Temecula Valley Astronomer

The monthly newsletter of the Temecula Valley Astronomers July 2020

Events:

Virtual meeting via Zoom on 6 July at 7PM. Join your fellow astronomers for What's Up, Gallery and a Mission Highlight. No Star-B-Q this year. Virtual refreshments provided by each participant. Watch your club email for meeting ID and password.

Until we can resume our monthly meetings, you can also interact with your astronomy associates on Facebook or by posting a message to our mailing list.

The global coronavirus lockdown has lowered air and light pollution levels. The night sky above Mont-Mégantic International Dark Sky Reserve in Quebec, Canada. Photo: South China Morning Post 19 Apr 2020.

WHAT'S INSIDE THIS MONTH:

Cosmic Comments
by President Mark Baker
Looking Up Redux
compiled by Clark Williams
The Other George Ellery Hale (Part I)
by Chuck Dyson
Mars's Latest Visitor: NASA's Perseverance Rover
by David Prosper

Send newsletter submissions to Mark DiVecchio <markd@silogic.com> by the 20th of the month for the next month's issue.

Like us on Facebook

General information:
Subscription to the TVA is included in the annual $25 membership (regular members) donation ($9 student; $35 family).

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Cosmic Comments
by President Mark Baker

Fathers Day I stepped outside before midnight and was struck at how the Milky Way was just dazzling and Jupiter and Saturn were brilliantly chasing The Teapot across the sky… I just stood there and took it all in. What an amazing sight on an amazing dark and clear night…

And then I thought about not having the Star-B-Q this July for the first time in a very long time… I so enjoy those gabfests and being with people from diverse places and backgrounds, all together to take in the gorgeous Summer Sky from Anza. And who will not miss the Outstanding Ostahowski hospitality…??!!!

But, that's one thing that cannot be taken away – Our Skies!!! Some live in a high Bortle area and have minimal viewing, and others have low Bortle skies, but regardless, the most important thing is to Look Up… something we all can do!!

In some ways, I'm enjoying my virtual experiences that are shared activities throughout, literally, the world, but admit to missing those vis-a-vis meetings and physical interaction… and I hope that once we resume the latter, we can keep the former going as well.

Grateful that we are resuming socially distanced Star Parties and that we can develop electronic astronomy as another "arrow in our quiver"…

So, keep looking up and chatting to all that will listen about doing so themselves… the rewards are lasting and deep!!

Clear, Dark Skies my Friends…

Looking Up Redux
compiled by Clark Williams

from these sources:
SeaSky.org
Wikipedia.com
in-the-sky.org
The American Meteor Society, Ltd.
cometwatch.co.uk
NASA.gov
TVA App (2.0.1296)
FullAndNewMoon App (2.0)
Starry Night Pro Plus 7 (7.6.3.1373)
SkySafari 6 Pro (6.1.1)
Stellarium (0.18.2)
timeanddate.com/astronomy
https://www.fourmilab.ch/earthview/pacalc.html

ALL TIMES ARE LOCAL PACIFIC TIME (PDT / PST) UNLESS NOTED OTHERWISE

Times are given in 24-hour time as: (hh is hours, mm minutes, ss seconds)
- hh:mm:ss or hhmmss
- hhmm+ (time of the next day)
- hhmm− (time of the previous day)
- hhmm (seconds not shown)
- yyyymmddThhmmss (Full date as: year month day Time separator hours minutes seconds)

Moon Phases for the month by phase:

Mon**day**	**the 27th**	**@ 0533 FIRST QTR in CAPRICORNI**
Satur**day**	**the 4th**	**@ 2145 FULL in SAGITTARIUS**
Sunday	**the 12th**	**@ 1630 THIRD QTR in PISCES**
Monday	**the 20th**	**@ 1033 NEW in CANCER**

Apogee comes on 2020-07-12 @ 1928 **– 404,200 km (251,158 mi)**
Perigee comes on 2020-07-25 @ 0455 **– 368,366 km (228,892 mi)**

2020 has: (12) new moons, (13) 1st Qtr moons, (13) Full moons, (12) 3rd Qtr moons
(1) Blue moon and (0) Black moons

Daylight Savings: Starts: 2020-Mar-08 : Ends: 2020-Nov-01

Luna: Luna is waxing gibbous on the 1st of the month. 892% illuminated Luna is transiting at **2206** setting by **0328+**. Luna by mid-month is a waning crescent, 21% illuminated. Rising early at **0220** and setting in the afternoon at **1637**. By the-end-of-the-month Luna is again waxing gibbous, 93% illuminated transiting at **2251** and setting by **0355+**.

Highlights: (distilled from**: SeaSky.org** and **Clark's planetary Orrey** program[s]**)**

July 4 - Full Moon. The Moon will be located on the opposite side of the Earth as the Sun and its face will be will be fully illuminated. This phase occurs at **2145**. This full moon was known by early Native American tribes as the Buck Moon because the male buck deer would begin to grow their new antlers at this time of year. This moon has also been known as the Thunder Moon and the Hay Moon.

July 5 - Penumbral Lunar Eclipse. A penumbral lunar eclipse occurs when the Moon passes through the Earth's partial shadow, or penumbra. During this type of eclipse the Moon will darken slightly but not completely. The eclipse will be visible throughout most of North America, South America, the eastern Pacific Ocean, the western Atlantic Ocean, and extreme western Africa. (NASA Map and Eclipse Information)

July 14 - Jupiter at Opposition. The giant planet will be at its closest approach to Earth and its face will be fully illuminated by the Sun. It will be brighter than any other time of the year and will be visible all night long. This is the best time to view and photograph Jupiter and its moons. A medium-sized telescope should be able to show you some of the details in Jupiter's cloud bands. A good pair of binoculars should allow you to see Jupiter's four largest moons, appearing as bright dots on either side of the planet.

July 20 - New Moon. The Moon will located on the same side of the Earth as the Sun and will not be visible in the night sky. This phase occurs at **1033**. This is the best time of the month to observe faint objects such as galaxies and star clusters because there is no moonlight to interfere.

July 20 - Saturn at Opposition. The ringed planet will be at its closest approach to Earth and its face will be fully illuminated by the Sun. It will be brighter than any other time of the year and will be visible all night long. This is the best time to view and photograph Saturn and its moons. A medium-sized or larger telescope will allow you to see Saturn's rings and a few of its brightest moons.

July 22 - Mercury at Greatest Western Elongation. The planet Mercury reaches greatest western elongation of 20.1 degrees from the Sun. This is the best time to view Mercury since it will be at its highest point above the horizon in the morning sky. Look for the planet low in the eastern sky just before sunrise.

July 28, 29 - Delta Aquarids Meteor Shower. The Delta Aquarids is an average shower that can produce up to 20 meteors per hour at its peak. It is produced by debris left behind by comets Marsden and Kracht. The shower runs annually from July 12 to August 23. It peaks this year on the night of the 28th and morning of the 29th. The second quarter moon will block many of the fainter meteors this year. But if you are patient, you should still be able to catch a few of the brighter ones. Best viewing will be from a dark location after midnight. Meteors will radiate from the constellation Aquarius, but can appear anywhere in the sky.

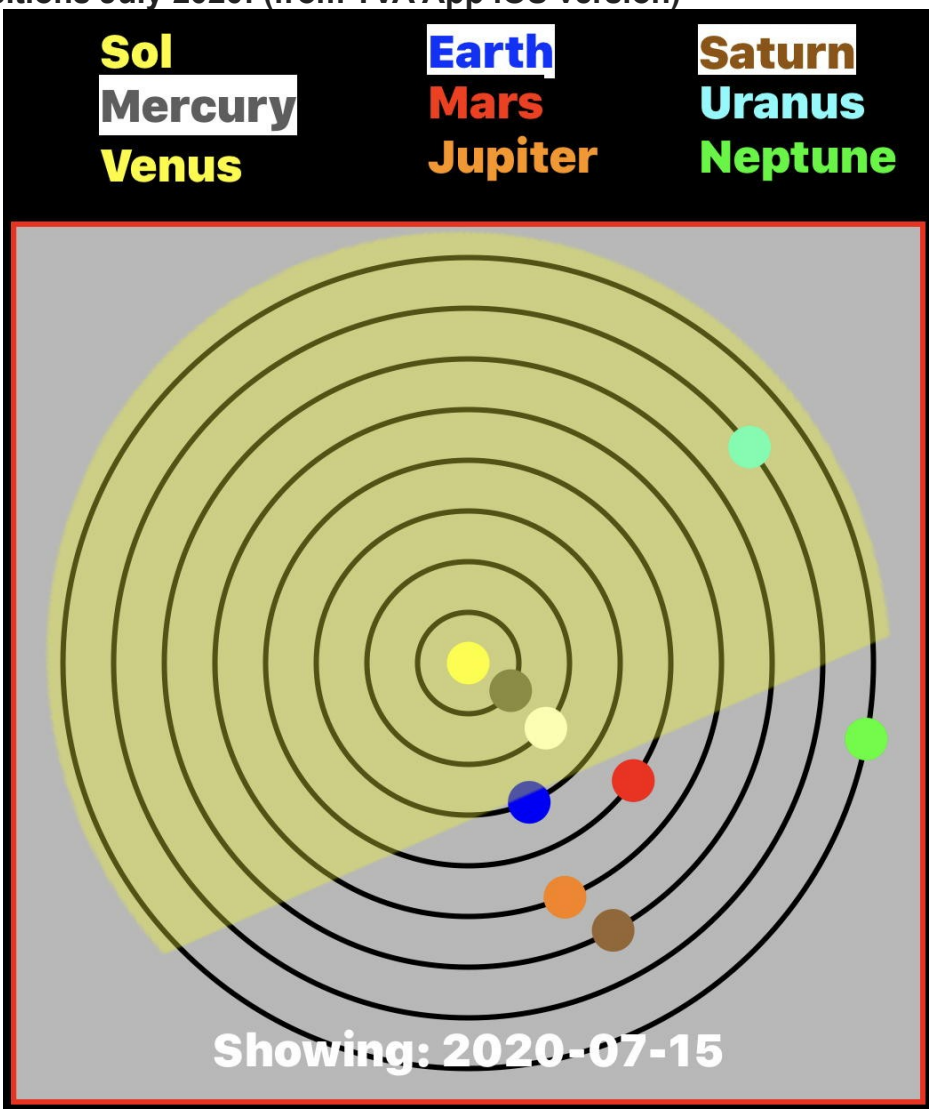
Algol minima: (All times Pacific Time)

07/01/2020	**0404**
07/04/2020	**0053**
07/06/2020	**2141**
07/09/2020	**1830**
07/12/2020	**1519**
07/15/2020	**1207**
07/18/2020	**0544**
07/21/2020	**1649**
07/24/2020	**0233**
07/26/2020	**2322**
07/29/2020	**2010**

Sun & Moon Rise/Set Times

		Rise	Transit	Set
07/01/2020	Sun	**054102**	**125304**	**200459**
	Moon	**164402**	**22061**	**032817+**
07/15/2020	Sun	**054833**	**125505**	**200121**
	Moon	**014605**	**084004**	**153900**
07/30/2020	Sun	**055923**	**125521**	**195058**
	Moon	**174810**	**225136**	**035501+**

Planets:
Planetary Positions July 2020: (from TVA App iOS version)



- **Mercury:** Mercury is neither an evening object nor a morning object in the beginning of the month. It is illuminated at 0.79% and 5.01 apparent magnitude. Mercury rises with the sun at: **0552** and sets by **1941** with the sunset following at **2005**. There will be an 88% illuminated Waxing gibbous Moon about away to the east along the ecliptic. But the Winged Messenger is so close to the Sun you won't be able to see anything. DO NOT LOOK DIRECTLY AT THE SUN. By mid-month the Winged Messenger ihas become morning object rising at **0440** with sunrise following an hour and eight minutes later. On the 22nd, just before sunrise, Mercury will be at Greatest Western Elongation of about 20°. Sunrise will obscure the planet so it is better to see it just after Mercury's rise at **0500**, when the Planet is about 6° above the horizon. Sunrise will be at **0553**. On the 31st Mercury rises at **0439** followed by sunrise at **0559**.
- **Venus:** Is the Morning Star in the beginning of the month, rising at **0336** in Taurus. By mid-month Venus rises at **0304** followed by Sol at **0548**. By the 31st Venus is rising at **0246**. followed by sunrise at **0559.**

- **Mars:** Mars is an early morning object on the 1st of the month. Mars rises just after midnight at **0023** on the first. Sunrise is not until **0530**. By mid-month Mars is rising at **2350** in Cetus. End-of-month finds the Warrior rising at **2307** and nestled between Neptune and Uranus. Neptune is °27.5° toward the west from Mars. While Uranus lays 22.5° toward the east.
- **Jupiter:** Jupiter is back in the sky at a reasonable hour. On the first of the month Jove rising at **2046** and transiting at **0148+**. There is a Waxing Gibbous Moon glaring away at 88% illumination 52° to the west of Jupiter but you should be able t get in some good visual observing. Pluto is less than a degree to the south-east of Jupiter. By mid-month Jupiter is rising at **1944** with no Earth Moon in sight. Saturn is less than 7° to the east of Jupiter. Pluto is less than 2° south of Jupiter. Come the end of month Jupiter is peaking above the horizon by **1834**. However the Moon is Waxing gibbous at 88% illumination and less than 12° away. But you'll have a great grouping of Jupiter, Pluto and Saturn – you just won't be able to see it.
- **Saturn:** Saturn is trailing Jupiter and Pluto; rising about **2107** on the 1st. Saturn by mid month is rising by **2009** and is within 8° of Jupiter and 6° of Pluto. Its a good grouping so cameras should be ready and working. By the end-of-the-month Saturn is rising at **1902**. See Jupiter for the Moon interference.
- **Uranus:** On the first Uranus doesn't rise until **0156**. The apparent magnitude is 5.83 so we're on the ragged edge of being naked-eye visible. The Astronomer's Bane will be 90% illuminated but 70° to the west so you should be able to eek out a view. Sunrise follows at **0541**. By the ides Uranus is rising at **0102** with a 28% illuminated waxing crescent Moon rising forty-four minutes later. End of the month and the “sky god” is rising at **0000** while as the Moon sets in the west at **0304**. Sunrise won't come until **0558** so you have plenty of time for viewing.
- **Neptune:** Neptune is leading both Uranus and Mars. Neptune and Mars are only 11° apart, rising at **2346** in the beginning of the month. There is a 81% illuminated Moon 122° westward of Neptune. You should be able to squeeze in a peek. By the 15th Neptune is rising at **2251**. By the end of the month Neptune is rising at **2147**. The Moon is 82.5° westward with 87% illumination.
- **Pluto:** Pluto rises by **2049** on the first of the month with a Full Moon hanging rather close; only 52° to the west. By mid-month Pluto is rising by **1953** and is very close to Jupiter and Saturn (see Jupiter above). By the 31st Pluto is rising at **1849** but the pesky Moon is right where youdo not want it to be, shinning at 92%.

Asteroids:

- Still a dearth of asteroids. I searched for asteroids in 2020 with a reasonable magnitude; say less than or equal to +10 in July there are a few beyond the regulars: Juno, Vesta. Hebe, Eros and Herculina. So consult your local planetarium softwarefor more or try: https://www.asteroidsnear.com/year?year=2020

  (7) Iris Asteroid in Sagittarius 1st -- 31st rising: mag 9.0 – the fourth-brightest object in the asteroid belt.
  (2) Pallas Asteroid in Vulpecula 1st – 31st rising: mag 9.8 – the second largest asteroid in the inner Solar System and the largest body in the Solar System not to be rounded by its own gravity.
  (129) Antigone Asteroid in Aquilla 1st – 31st rising: mag 10.3 – orbiting the sun every 4.9 years at an average distance of 2.9 AU. Antigone is a large object at 125km in diameter and is a main belt asteroid orbiting the Sun between Mars and Jupiter.

Meteors:

- July 28, 29 - Delta Aquarids Meteor Shower.

- See Highlights above for more details. (SeaSky.org**)** (American Meteor Society)

Comets: come in various classifications:

- 1) Short Period comets – further broken down into:
  - Halley Type: The Halley Types are believe to come from the Kuiper Belt and have periods in excess of 20-years.
  - Jupiter Type: The Jupiter types have a period less than or equal to 20-years.
  - Short period comets July have a near circular orbit or an elliptical orbit. The latter being far more common.
- 2) Long Period comets – thought to originate from the Oort cloud these comets have periods of over 200 years and have random inclinations around the celestial sphere.

ESTIMATES ONLY

Local time 2100 PDT

2P/Encke

July 01 Mag: 5.2 Rises: 0727 Sets: 2108 comet in Cancer

July 15 Mag: 7.6 Rises: 0851 Sets: 2113 comet in Sextans

July 30 Mag: 9.8 Rises: 1100 Sets: 2135 comet in Corvus

289P/Blanpain

July 01 Mag: 8.4 Rises: 1140 Sets: 0018+ comet in Virgo

July 15 Mag: 8.5 Rises: 1109 Sets: 2331 comet in Virgo

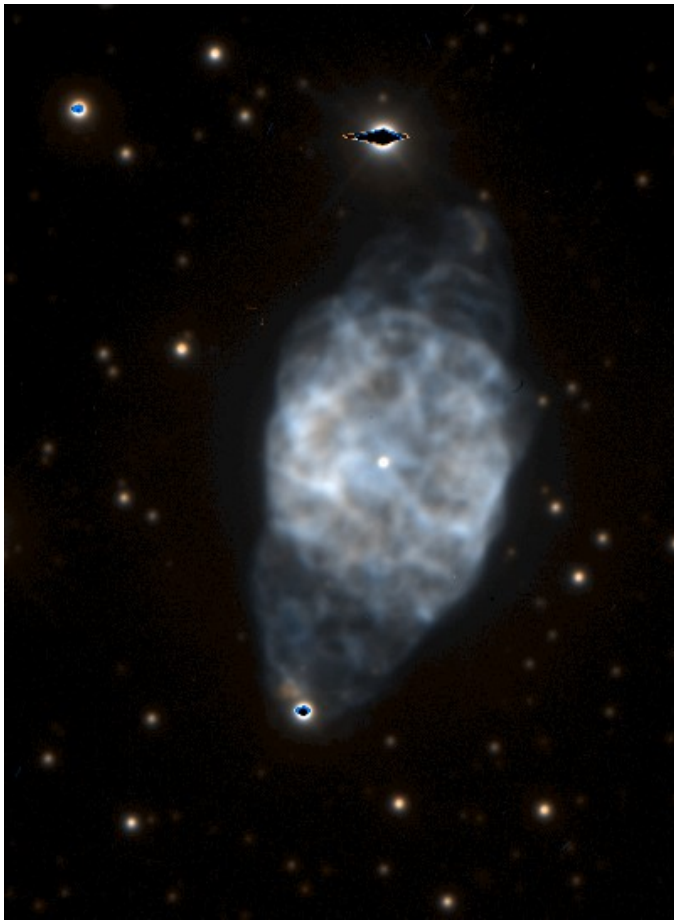
July 30 Mag: 9.3 Rises: 1033 Sets: 2241 comet in Virgo

Deep Sky:

Notes:

L/Z abbreviation for ALT/AZ
R/D abbreviation for Right Ascension/Declination
α is right ascension
δ is declination
In each case, unless otherwise noted, you should look for the following on or about the 15th Day of July 2020 at 2100 PDT and you will have about 20 minutes of viewing time total.

- **NGC6905 The Blue Flash Nebula**



By Fabian RRRR (talk) 21:54, 7 June 2012 (UTC) - This media was produced by European Southern Observatory (ESO).Their website states: This file is licensed under the Creative Commons Attribution 4.0 International license.ensor endorses you or your use., CC BY 4.0, https://commons.wikimedia.org/w/index.php?curid=19808758

NGC 6905, also known as the **Blue Flash Nebula**, is a planetary nebula in the constellation Delphinus. It was discovered by William Herschel in 1784. The central star is 14.0 mag. The distance of the nebula, as with most planetary nebulae, is not well determined and estimates range between 1.7 and 2.6 kpc. The shape of NGC 6905 is characterized by an internal shell with angular dimensions 47" ×34" and roughly conical extensions, with ansae-type formations along the major axis. The nucleus of the nebula possesses one of the most broad emission of OVI emission lines among planetary nebulae. Moreover, OVIII emission has been detected in NGC 6905. The ansae were particularly intense in NII.The central star, a white dwarf is estimated to have surface temperature 150.000 K.

NGC 6905 can be detected under dark skies with a 4-inch telescope, but it better observed with larger instruments. (Wikipedia)

I saved the best for last – This should be a challenge for each astrophotographer out there! See what astrophotographer Peter Goodhew has done below and see if you can match it.

- **StDr 1 (New Planetary Nebula)**

© 2020 Peter Goodhew FRAS – StDr-1; Equipment: APM TMB 152 LZOS Refractors10Micron GM2000 HPS mountQSI6120wsg8 cameras; Exposure: Astrodon Blue: 17x300" Astrodon Green: 18x300" Astrodon Red: 18x300" Astrodon Lum: 21x300" Astrodon OIII: 8x1800s bin 3x3 As – ***Used by permission.***

- As reported by Steven Bellavia in Sky & Telescope. May 11 2020 Amateur astronomers Xavier Strottner and Marcel Drechsler discovered a planetary nebula in Taurus they are calling St-Dr-1. St-Dr is their catalog name and this is the first entry. I scoured some online resources and eventually found some sky data listed below:
  - **Sky data: StDr 1 Gal Coord: PN-G 185.1-00.9 α: 05:53:50.86 δ: +24:02:27.11 Size: 4.8 arc min** (PlanetaryNebula.net)
  - This image a, as near as I can tell, was taken by Peter Goodhew from the UK remotely via his observatory in Spain. Well done.

July is great for both viewing and imaging. Spend some time outside with your scope. Spring is here.

For now – Keep looking up.

The Other George Ellery Hale (Part I)
by Chuck Dyson

Thanks to the excellent talks by Curtis and his friends I think we all have a great understanding of the drive, ambitions, and actions that resulted in George Ellery Hale being posthumously honored for his last and greatest work the Palomar 200 inch telescope. One is driven to ask, “Is building great telescopes, as if this weren’t enough, all that Hale did in his lifetime?”

As a young boy Hale showed an intense interest in science especially physics and because his family was well-to-do, his father owned an elevator manufacturing company, Hale soon had a machine shop in the house. As the machine shop had a hand, or foot, powered lathe Hale and his younger brother are able to make instruments of their own design; but, not liking heavy manual work the boys designed and then fabricated their own steam engine to turn the lathe, this ain’t your average teenager folks.

At this time Hale has also prevailed upon his father to purchase for him a “small” 4 inch refractor, an Alvin Clark naturally. I put quotes around the word small because in the 1860’s when Hale is born the largest scope in America is the Dearborn at 18 ½ inches at the University of Chicago and many universities have 10 in or 8 inch refractors as their major scopes; so, a 4 inch refractor is a major scope of the time. Upon graduating from high school Hale trots off to MIT to study physics. By studying physics Hale is one of a new wave of astronomers who are asking the question how does the stuff in the cosmos work and not how is the stuff in the cosmos moving and what is its distance from us. Because MIT and Harvard are so close together and Hale has time on his hands he naturally trots off to Harvard and volunteers to work in Edward C. Pickering’s lab. During the summer breaks, Hale returns home where, naturally, his father has built him a separate observatory/lab/shop/dark room where he can pursue his interests.

To be completely honest, it is quite possible that the senior Hale did not build the observatory solely to promote his son’s interests and career because rumor has it that when the Hale boys had the steam engine going in the house the whole house shook and with all the machinery now in the observatory the engine could run and Mr. and Mrs. Hale could have their peace.

Hale’s observatory included a horizontal solar scope and the young Hale used this scope to develop a two slit spectrohelioscope of his own design. A two slit spectrohelioscope operates like this; the first slit allows only the light from the section of the sun through that you want to study, such as a sunspot or light from the edge of the solar disk, then the sunlight is reflected off of a spectral grating or prism and through the second slit that is tuned to the wavelength that the researcher wants to study, this allows the researcher to capture the spectrograph of a specific area or to photograph the area. Hale uses the results of his observations with the spectroheliograph as the bases of his senior project and yes the paper includes several discoveries about the nature of solar magnetism.

A wondrous bit of serendipity has just occurred, in the June 2020 edition of the Reflector there is an article on page 22 about the Stellafane Group in Vermont reconstructing and putting into

service, as a public outreach instrument, an original Hale design spectrohelioscope. The article offers an excellent description on how the scope is designed and how it works.

Two days after graduating in 1890 Hale gets married and three to four days after that he and his new bride are honeymooning at Mt Hamilton in California. Hale is at Mt Hamilton for two reasons the first the refractor is at 36 inches the largest refractor in the world and second, the observatory is the first to be built at a location that is good for the telescope and not the astronomy professor. Prior to Mt Hamilton telescopes were located on the campus of the university and the professors could give a lecture or two and then saunter home for dinner then saunter back to the observatory and do a little observing, sweet life. Mt Hamilton at 19 miles out of San Jose put an end to this, but at 4,220 feet elevation it was above the coastal fog and away from the ever glowing city lights.

Upon returning home from the honeymoon trip Hale starts teaching at Beloit College a small local college under unique circumstances i.e. his entire salary is paid for by his father and the students do field work in Hale's private observatory (now named Kenwood). In 1893 after only two years at Beloit Hale is offered a position as an assistant professor at the University of Chicago again with unique circumstances; Hale's father is to pay his salary for the first three years and Hale will have **no** teaching or research responsibilities.

What is happening here has our little rich boy landed himself a sinecure? **NO!** In the 1860's the 18.5 inch Dearborn telescope at the university was the largest refractor in America but now it is only a medium size scope and the glowing Chicago night sky is rendering it less than useful. In the 1890's there is no government funding and all projects are funded by philanthropic donors and Hale's job is to get the money to build a world class observatory at a remote site that is good for the telescopes.

Hale hits the ground running and has an ideal donor all lined up. Charles T. Yerkes is richer than Hale's father and is a man with a big problem; Yerkes is a financier and just has been accused and convicted of embezzlement. Yerkes really needs to polish his public image and Hale tells him "I can do that for you". Yerkes makes only three demands of Hale for the project. First, cost can be no object, the facility must be incredible; Hale is really OK with this one. Second, the refractor must be the biggest in the world; perfect thinks Hale as the University of Chicago wants the same thing. Third, the facility must be at a site close enough to Chicago for Yerkes to take potential investors there for the weekend to show them what a great, generous, wonderful, and civic minded person he, Yerkes, is. This is a huge problem because the highest point in the entire state of Wisconsin is Timms hill at 1957 feet not even close to the altitude Hale is looking for; they settle on Lake Geneva at 1,000 feet of elevation. Despite the altitude disappointment Hale proceeds and over the course of the entire project Hale will relieve Yerkes of $500,000 dollars, that's about 15 million in today's dollars. Polishing your image don't come cheap.

Hale quickly builds Mr. Yerkes his observatory and he is able to do this because real estate tycoons in Los Angeles had pledged large sums of money to USC for the construction of the world's largest refractor telescope; however, when Alvin Clark & Sons were finished grinding the lenses, the real estate market had crashed in L.A. and they could not pay up. Unfortunately USC didn't have enough funds to cover the bills, one for the lenses and one for the telescope

tube and mount. Hale hears of this predicament and approaches Alvin Clark with cash in hand; thus, USC designed and built the 41 inch refractor and Hale paid for it and got it.

The world's biggest refractor sees first light in 1895 and is dedicated in1897 at Lake Geneva Wisconsin not Mt Wilson California. Apparently, Hale used some of the Yerkes money to build a modest but very nice solar telescope, remember solar astronomy is Hale's real passion; unfortunately, he has a little trouble with the light beam and burns the scope to the ground, oops. Not to worry, our boy Hale has another donor lined up and Helen Snow gives him $10,000 dollars to build a new solar telescope in memory of her father; ladies and gentlemen the worlds first permanent horizontal solar telescope the Snow solar scope. Prior to the Snow, astronomers built solar scopes horizontal and mobile so that they could use them to chase solar eclipses, but Hale wants to study the physical properties of the sun and needs big permanent solar scopes. The snow scope is not a resounding success as the air in the building gets heated by all that sun light and this generates warm air currents that distort the image, think of it as a scope that never gets to thermal equilibrium.

In his spare time Hale starts The Astrophysical Journal in 1895, the journal is still being published; organizes the first science meeting of the American Astronomical Society in 1899, the society is still active today. Finally, Hale travels to Europe and visits multiple astronomers working in isolation and others working in groups and decides that an astronomy collegium is the way to go, returns to Yerkes and starts to encourage other astronomers to do their work there and collaborate with each other.

After four more or less blissful years with the University of Chicago, cracks start to appear in the relationship. Hale is convinced that refractors are at the end of the road and wants to investigate the possibility of a large mirror telescope. Until 1856 mirrored telescopes are made with metal mirrors and these have some serious issues - large expansion and contraction with temperature changes, hard to support evenly as they get bigger, the mirrors last only two to three years and then are oxidized and must be completely reconfigured, and finally the metal mirrors reflect only 66% of the light that falls on them. This 66% reflectivity is a really big deal because it takes two mirrors to get the light to the eyepiece and thus in a metal mirror telescope only 44% of the incident light makes to the eyepiece.

The new silver coated glass mirrors are easier to support, have a, compared to metal, very low expansion coefficient, are very easy to resurface, and reflect 89% of the light so that 79% of the incident light gets to the eyepiece; although this is not as good as refractors that gets 90% of the light to the eyepiece, its way better than metal and the glass mirrors can grow - glass lenses cannot.

There were two causes for the growing discord. First, Hale's father has agreed to pay for a 60 inch glass mirror blank to be cast and Hale Jr., is to fund the polishing of it and the observatory it is to be housed in, the University of Chicago is not interested in this project. Second, under Hales policy of recruiting smart and talented people to work with him E. E. Barnard had come to Yerkes to do photographic work, Barnard is self taught and self trained but is a superb astrophotographer. Barnard receives an invite to go to Mt. Hamilton, with his own photographic scopes, and off he goes to photograph selected areas of the milky way. Barnard goes to Mt.

Hamilton, takes his photos, returns to Yerkes, compares the quality of his Yerkes photos to the Mt. Hamilton and in his best Horace Greeley says to Hale “Go West young man, go West”.

The Carnegie Institution for Science at this time, 1900, is looking for big science projects to fund and Hale has a proposal for them to build a world class observatory in the mountains by Pasadena, California and as luck would have it a small technical college, Troop Poly Tech, is looking for a physics professor. By 1904, although he is still listed as a professor at the University of Chicago, Hale is already in Pasadena as the head, and only, professor of Physics at Troop and strapping on his hiking boots to explore Mt. Wilson.

Before I go any farther with Hale’s story let me clear up some back stories. First: After Hale left Yerkes the 41 inch telescope did not fall into disuse. On the contrary because Hale had recruited good people to join the staff of the university the scope was very instrumental in measuring the parallax of stars to form a large part of the data base that became the H-R diagram of stars. The telescope also measures the change in the position angle of double stars and this lets us measure the mass of the stars, with a little help from Newton. The final project the scope was involved in was the measuring the change in positions of stars in globular clusters this data was used to determine the proper motion of stars, the proper motion of a star is its change in position over time in relation to very distant background stars. The final papers written about the proper motion of stars in globular clusters were by Kyle Cudworth in 1974 to 1980 and by comparing his plates to the original plates he was able to measure the change in position of the stars over a 40 year period and his papers are the definitive work on stellar motion in a globular cluster. From the 1980’s to today the venerable 41 inch scope has been used for public viewing.

Our second back story starts with Hale tying the laces on his hiking boots at the base of Mt. Wilson and we must ask ourselves “Is Hale the first astronomer to go up Mt. Wilson?” And the answer is “No” the first astronomers on the mountain were the boys from Harvard. The Harvard team came west for the same reason Hale did, relatively cloud free mountain tops, but they got here in the 1890’s and apparently entered into an agreement with USC, remember USC is backing the 41 inch lenses being shaped and polished at A. Clark & Sons, to develop Mt. Wilson as an observatory. Harvard will build a smallish observatory and place its 13 in refractor there. The refractor, named the Boyden scope, arrived at Mt. Wilson but was unable to be place on the mountain because a land owner claimed that the trail to the summit, there is no road yet just a dirt trail, runs across his land and he wants a toll paid. This sets off the Mt. Wilson war; not to worry no shots are fired just hot words and subpoenas. Eventually the matter is taken to court and the judge rules that as the trail has been in general use since 1864 it is public domain and the Harvard observatory can go forward. Alas the Harvard people hate the place, USC cannot pay for the 41 inch lenses, and someone, perhaps one disgruntled landowner, is putting bullet holes in the observatory. Harvard quietly and politely dissolves its agreement with USC and places the Boyden scope on a ship bound for Lima, Peru, Harvard realizes that the southern hemisphere is just as interesting as the northern hemisphere and a lot less studied. After only a year or two the Harvard team realize that at 1500 feet elevation and cloudy Lima is not where they want to be; so, the scope is packed up again and trucked to Arequipa, Peru, elevation 7600 feet, better but still too cloudy so in 1927 the scope is packed up again and shipped to South Africa and the Harvard/Boyden Observatory is established

there, this scope really gets around. Spoiler alert; remember this observatory. If you go to Mt. Wilson today, via Google Earth, you will see the Mt. Wilson Toll Road on the south/west side of the transmission towers and if you follow its wiggly path for a little more than a mile you will come to a transmission station on Mt. Harvard and this is the site of the original Harvard observatory.

(Part II next month)

Cheers, Chuck

Mars's Latest Visitor: NASA's Perseverance Rover

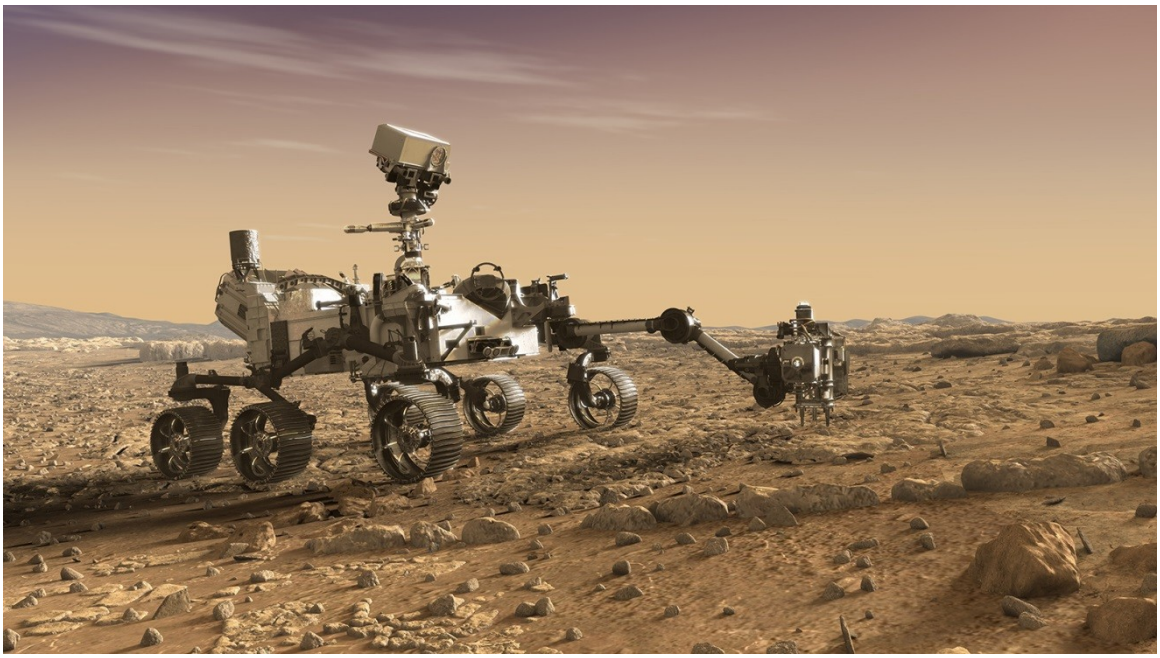
by David Prosper

NASA's latest Mars rover, Perseverance, is launching later this month! This amazing robot explorer will scout the surface of Mars for possible signs of ancient life and collect soil samples for return to Earth by future missions. It will even carry the first off-planet helicopter: Integrity. Not coincidentally, Perseverance will be on its way to the red planet just as Mars dramatically increases in brightness and visibility to eager stargazers as our planets race towards their closest approach in October of this year.

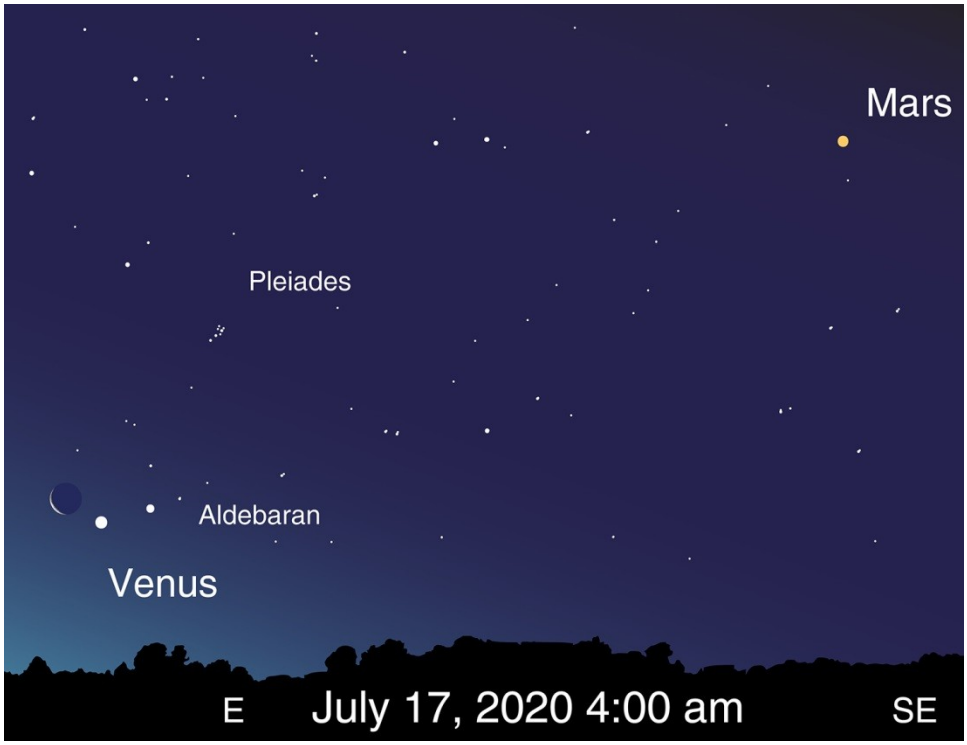
Perseverance's engineers built upon the success of its engineering cousin, Curiosity, and its design features many unique upgrades for a new science mission! In February of 2021, Perseverance will land at the site of an ancient river delta inside of Jezero Crater and ready its suite of seven primary scientific instruments. The rover will search for traces of past life, including possible Martian fossils, with WATSON and SHERLOC, two advanced cameras capable of seeing tiny details. The rover also carries an amazing instrument, SuperCam, to blast rocks and soil outside of the rover's reach with lasers to determine their chemical makeup with its onboard suite of cameras and spectrometers. Perseverance will also take core samples of some of the most promising rocks and soil, storing them for later study with its unique caching system. Future missions will retrieve these samples from the rover and return them for detailed study by scientists on Earth. Perseverance also carries two microphones so we can hear the sounds of Mars and the noises of its instruments at work. It will even launch a small helicopter - Ingenuity - into the Martian atmosphere as a trial for future aerial exploration!

Would you like to contribute to Mars mission science? You can help NASA's rover drivers safely navigate the Martian surface by contributing to the AI4Mars project! Use this tool to label terrain features on photos taken of the Martian surface by NASA missions to help train an artificial intelligence algorithm to better read their surrounding landscape: bit.ly/AI4Mars

The launch of Mars Perseverance is, as of this writing, scheduled for July 20, 2020 at 9:15am EDT. More details, updates, and livestreams of the event are available on NASA's official launch page: bit.ly/Mars2020Launch . Dig deep into the science of the Mars 2020 mission and the Perseverance rover at: mars.nasa.gov/mars2020/ . Find out even more about past, present, and future Mars missions at nasa.gov.



Perseverance inspects a cluster of interesting Martian rocks with its instruments in this artist rendering by NASA JPL/Caltech



Observe Mars yourself over the next few months! Mars can be found in early morning skies throughout July, and by the end of the month will rise before midnight. Mars gradually brightens every night until the close approach of Mars in October. The pre-dawn skies of July 17 present an especially nice view, as the waning crescent Moon will appear near Venus and Aldebaran.

This article is distributed by NASA Night Sky Network The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit https://nightsky.jpl.nasa.org to find local clubs, events, and more!

The TVA is a member club of The Astronomical League.