computer programming, imaging and engineering. There are professional development workshops for teachers in STEM fields and even science-focused summer camps for teenagers. Public viewing with the refractor and several of the smaller telescopes are scheduled frequently when the moon is not going to interfere.

The University of Chicago decided some time ago that the Yerkes Observatory was no longer appropriate for its research mission. Maintenance cost too much and research productivity was too low, particularly after Gerard Kuiper left in 1960 for the University of Arizona. In the mid-2000's, the University tried to sell the property to a developer for $8 million. The plans called for a 100-room luxury resort on the lakefront as well as 70 private homes, with the observatory preserved on 30 protected acres. The town of Williams Bay refused to change its zoning and the project was abandoned in 2007. On March 7, 2018, the University announced that it would close the observatory on October 1, 2018. The astronomy research facilities and staff are being moved back to the main campus in the Hyde Park neighborhood of the city. The University is making a major investment in the Giant Magellan Telescope (see the December 2014 SkyWAAtch) in Chile and has expensive commitments to astronomy at the South Pole. The University's press release said

> "Unfortunately, operating Yerkes no longer makes sense for the University from a programmatic or cost standpoint. Drawing to a close our operations there is the first step in a collaborative process to determine the ultimate disposition of the buildings and property," said David Fithian, executive vice president of the University. "We currently have no specific plans nor have we approached any potential buyers."

Since that press release, no news has come from the University about Yerkes' fate (as of mid-July). Whether Yerkes Observatory will follow into oblivion such wonderful edifices as Pennsylvania Station, Frank Lloyd Wright's Imperial Hotel in Tokyo and Larkin Building in Buffalo, the Singer Building in New York and the Chicago Federal Building (like Yerkes another Henry Ives Cobb masterpiece) remains to be seen. Will there be an angel to step in and save the building, its telescopes and its educational and outreach missions the way Isaac Stern saved Carnegie Hall from demolition? One thing that would help would be to have it declared a National Historic Landmark, and I'm amazed that it is not one already. The University of Chicago is unlikely to pursue that now, and probably never did, since it would limit their options.

We think of George Ellery Hale today as an impresario of "world's largest" telescopes and major American observatories (Yerkes, Mount Wilson and Mount Palomar). He followed the Yerkes refractor with Mount Wilson's 60-inch reflector in 1908 and 100 inch Hooker reflector in 1917, and then the 200-inch Hale reflector on Mount Palomar in 1949 (although Hale had been dead for 11 years by the time of the scope's first light). But Hale was an authentic research astronomer whose influence on the field is still felt today. His major scientific discovery, and it's a significant one, was the elucidation of the sun's magnetic field by observing the splitting of the iron line (the Zeeman effect) in the sun's spectrum, using his 150-foot solar telescope on Mount Wilson. His interest in ever larger telescopes was driven by his desire to solve the most challenging problems in astronomy. As an organizer of scientific activity and scholarly institutions, Hale founded the journal *Science*, the top general science periodical in the US, and the *Astrophysical Journal*, the most prestigious astronomy journal in the world. He established American Astronomical Society and the organization that later became the International Astronomical Union. He helped found the National Research Council during World War I. He mentored astronomers like Harlow Shapley and Edwin Hubble. His influence helped transform the Throop vocational and preparatory schools in Pasadena into the California Institute of Technology, one of the top 10 universities in the world. The Yerkes Observatory and its 40" refractor are testaments to his energy and creativity. Let's hope that they continue to thrive as a tribute to Hale and a reminder of the rich history of astronomy in the United States. ■

The 40-inch Alvan Clark refractor at Yerkes Observatory (LF)

A Trip Through the Milky Way

Jane Houston Jones and Jessica Stoller-Conrad

Feeling like you missed out on planning a last vacation of summer? Don't worry—you can still take a late summertime road trip along the Milky Way!

The waning days of summer are upon us, and that means the Sun is setting earlier now. These earlier sunsets reveal a starry sky bisected by the Milky Way. Want to see this view of our home galaxy? Head out to your favorite dark sky getaway or to the darkest city park or urban open space you can find.

While you're out there waiting for a peek at the Milky Way, you'll also have a great view of the planets in our solar system. Keep an eye out right after sunset and you can catch a look at Venus. If you have binoculars or a telescope, you'll see Venus's phase change dramatically during September—from nearly half phase to a larger, thinner crescent.

Jupiter, Saturn and reddish Mars are next in the sky, as they continue their brilliant appearances this month. To see them, look southwest after sunset. If you're in a dark sky and you look above and below Saturn, you can't miss the summer Milky Way spanning the sky from southwest to northeast.

You can also use the summer constellations to help you trace a path across the Milky Way. For example, there's Sagittarius, where stars and some brighter clumps appear as steam from a teapot. Then there is Aquila, where the Eagle's bright Star Altair combined with Cygnus's Deneb and Lyra's Vega mark what's called the "summer triangle." The familiar W-shaped constellation Cassiopeia completes the constellation trail through the summer Milky Way. Binoculars will reveal double stars, clusters and nebulae all along the Milky Way.

Between Sept. 12 and 20, watch the Moon pass from near Venus, above Jupiter, to the left of Saturn and finally above Mars!

This month, both Neptune and brighter Uranus can also be spotted with some help from a telescope. To see them, look in the southeastern sky at 1 a.m. or later. If you stay awake, you can also find Mercury just above Earth's eastern horizon shortly before sunrise. Use the Moon as a guide on Sept. 7 and 8.

Although there are no major meteor showers in September, cometary dust appears in another late summer sight, the morning zodiacal light. Zodiacal light looks like a cone of soft light in the night sky. It is produced when sunlight is scattered by dust in our solar system. Try looking for it in the east right before sunrise on the moonless mornings of Sept. 8 through Sept 23.

You can catch up on all of NASA's current—and future—missions at www.nasa.gov

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This illustration shows how the summer constellations trace a path across the Milky the best views, head out to the darkest sky you can find. Credit: NASA/JPL-Caltech

What's It Like Inside Mars?

Jessica Stoller-Conrad

Mars is Earth's neighbor in the solar system. NASA's robotic explorers have visited our neighbor quite a few times. By orbiting, landing and roving on the Red Planet, we've learned so much about Martian canyons, volcanoes, rocks and soil. However, we still don't know exactly what Mars is like on the *inside*. This information could give scientists some really important clues about how Mars and the rest of our solar system formed.

This spring, NASA lauched a new mission to study the inside of Mars. It's called Mars InSight. InSight—short for Interior Exploration using Seismic Investigations, Geodesy and Heat Transport—is a lander. When InSight lands on Mars later this year, it won't drive around on the surface of Mars like a rover does. Instead, InSight will land, place instruments on the ground nearby and begin collecting information.

Just like a doctor uses instruments to understand what's going on inside your body, InSight will use three science instruments to figure out what's going on inside Mars.

One of these instruments is called a seismometer. On Earth, scientists use seismometers to study the vibrations that happen during earthquakes. InSight's seismometer will measure the vibrations of earthquakes on Mars—known as marsquakes. We know that on Earth, different materials vibrate in different ways. By studying the vibrations from marsquakes, scientists hope to figure out what materials are found inside Mars.

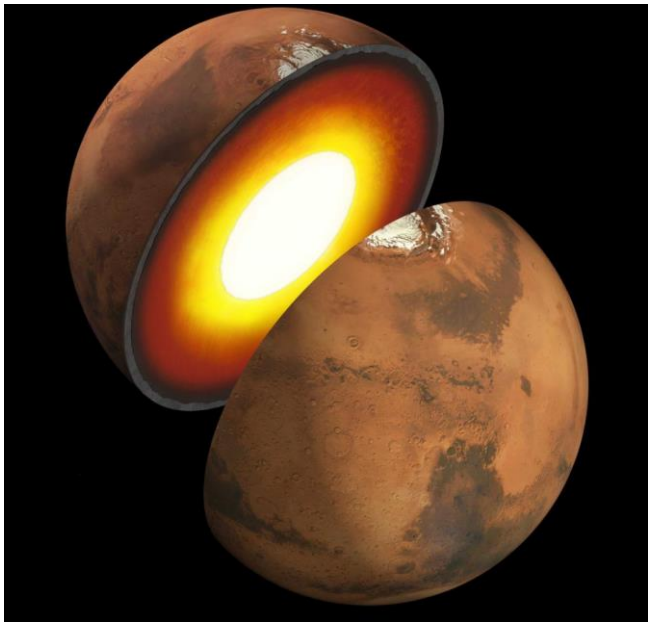
InSight will also carry a heat probe that will take the temperature on Mars. The heat probe will dig almost 16 feet below Mars' surface. After it burrows into the ground, the heat probe will measure the heat coming from the interior of Mars. These measurements can also help us understand where Mars' heat comes from in the first place. This information will help scientists figure out how Mars formed and if it's made from the same stuff as Earth and the Moon.

Scientists know that the very center of Mars, called the core, is made of iron. But what else is in there? InSight has an instrument called the Rotation and Interior Structure Experiment, or RISE, that will hopefully help us to find out.

Although the InSight lander stays in one spot on Mars, Mars wobbles around as it orbits the Sun. RISE will keep track of InSight's location so that scientists will have a way to measure these wobbles. This information will help determine what materials are in Mars' core and whether the core is liquid or solid.

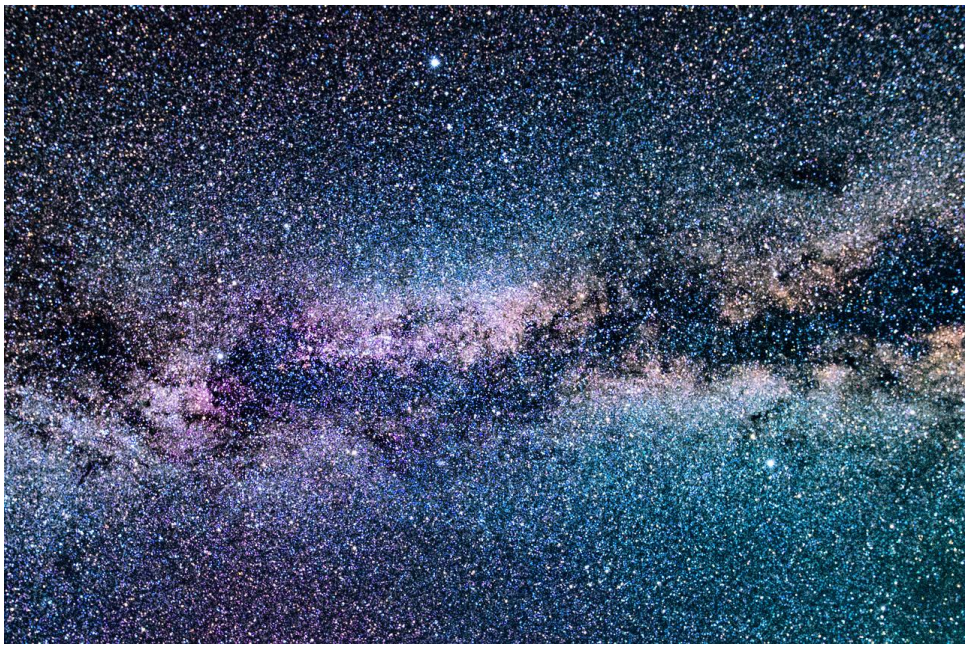
InSight will collect tons of information about what Mars is like under the surface. One day, these new details from InSight will help us understand more about how planets like Mars—and our home, Earth—came to be.

For more information about earthquakes and marsquakes, visit: https://spaceplace.nasa.gov/earthquakes. This article is distributed by NASA Space Place. With articles, activities and games NASA Space Place encourages everyone to get excited about science and technology. Visit spaceplace.nasa.gov to explore space and Earth science!



An artist's illustration showing a possible inner structure of Mars. Image credit: NASA/JPL-Caltech

Astrophotos



David Parmet took this image of the Milky Way slicing through the Summer Triangle at Cherry Springs State Park in Pennsylvania. He used a Nikon D810 on an AstroTrac mount (ISO 3200, 15mm, *f*5.6, 10 minutes).

During the last weekend in July, Mars was closer to Earth than at any time between 2003 and 2015. Backyard astronomers had been frustrated earlier in the summer by a raging dust storm on the Red Planet, but Mauri Rosenthal and others who tried that weekend were able to extract some detail on the planet's surface. Mauri used his 3.5" Questar telescope with a 2x Televue Powermate and a ZWO ASI 120MC planetary camera to shoot this image on July 30th from his yard in Scarsdale. The best 300 out of 5600 frames required processing with PIPP, AutoStackert3, Registax 6, PixInsight, and ACDSee to bring out the surface features including the South Polar ice cap.

Member & Club Equipment for Sale

September 2018

Item	Description	Asking price	Name/Email
Celestron 8" SCT on Advanced VX mount	Purchased in 2016. Equatorial mount, potable power supply, polar scope, AC adaptor, manual, new condition.	$1450	Santian Vataj spvataj@hotmail.com
Celestron CPC800 8" SCT (alt-az mount)	Newly donated to WAA. Like new condition, perfect optics. Starizona Hyperstar-ready secondary (allows interchangeable conversion to 8" f/2 astrograph if you get a Hyperstar and wedge). Additional accessories: see August newsletter for details.	$1300	WAA ads@westchesterastronomers.org
ADM VCW Counterweight system	Clamping plate for a V series dovetail. 5" long ½" thick threaded rod for counterweights. Original ADM 3.5 lb counterweight plus a second weight. New condition. Lists at $55. Link.	$35	WAA ads@westchesterastronomers.org
Celestron Advanced GT Equatorial Mount	Celestron Nexstar+ hand controller, 2" tripod, counterweight bar with 10 lb. weight , cables	$225	Gary Miller garymiller7@optonline.net
Televue Everbrite Diagonal	1.25", brass compression ring	$95	Gary Miller garymiller7@optonline.net
Illuminated Reticle Eyepiece	Meade, 12mm	$30	Gary Miller garymiller7@optonline.net
SuperView 30mm Eyepiece	Generic, 68 degree AFOV, 2" diameter	$35	Gary Miller garymiller7@optonline.net
Meade 395 90 mm achromatic refractor	Long-tube refractor, f/11 (focal length 1000 mm). Straight-through finder. Rings but no dovetail. 1.25" rack-and-pinion focuser. No eyepiece. Excellent condition. A "planet killer." Donated to WAA.	$100	WAA ads@westchesterastronomers.org
William Optics E-BINO-P Binoviewer	1¼" nosepiece. Comes with a pair of 20 mm 66° eyepieces, 1.6x Barlow. Compression ring eyepiece holders, BaK4 prism. New condition in original packaging. Lists @ $268.	$150	Larry Faltz lfaltzmd@gmail.com

Want to list something for sale in the next issue of the WAA newsletter? Send the description and asking price to ads@westchesterastronomers.org. Member submissions only. Please only submit serous and useful astronomy equipment. WAA reserves the right not to list items we think are not of value to members.

Buying and selling items is at your own risk. WAA is not responsible for the satisfaction of the buyer or seller. Commercial listings are not accepted. Items must be the property of the member. WAA takes no responsibility for the condition or value of the item or accuracy of any description. We expect, but cannot guarantee, that descriptions are accurate. Items are subject to prior sale. WAA is not a party to any sale unless the equipment belongs to WAA (and will be so identified). Sales of WAA equipment are final. *Caveat emptor*!