The Young Astronomer Program makes its Debut in September!

THE OBSERVER

The Newsletter of Central Valley Astronomers of Fresno September-October 2018

The 40" at Yerkes Observatory: a Personal Experience

Former CVA president Chad Quandt writes about observing familiar and well-known celestial objects through the largest and most famous refractor telescope in the world

"Who ordered that?"

Nobel laureate Isidor Rabi, in 1936, after hearing that the muon particle had been discovered.

In this Issue

Central Valley Astronomers

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To all CVA members:

September is an important month. On September 1 the Young Astronomers Program, one of the most significant projects that CVA has done in many years, starts to take applications for its first class, which will begin in January 2019. The Young Astronomers Program was highlighted in a previous Observer issue, but I'll recap it here. Starting on January 1, a limited number of young people will study a lengthy curriculum of academic astronomical knowledge, and, at the same time, demonstrate practical astronomical skills over a period of at least a year. At the end of their program, they will give a presentation before the CVA membership at a monthly meeting, and then be given their own telescope. A number of CVA officers and members have been working on this program for several months, and it is finally coming to fruition. This will be a milestone for CVA, and a major step forward in the lives of young people who are interested in astronomy and space sciences.
-Larry Parmeter, *Observer* editor

Number of exoplanets that have been found as of

August 2018- 3,823

How many more are out there?

Tens of thousands? Hundreds of thousands?

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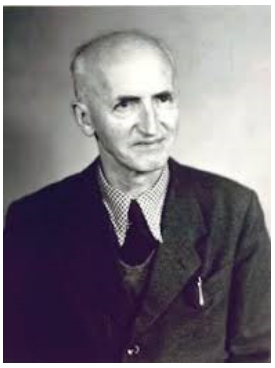
Profiles in Astronomy

Cuno Hoffmeister 1892-1968

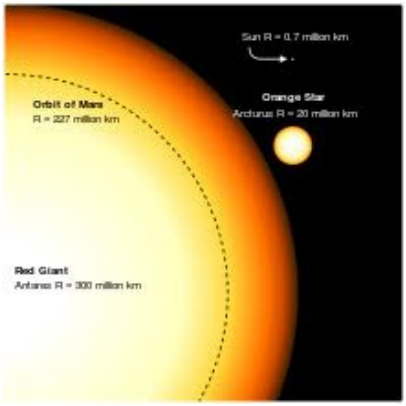


Hoffmeister was born and raised in Sonneberg, Germany. He had to drop out of school at age fourteen due to his family's financial situation, but after World War I attended the University of Sonneberg and also Jena University, where he earned his doctorate in physics in 1927. During the same year, he started building what would become the Sonneberg Observatory. He expanded the observatory over the years, and made it into what it is today. After World War II, when Germany was divided between West and East, the observatory lost most of its equipment when it was taken over by the communist East German government. Even though he protested against the confiscation, Hoffmeister was allowed to continue as director, and did so until his death. During the years after the war, he established and directed a nation-wide amateur observing program of auroras, nightglows, and other dark sky phenomena.

Hoffmeister is best known for his study of variable stars. The main reason for his establishing the Sonneberg Observatory was to observe variable stars, and during his lifetime, he discovered, catalogued, and imaged over 10,000 of them. In addition, he amassed a huge catalogue of dark skies images, over 100,000, which remains the largest in the world. Hoffmeister also discovered five asteroids and a comet, C/1959-01. A crater on the Moon and two asteroids are named for him. Today, the Sonneberg Observatory is still operational, and is administered by the German Academy of Sciences.
Source and image-Wikipedia

Star Stories

Antares, also known as Alpha Scorpi, is the brightest star in the constellation Scorpius. It is a reddish looking star which is actually a variable; its apparent magnitude fluctuates from .6 to 1.6. Its absolute magnitude is -5.3. It is an M1 star, a red supergiant that is over three hundred times the size of the Sun, and, as such, is one of the largest stars ever observed. Scientists believe that it will explode in a supernova sometime in the next 10,000 years. It is approximately 550 light years from Earth



In 1844, the Scottish scientist James Grant discovered that Antares has a small companion, now known as Antares B. Antares B is a blue-white main sequence star with a classification of B2 and a magnitude of 5.5. It is about 530 AUs from its larger companion.

The origin of the name Antares is disputed. Many believe that it is based on a Greek word meaning "rival to Ares(Mars)." Others, though, say that it comes from Arabic, named in honor of Antarah ibn Shaddah, a mythical Arab warrior-hero. Like many other stars in the sky, Antares was well known to the ancient peoples. The Babylonians called it *Gaba-GirTab*, "The breast of the scorpion." To the ancient Persians, it was *Satevis*, one of the "royal stars." The Chinese called it *Huoxing*, the "fiery star." To the Maoris of New Zealand, Antares is known as *Rahua*, the "father of stars," and its annual appearance and disappearance play an important role in the workings of the Maori calendar.

What's New in Space

Trump and the Space Program

People may like Donald Trump, and they may hate him, but one thing that catches attention in the aerospace community is that he wants to get America's manned space program back on track after drifting aimlessly during the Obama years. I get the feeling that Barrack Obama really didn't care about the manned space program, and if he had the chance, might have ended it altogether. Trump, whatever people may think of his other views, is a strong proponent of America in space, seeing it as an integral part of his "Make America Great Again" philosophy. As soon as he took office, he proposed that the U.S. make a manned circumlunar flight as early as 2019, only to be told that the Orion-MPCV won't be ready until at least 2021. The new head of NASA, James Brindenstine, is working on pressing the agency out of its lethargy. Since taking office earlier this year, Brindenstine has been focusing on three major projects that Trump wants to see initiated.

The first has to do with the International Space Station. Right now, NASA's funding for it ends in 2028, and Trump and Brindenstine would like to see it taken over by private enterprise. Brindenstine says that a number of companies are interested, but none have come out and said so publicly so far. Critics say that the government should maintain ownership of ISS; Ultimately, ISS's future will be fought over in Congress.

The second major enterprise is America's plans in deep space. Trump has made it very plain that he wants the U.S. go back to the Moon, and on to Mars, and he sees a first step in the so-called "Gateway" program, which would involve putting a manned space station into orbit around the Moon as a jumping-off point for lunar landing missions and also missions to Mars. The main concern here is the financing; whether Congress will fund upwards of $50 billion for a smaller version of ISS in lunar orbit. Again, the Gateway proposal has supporters, but also many critics.

The third is the "Space Force," a new branch of the military which would be part the Air Force(in the same way the Marine Corps is part of the Navy), which Trump announced in June, It would be responsible for space-based military and commercial, and especially technological, activities. It's actually not a new idea. It was first proposed in the 1980s by President Reagan and has resurfaced every once in a while since then. Russia has already established a similar unit as part of its air force. Trump apparently sees it as essential in coming years, since a number of nations: Russia, China, and India among them, will be competing for territory, technology, and resources beyond Earth. And, yes, the Moon and Mars and other solar bodies are, by treaty, *terra nullis,* like Antarctica, meaning that no nation can make territorial claims to them, but that could eventually end. (On August 8, Vice-President Pence announced that legislation to officially establish the Space Force will be sent to Congress, and, if passed, could be in place by 2020 or 2021. If so, it will be the first new branch of the military since the Air Force was established out of the Army Air Corps in 1947).

The good news right now is that America's manned spaceflight dearth is finally ending, and that this country may once again be a major presence in space, which is the way it always should have been.

Above-proposed logos for the Space Force

Nasa Announces Crews and Dates for Commercial Space Flights

On August 3 NASA announced the crews for the first commercial test and ISS missions, which will begin in the Spring of 2019. As a prelude, the space agency also announced that the first unmanned test flight of Space-X's Dragon V2 will be in November 2018, and the first flight of Boeing's CST-100 Starliner will be in December. If those are successful, the first manned flight of the Dragon V2 will be in April 2019, with crew members Robert Benhken and Douglass Hurley, both veteran space shuttle pilots. The first manned test mission for the CST-100 will be in June 2019, and will have aboard Eric Boe, Christopher Ferguson, and Nicole Anapu-Mann. Boe and Ferguson are also veteran shuttle pilots; Ferguson has been the director of the CST-100 program for Boeing since 2012; and Aunapu-Mann, a rookie, is one of the new generation of NASA astronauts, being chosen in 2013. The first ISS Dragon mission will be in the summer of 2019 and will be crewed by ISS veteran Michael Hopkins and rookie Victor Glover. The first CST-100 mission to ISS will be in the fall of 2019, and will be commanded by shuttle veteran Sunita Williams and rookie Josh Cassada. NASA also announced that crews for Dragon and CST-100 missions in 2020 and 2021 will be announced in the next few months. The Dragon V2 will be launched by Space-X's Falcon rocket, and the CST-100 will use the Atlas-5 rocket for its initial missions.

NASA has had a tradition of taking astronaut crews to the launch pad in a modified RV van, but on August 25, Space-X and Tesla head Elon Musk announced that the Dragon V2 crews will be driven from the preparation building to the launch pad in the latest model Tesla.

Astronaut Reassignment Causes Controversy

NASA astronaut Jeanette Epps, a member of the class of 2013, was scheduled to spend five months aboard ISS starting in November 2018, but earlier this year, she was removed from the crew and has not yet been reassigned, causing family and friends to charge that NASA was being racist. Epps, who is African-American, explained that crew changes and reassignments are not unusual, and asked people not to speak out for fear that it might jeopardize her chances of being assigned to a future flight. Speculation is that she will eventually be chosen for one of the future Dragon or CST-100 crews. While it is true that all of the early 1960s astronauts were white males, starting with the shuttle program, NASA has made a particular effort to bring minorities and women into the astronaut corps and aboard space flights, the most recent examples being Sunita Williams, Nicole Aunapu Mann, and Victor Glover, who were just assigned to the initial Dragon and CST-100 missions.

Astronomical Short-Some more Celestial Grammar

Jupiter, the largest of the planets, was named after the king of the gods in Roman mythology. Yet the adjective form of the name, which seems like it should be *Jupiterian*,(which is a real tongue-twister) is instead Jovian, after Jove, which is a shortened version of the god's name. Jupiter was thought to be full of laughter and happiness, so we say that someone who is humorous and light-hearted is jovial. In the same way, from Saturn, the Roman god of prosperity and well-being, we get the modern adjective Saturine, which means calm and peaceful. Saturn has several adjective forms; one of them is *Kronian* ,or *Cronian*, because Saturn was identified with Kronos, the Greek god of time(where we get the modern words chronicle and chronology). So, it's perfectly acceptable to say the Kronian system when referring to Saturn and its moons, and watch people try to figure it out.

A View Through the Historic Yerkes Refractor

By Chad Quandt

For most of us observing the night sky through a large observatory telescope is a rare, maybe even once-in-a-lifetime experience. Most of the large telescopes used in modern observatories are designed to focus their light onto a camera sensor and are optimized for data acquisition. There is no practical way to look through these telescopes. For most recreational astronomers, it's an unobtainable fantasy. However, the largest telescopes of a century ago or more were designed and made before photography was essential for astronomical study. At that time astronomers were still observers. Luckily, there are a few places where such instruments still exist. With a little planning and luck, it is still possible to look through some of them. I recently had an opportunity to observe through the historic 40″ refractor at the Yerkes Observatory in Williams Bay, Wisconsin. Below is an account of that experience.

As a young visual observer growing up in Wisconsin I had toured the Yerkes Observatory in the mid-1990s, about 100 years after it was first founded by the University of Chicago. I can remember visiting the grounds on a cold winter day and stepping into the equally cold large dome housing the principal instrument for which the facility was known. The refractor was huge, over 63 feet long and 6 tons in weight. It was supported by an equally huge equatorial mount situated on top of a very tall pedestal. The dome's wooden floor is approximately 75 feet across and moves up or down to position the astronomers at the focus of the telescope. The 40 inch objective is an Achromat doublet and was made from crown and flint glass by Alvan Clark and Sons to a focal length of over 19,300mm and a focal ratio of f/19.

At the time I never thought there would be an opportunity to view through it, but two decades later such an opportunity finally presented itself while on a visit back to Wisconsin. We made our reservations for July 2nd, 2018, about a month and a half in advance. The session was planned to begin shortly after sunset and would conclude around midnight. The moon would be over 80% illuminated, but being a Waning Gibbous phase it would not rise until nearly the end of the program. By luck, the weather was perfect. The sky was cloudless and calm with temperatures predicted to drop no lower than the mid-60s. The total group of observers was 12-14 with only a few experienced observers present. The rest were novices and I hope, appreciative of the rather special opportunity they had for their first view through a telescope.

Practical considerations for making a smooth running program limited the prospective targets to within a couple hours or Right Ascension of the Meridian and there would be only enough time to see six different objects. Luckily this included some favorites; Jupiter, M13, M57, M11, M17 and ending on Saturn. Having observed all of these objects before with a variety of telescopes, I was curious how they would appear in the world's largest refractor. Just what does 40″ of aperture get you? Well, it turns out that the comparison isn't as straightforward as you might think. For example, in this session we were not permitted to change eyepieces. For convenience, a 40 mm eyepiece with a 2″ barrel was used throughout the night providing a little over 480X. That's a lot of magnification, far more than I typically use on my scopes. The use of such high magnification also results in a very narrow field of view. This is of little consequence when viewing the planets, but many deep sky objects benefit from being viewed within the context of their region of the sky.

At the start of the session, the floor was elevated to place the eyepiece at a comfortable viewing height with the telescope centered on Jupiter. The sky was mostly dark but some dim lights were left on in the dome to allow observers time to gain familiarity with the telescope. A light-green filter was placed on the eyepiece, which accomplished two goals. Many observers find that a simple color filter can be used to increase the contrast of some cloud features.

The second goal is more fundamental to the design of the telescope. Like a prism, a lens refracts light. White light is split into the full visible spectrum. What makes a telescope lens different than a simple prism is that rather than projecting a rainbow, the telescope lens focuses each color of light at a different location from the lens. The Yerkes refractor, like all Achromats, has a two-element objective made of two different glasses with different dispersion properties. This effect is called Chromatic Aberration. It's not a defect. It's a characteristic of the optical system, but it gets more noticeable and more intrusive with larger telescopes. Modern Apochromat reflector designs can effectively eliminate it by using low-dispersion glasses and more than two lens elements. These can provide superior images but they are also much more expensive to manufacture. At the time the 40" objective of the Yerkes refractor was built, Achromats were still the state-of-the-art, regardless of chromatic aberration. Through the Yerkes refractor, Jupiter would have certainly been surrounding by an obvious violet halo if it weren't for that light-green filter.

Filter aside, the view of Jupiter was pretty nice. Atmospheric seeing is often best shortly after sunset and viewing the gas giant early in the evening benefited from this pattern. Initially, I had difficulty finding best focus which I attributed to the relatively long f/19 focal ratio and variations in the seeing. Compared to the optically faster telescopes I am accustomed to using, it was somewhat difficult to be confident that the image was the sharpest possible. The problem was enhanced by the high magnification and atmospheric seeing. The image was a little bloated, somewhat blurry. Then, for just a moment, it would steady and a great amount of detail was visible including many cloud bands. The Great Red Spot, which seems like it spends more time than not on the far side of the planet, was clearly visible approaching the limb. All four Galilean satellites were also visible. In most telescopes they appear like four little stars next to the planet's disc, but here they appeared as very small but distinct discs. Jupiter is a stunning sight, even in small telescopes and I can't say the 40" refractor provided the best view I've ever seen of it, but I have to say it was a satisfying view considering this was a singular opportunity to view it.

After Jupiter, the floor was lowered and the telescope pointed near the zenith and centered on M13, the Great Globular Cluster in Hercules. Like Jupiter, I've viewed M13 on countless occasions. It is said by many to be the best globular cluster visible from mid-Northern Latitudes. Refocusing for my eyes, the field of view was full of stars. Seemingly resolved to the cluster's core, the density of stars in the center of the field of view was greater, but a little space around the cluster would help define it and set it apart from the surrounding sky. In this scope, all we were seeing was the center of the cluster. To the casual observer, most globulars tend to look alike, but with some patience and experience they often have signature characteristics. In M13, there are several dark features that appear as short segments or lanes, two of which cross to make a tell-tale "X". These were visible, but again, backing off on the magnification would have made them stand out a little more against a visibly tighter starfield.

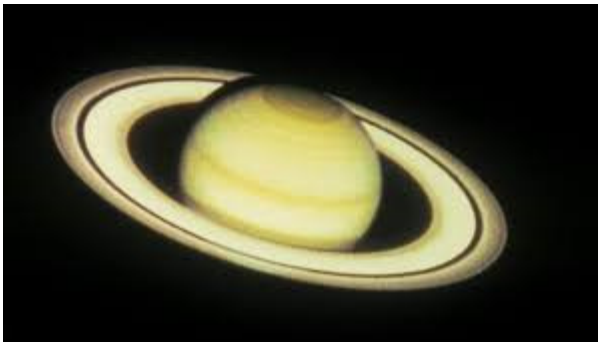
After the group had examined M13 the telescope was moved again, this time to the famous Ring Nebula (M57) in Lyra. The Ring Nebula is one of the few nebulae that obviously resembles its appearance in photographs. It looks like a smoke ring. At 480X, it's a rather large ring set against a very dark background. The space inside the ring, the hole, was not as dark as the background sky and indicated the presence of fainter nebulosity. A closer look revealed what I consider to to be the highlight of the evening, the star at the center of the Ring. The central star in the Ring Nebula is a white dwarf, the exhausted core of a dead star. It is also especially difficult to see. Only once before was I confident that I had seen it using averted vision with a 25-inch telescope at 360X. Through the Yerkes refractor, it was easily visible with direct vision.

The next object, M11, was lower in the sky. This classic open star cluster is also popularly known as the Wild Duck Cluster. Its resemblance to a duck or a flock of ducks is debatable, but it's a beautiful

cluster in small scopes. While it is compact for an open cluster, the narrow field of view made it more difficult to identify the boundary of the cluster against the background stars. It was a beautiful view, but not as pleasing as I've seen it through many smaller scopes.

Peering lower in the south, the telescope was moved to M17, otherwise known as the Swan Nebula. M17, like the ring, actually resembles its namesake to the visual observer. Even fairly small telescopes show it like a ghostly duck in profile, but the big refractor showed us just the gizzard. The nebulosity was obvious, but the field was just too narrow to take in the whole object at once.

The last object of the evening was Saturn, which had just risen high enough to the Southeast to get a decent view. Perhaps the most inspiring sight in the night sky, Saturn is almost everyone's favorite. The iconic rings were at nearly maximum tilt, allowing a decent view of the Cassini Division and I could detect a slightly brighter band across the equatorial region of the planet. Six moons were visible set against a few stars. As expected, the atmospheric seeing had deteriorated somewhat by this point. Furthermore, without the use of colored filters, chromatic aberration was obvious through not overly distracting. Saturn is a beautiful planet, but again, I think dropping the magnification by half would have made it appear much sharper and more pleasing to the eye. Nevertheless, who would complain about viewing Saturn through such a large and historic scope! Not I.



As the program ended, dome lights were turned on and the group took turns taking pictures around the telescope. Of all the objects we looked at, only the Ring Nebula appeared better than any previous view I've seen. The rest of the objects were all enjoyable and fit closely to my expectations. While seeing was not perfect, the program guide thought this was the best night they'd had in several months. Maybe he says that every time to make his guests feel like their hundred bucks were well spent, but for me I could believe it. Maybe I'd have old myself that even if we got to see just one object through the scope and got clouded out for the rest, but I also walked away with something else.

Observing the night sky can be inspirational, it can be humbling, and it can be therapeutic. It can also be an exercise of personal discovery, but for those who do it regularly they often end up doing it alone. On this night it was the best kind of discovery, that which includes a touch of fellowship. Accompanying me was my father, Richard, who has always encouraged and supported my interest in astronomy, the night sky and other things. That alone makes this night a special one I will always remember. Also present were my Uncle Ray and cousin, David, who on more than one occasion have demonstrated their enthusiasm for observing the night sky and I am greatly appreciative to have been able to share this experience with them as well. I sincerely hope there are more such adventures to come!

This article originally published at www.oldestshowonearth/session-at-yerkes.html
Republished here courtesy of Chad Quandt
Images of Yerkes Observatory from Wikipedia Planetary and deep sky images from NASA

Editor's note-

I can relate to Chad. Several years ago I had the privilege of observing though Percival Lowell's 24" Alvan Clark refractor, which was built about the same time as the Yerkes refractor, at the Lowell Observatory in Flagstaff, Arizona. I also saw M13, among several other objects; it was an experience that I will not soon forget.

Part of a continuing series on lesser known-but still important-astronomical observatories throughout the world

The Coats Observatory

The Coats Observatory, located in Paisley, Renfrewshire, Scotland, is one of the oldest public observatories in existence. Its formation and operation is unique in that it was founded, not by scientists, but local citizens, and its purpose upon founding, as is now, is to educate the public about astronomy and space sciences.

The observatory was established in 1881 by the Paisley Philosophical Institution(PPI), an organization of local teachers, doctors, bankers, and businessmen, which itself was established in 1808, with the purpose of improving the intellectual lives of the people of the community. Along with the observatory, the PPI also established a museum and a series of scientific workshops and lectures, all of which continue to this day. The main building was built and dedicated in 1883, and a smaller building behind it, housing a transit telescope for timekeeping, was built in 1884. Thomas Coats, a wealthy Scottish businessman, donated the funding for the building and telescopes, and the PPI named the facility after him. After he died, his family gave an endowment to the observatory to provide for its operating expenses.

The observatory's original charter specified that the museum be open from 11-3, and the observatory from 7pm to midnight. PPI members got in free, and others had to pay a small fee. Even then the observatory was a great success for many years, being used by the general public, amateur astronomy organizations, school groups, and even professional astronomers. The site was also often used by scientific organizations for conferences, and the regular lectures brought in additional income and members. After World War II, though, the observatory declined and was in danger of closing due to lack of funding. In 1963, it was taken over from the PPI by the Paisley town council, and is now administered by the arts and museums committee. In 1983, the centenary of the observatory was commemorated with a medal and a number of ceremonies. The museum is still open every day, the observatory is open to the public one night a week, and scientific lectures and workshops are still regularly scheduled.

The observatory has two operational telescopes which are used by the viewing public. One is a 5" Thomas Cooke refractor, which was the original telescope installed in 1883. The other is a 10" refractor built by Howard Grubb of Dublin, Ireland, which was installed in 1898. Both have been updated with the latest technology. In 1994, the observatory opened a planetarium for the public. In addition to its public activities, the observatory also maintains a seismology station, first established in 1900(which detected the 1906 San Francisco earthquake), and a meteorology facility.
Source and image-Wikipedia

From The Observer Archives

"The Light Stuff-

April: National Ulcer Month, the first half of which is spent worrying about the tax deadline, and the second half worrying about being audited;
Electron: an extremely small particle, so tiny that an average person could sit on six billion of them and not know it;
Euclid: an ancient Greek mathematician whose principles of geometry are as useful today in confusing the average high school student as they were in 300BC."

From the April 1985 *Observer*