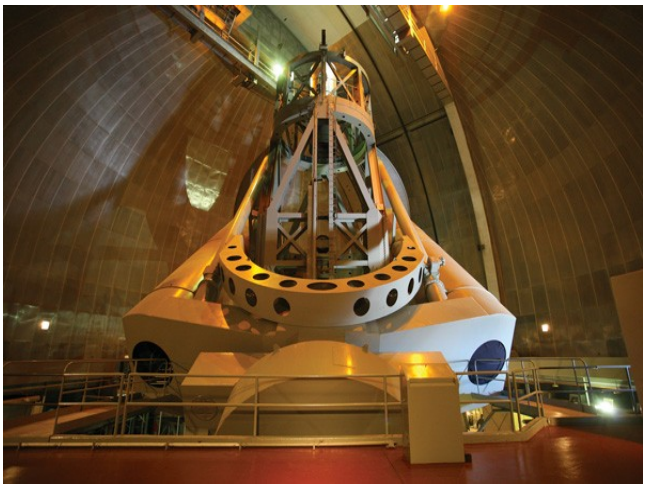
Temecula Valley Astronomer

The monthly newsletter of the Temecula Valley Astronomers Mar 2017

Events:

General Meeting : Monday, Mar 6, 2017 at the Temecula Library, Room B, 30600 Pauba Rd, at 7 pm. What's Up by Skip Southwick. Then Chuck Dyson and Paul Kreitz will present "Are you Smarter Than a 6th Grader?". Ray Stann will bring refreshments.

For the latest on Star Parties, check the web page.



The 200-inch (5.1-meter) Hale Telescope at Palomar Observatory. (Palomar/Caltech)

WHAT'S INSIDE THIS MONTH:

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).

President: Mark Baker 951-691-0101 <shknbk13@hotmail.com>
Vice President: Skip Southwick <skipsouthwick@yahoo.com>
Past President: John Garrett <garrjohn@gmail.com>
Treasurer: Curtis Croulet <calypte@verizon.net>
Secretary: Deborah Cheong <geedeb@gmail.com>
Club Librarian: Bob Leffler <bobjleffler@msn.com>
Facebook: Tim Deardorff <tim-deardorff@yahoo.com>
Star Party Coordinator and Outreach: Deborah Cheong <geedeb@gmail.com>

Address renewals or other correspondence to:
Temecula Valley Astronomers
PO Box 1292
Murrieta, CA 92564

Member's Mailing List: tvastronomers@googlegroups.com
Website: http://www.temeculavalleyastronomers.com/

Cosmic Comments – Mar/2017
by President Mark Baker

A recent movie has made quite a stir about the contributions of women in the Space and Aerospace arenas…and how they have been almost invisible. “Hidden Figures” portrays the story of three specific Black women, but to be fair, the story could be applied to women in general. I was proud to associate with many during my related career that didn’t “pilot the plane”, but were often responsible for keeping it in the air!!!

And we at the TVA have been equally blessed by the involvement of women in our organization. The recent passing of Selma Lesser has made me think of how we often unintentionally overlook such invaluable support and enthusiasm. In my tenure, I’d also like to recognize Maureen Salmi, Linda Croulet, Sharon Fleming, and Deborah Baker, who now carry the torch that Selma held so high for so long.

And that is not to overlook the contributions of all the members of our Club, regardless of gender, age, etc. We all do our part to keep the plane flying…

So again, here’s to all TVA supporters…we have done well, and we hope to do better, in promoting the Things Celestial that we all wonder at and have a love for. And thanks, Selma, for the example…

Clear, Dark Skies my Friends…

Looking Up – Mar 2017
by Curtis Croulet

Daylight Saving Time begins at on March 12. At 2:00 AM turn your clock forward to 3:00 AM.

Vernal Equinox occurs on March 20 at 3:29 AM PDT. At that time the Sun crosses the celestial equator, heading north.

First Quarter Moon is March 5 at 3:32 AM PST; Full Moon is March 12 at 7:54 AM PDT; Last Quarter Moon is March 20 at 8:58 AM PDT; New Moon is March 27 at 7:57 PM PDT.

Mercury will be in the evening sky in the latter half of March. This will be its best evening apparition of the year.

Venus reaches inferior conjunction on March 25. It'll plunge from its brilliant, privileged, place in the evening sky to inferior conjunction in only a bit more than three weeks. From around March 15 and through inferior conjunction, you might be able to see Venus in both the evening *and* following morning sky. That's because Venus will be 8 degrees north of the Sun at inferior conjunction, which is as far north of the Sun as it can be. Also, Venus will be large enough and close enough that a few young eyes may be able to see the crescent Venus without a telescope. Venus decreases from mag -4.8 to -4.1 during March.

Mars moves from Pisces into Aries during March. Although it remains in the evening sky, it creeps ever closer to the Sun. Mars fades mag +1.3 to +1.5. It shrinks from 4.5 arc sec in diameter to 4.2. It's tiny.

Jupiter rises at 8:47 PM on March 1 and as early as 7:34 PM (DST now) on March 31. Opposition is April 7. Jupiter is in Virgo.

Saturn is still a morning northwestern Sagittarius. Opposition is June 14.
Uranus is a dusk object in Pisces.

Forget Neptune. It's too close to the Sun.

Pluto is a morning object in northeastern Sagittarius.

Two sparse meteor showers occur in March: March Lyncids and K Serpendids.

Let's look up.

Johannes Kepler (1571-1630) is one science's pivotal personalities. Many of you have heard of Kepler's Laws of Planetary motion:

1. The orbits of the planets are ellipses, with the Sun at one focus.
2. A line joining the Sun and a planet sweeps out equal areas in equal time.
3. The square of the planet's orbital period (i.e., the time to complete one orbit) is proportional to the cube of the semimajor axis of its orbit.

These laws have had profound influence on our understanding of our place in the universe. We'll get back to Kepler's laws shortly. But for the moment I want to talk about Kepler's significance in astronomy's emergence from the philosophical and astrological assumptions of the medieval world to an observation-based science.

In 1600, when Kepler entered the employ of Tycho Brahe (1546-1601) in Prague, astronomers were still trying to come to terms with Copernicus's claim that the Sun, not the Earth, was at the center of the Universe. As we saw last month in our examination of James Bradley's work, the most important objection to the heliocentric Universe was its implication that we should observe the stars to change position as they were observed from different parts of the Earth's orbit, i.e. we should see stellar parallax. No stellar parallax was observed. One possible explanation – the correct explanation, it turned out -- was that the stars were simply too far away for parallax to be detected with the instruments of the day. But that implied a vast amount of empty space between the stars and the Solar System. In accordance with the prevailing view of the time, Tycho believed everything in the Universe had a divine purpose. God would allow such "useless" space to exist. Therefore, the stars must be relatively nearby. If the stars were nearby and yet showed no parallax, then the Earth must be fixed and the stars must revolve around it.

Tycho's model of the Universe had the planets revolving around the Sun, but the Sun revolved around the Earth. Outside was a sphere carrying the stars. The planets themselves were not carried on crystalline spheres, as commonly believed at the time, because a recently-observed comet would have had to cross through the spheres.

Although Tycho had hired Kepler to lend his mathematical expertise to explaining this model of the universe, Tycho was parsimonious with his data, frustrating Kepler. When Tycho died the following year, Kepler snatched up Tycho's data before his heirs had a chance to claim them. The importance here of both Tycho's and Kepler's work was that both understood that real knowledge required hard data – numbers -- not just assumptions based upon religion or ancient philosophies. Although each astronomer still bore the baggage of obsolete and erroneous concepts, they were among the first to adopt a modern, data-based concept of science.

Kepler proceeded with his own observations of Mars. He could see that Mars did not move at a uniform speed in its orbit. Thus Kepler conceived his First and Second Laws. First, planetary orbits are ellipses, with the Sun at one focus of the ellipse. Second, a line joining the Sun and a planet sweeps through equal areas in equal time, which said that planets slowed down when they were more distant from the Sun, and they sped up when they were closer.

The Third Law came a bit later, and, alas, it's harder to explain. This applies to all planets, but we'll consider Mars. We know that Mars's orbital period is 1.88 times that of the Earth. The square of 1.88 is 3.534. Since this must be in the same proportion to the Earth's period as the *cube* of the semimajor axis of the orbits, we can take the cube root of 3.534 to learn that the semimajor axis of Mars's orbit must be 1.524 times the Earth's.

But we still don't have absolute values. Establishing the astronomical unit – the distance from the Earth to the Sun – was a challenge for astronomers going back many centuries. It's an important yardstick for everything else in the Solar System. During the opposition of Mars in 1671, Giovanni Cassini and John Flamsteed independently measured the distance to Mars using Mars's parallax. From this, using Kepler's Second Law, they were able to calculate the size of Mars's orbit. From this, they were able to use Kepler's Third Law to calculate the distance from the Earth to the Sun. Their figure was 87 million miles, pretty close to the modern value of 149,597,870,700 meters or about 92,955,779 miles. Later astronomers improved on the accuracy of Cassini and Flamsteed, but theirs was an important step in establishing the true scale of the Solar System, and, later on, the distances to the stars.

Clear skies.

Random Thoughts
by Chuck Dyson

The Age of Enlightenment

I have often thought that it would have been wonderful to live in the Age of Enlightenment with awakening of Western Civilization to the scientific method and the founding of so many of the branches of science that we know and use today. However, when you go to look up a definition for the Age of Enlightenment it gets a little upsetting and confusing. The upsetting comes from the fact that the vast majority of accounts of what constituted the Age of Enlightenment are written by history people, this is after all their job, and well they seem to lean considerably toward the political events and people involved in those events of the period. Now don't get me wrong as I do admit that some of these people were great thinkers and architects of great social changes but there was more going on than just social changes and yet most papers on the Enlightenment only mention the social works of the scientists and not their works in the scientific field. A very good example of what I am talking about is Rene' Descartes who is well known for his philosophical works and his statement "Je pense, donc je suis" although when Descartes published his book on philosophy he switched from French to Latin and the phrase came out "Cognito ergo sum" or "I think therefore I am" but you must dig deep into the writings about Descartes to discover that he is also the father of the Cartesian coordinate system also known as analytical geometry, if you have ever sweated over a vector math problem thank Descartes. It seems that the only scientist who gets credit for being a scientist in the Age of Enlightenment is Isaac Newton and all he usually gets is the old "Oh yes, there was also this chap Newton who did something with math". In addition to the lack of recognition of the contributions by scientists to the Age of Enlightenment there is confusion as to when the period actually was. If you are French then the Age of Enlightenment was from the death, by natural causes, of Louis XIV in 1715 to the death, by unnatural causes, of Louis XVI in 1789; as in revolution over, monarchy gone, republic established, and enlightenment complete. Others, non-French historians, consider the Age of Enlightenment to be the long century and to have gone from 1685 to 1815 and please do not ask me how historians came up with this date. These dates seem a little harsh on, well, Copernicus, Galileo, Tycho Brahe, and Kepler to name just a few; so, let's take a slightly broader look at the Age of Enlightenment and see if we can establish our own dates for its beginning and end of the Age of Enlightenment for science.

I will start a little before 1685, ok I will start a lot before 1685, let's go back to Pythagoras of Samos in about 570 BC and he is famous for his rigorous scientific proof of the squares of the two sides of a right triangle being equal the square of the hypotenuse it looks like science is alive and well here. Next is Aristarchus of Samos in about 300 BC and although none of his works have survived we know from others that he used the scientific method to answer questions and actually got relative distances to the moon and the sun, the moon he got right and the sun he missed on, and he started to map the stars. The mapping of the stars was carried on most notably by Hipparchus of Nicaea in about 140 BC mostly on the island of Rhodes. Both Aristarchus and Hipparchus had an advantage that Pythagoras did not in that the great library of Alexandria was operational during their lives. The library of Alexandria was not just a library it was the world's first think tank and it was THE LIBRARY of the world. The

library lasted from about 300 BC to around 30 BC and we know that at least Hipparchus made use of it. All three of our early scientists had the same problem to deal with - paper in the form of papyrus was not plentiful but you could also use tree bark or clay tablets everything had to be hand written, getting a copy of a book meant you made a copy of the book, and there was no public postal service, if you wanted to mail a letter to a colleague you went to the market and found a caravan that was going to the city that you wanted to mail your letter to and you paid the merchant and your letter went off at the speed of an overloaded camel and delivery was definitely not guaranteed. This was the major problem with science, it was not that people were not doing good science it was the fact that communication was so slow and ideas and thoughts could not be exchanged easily and quickly that resulted in people worked in isolation and when the leading person of a school died the flame of science would often go out. There was also another problem around 190 BC Rome was on the move, at this time Samos was under the control of the Ptolemies of Egypt, think Cleopatra &Co., and the Romans moved in, liked the place, and said to the Ptolemies “Can we have the keys please?” no more science club. Later around 30 BC the Ptolemies were acting up and Cesare personally went to Egypt to bring them in line and well someone started a fire and the library in Alexandria went up in smoke. To give you an idea of how big a deal this was when the first library, the Harvard library, was started in America in 1638 it began with about 260 books; the library of Alexandria was estimated to contain between 40,000 and 400,000 scrolls, this was virtually all of the knowledge in the world suddenly gone. Within 400 years Rome is also gone and the light of science goes out in the Western world but not the Eastern world. This was the time that the Arabic world flourished. Both civil and religious leaders are tolerant of science and as a result astronomy advances, this is the reason so many stars have Arabic names, math advances - especially algebra, and the Arabian merchants bring Chinese paper to their countries and the Arabic countries are soon making their own paper, Arabic astronomers may still need to write books by hand, but, they now have something to write on. While the religious climate in the East was tolerant of new ideas the emerging Catholic Church in the West was not. Thanks to the crusades and the Moors coming into Spain the books of the Greek and Roman scholars and the works of the Arabic scholars were being translated into Latin and were starting to be read in Europe, change was afoot but was strongly opposed by the Catholic Church. Perhaps nothing exemplifies the spirit of change that was sweeping Europe more than the actions of Cosimo de' Medici in 1444 he opens the first public library with 400 volumes from his own collection of books. There is still the problem of needing books to be copied by hand, in 11 years one man will change everything for everyone. In 1455 Johannes Gutenberg publishes the first book printed on a printing press. Although Gutenberg is generally acknowledged to be the inventor of movable metal type, among other things, he was actually 250 years behind the Koreans but had no knowledge of their work, see what I mean by the word traveled slowly back then. The printing press is the cell phone of the day and soon everyone is printing everything and keeping a tight lid on what gets printed is giving the Church fits, not to worry as things are about to get worse, much worse, In 1510 England starts the first public, private, mail service[1], so you can now say anything to anyone privately and have a reasonable expectation the letter will arrive at its intended destination. In 1517 disaster, Martin Luther nails his ninety-five thesis letter to a church door intending to start a discussion within the Church over some of its policies and practices a copy of the letter makes its way to a printer and the whole thing

1 Editor’s note: Some give credit for the first mail service to the Roman ***cursus publicus*** .

goes public. The Pope publicly demands that Luther recant. Luther publicly refuses. The Pope publicly excommunicates him. Luther has people who agree with him and they protest the Popes action. The Protestant Church is formed. Can things get any worse? 1530 King Henry VIII, unhappy with how the Church is handling his latest divorce, forms the Church of England, beautiful just beautiful. Now instead of one church we have three with very different views toward science; so, if someone is leaning on you in one part of Europe you just go to another and continue your work. Is it any wonder that the Age of Enlightenment occurred at this time? But what was the effect of this age? The best example I can give you is in 1814, one year before the historians declare the Age of Enlightenment over, the British march into Washington and burn the President's Mansion[2], The Capitol, other government buildings, and the Library of Congress. To replace the library books lost, Mr. Jefferson sold to Congress 6,700 books from his personal collection and that is quite a jump in numbers from the 400 volumes of Cosimo de' Medici and the 260 volumes that started the Harvard Library.

Is, as the historians say, the Age of Discovery over? In 1954 when I was 9 years old, a child in Philadelphia underwent the worlds first successful heart operation and 13 years later I was working with a heart team. Carl Sagan loved to say "We are all star stuff" in 1957 when I was 12 years old Margaret and Geoffrey Burbidge, William Fowler, and Fred Hoyle published the B2FH paper on stellar nucleosynthesis showing how all the elements in the universe except Hydrogen, Helium, and Lithium are made inside of stars. In 1969 when I was 24 years old I saw a man on TV step off of a ladder and say "That is one small step ……". In 1992 when I was 47 the first exoplanet was discovered and we started to put numbers into the Drake Equation. Historians may say that the Age of Discovery is over but in science we know different; with luck, it has only just begun.

Cheers
Chuck

2 Editor's note: Today, known as the White House.

Call for Palomar Observatory Docent Volunteers (PODs)

By Curtis Croulet

As part of Palomar Observatory's public outreach mission, the observatory hosts weekend public tours of the 200-inch Hale Telescope from April through October. The tours are provided by docent volunteers, of which I am one.

We are inviting interested parties to join us. The only requirement is that you be enthusiastic about your love of astronomy and the Hale Telescope, and that you be willing to devote one day per month to the observatory's outreach program. You do not need to be an astronomy expert. You do not need to have prior knowledge of the history of the observatory. We will teach you what you need to know. You can scale your duties to suit your personality. If you wish, you can freely interact with the public in the Visitors' Gallery. If you wish to help with tours, you can assist with directing the visitors, or you can do the talking, explaining the technology and history of the telescope. As a docent, you will be able to see areas and viewpoints of the telescope normally off-limits to observatory visitors. You will be able to stand beneath the great telescope.

On a behind the scenes tour, Docent Mark DiVecchio is examining original glass plates shot by the 48-inch Samuel Oschin Telescope. Mark is looking at the plates through a magnifying loupe.

We also hold occasional weekend star parties for invited groups, such as the Friends of Palomar Observatory, in the Outreach Center parking lot. You can show off your own telescope and your knowledge of the sky, or you may operate one of the Outreach Center's available telescopes, including a 22-inch Dobsonian.

You are invited to attend our 2017 season kickoff event at the Palomar Observatory Outreach Center on March 18 at 10:30 AM (no obligation). We will need a head count, so please let us know soon if you're interested in this event. There also will be a special docent recruitment program on June 3 at 1:00 PM.

If you are interested in becoming a Palomar Observatory Docent, please contact me personally at (951) 763-4830 or at ccroulet@gmail.com. Or you may call the Palomar Observatory Outreach Coordinator, Steve Flanders, at (760) 742-2111.

Solar Eclipse Provides Coronal Glimpse
by Marcus Woo

On August 21, 2017, North Americans will enjoy a rare treat: The first total solar eclipse visible from the continent since 1979. The sky will darken and the temperature will drop, in one of the most dramatic cosmic events on Earth. It could be a once-in-a-lifetime show indeed. But it will also be an opportunity to do some science.

Only during an eclipse, when the moon blocks the light from the sun's surface, does the sun's corona fully reveal itself. The corona is the hot and wispy atmosphere of the sun, extending far beyond the solar disk. But it's relatively dim, merely as bright as the full moon at night. The glaring sun, about a million times brighter, renders the corona invisible.

"The beauty of eclipse observations is that they are, at present, the only opportunity where one can observe the corona [in visible light] starting from the solar surface out to several solar radii," says Shadia Habbal, an astronomer at the University of Hawaii. To study the corona, she's traveled the world having experienced 14 total eclipses (she missed only five due to weather). This summer, she and her team will set up identical imaging systems and spectrometers at five locations along the path of totality, collecting data that's normally impossible to get.

Ground-based coronagraphs, instruments designed to study the corona by blocking the sun, can't view the full extent of the corona. Solar space-based telescopes don't have the spectrographs needed to measure how the temperatures vary throughout the corona. These temperature variations show how the sun's chemical composition is distributed—crucial information for solving one of long-standing mysteries about the corona: how it gets so hot.

While the sun's surface is ~9980 Farenheit (~5800 Kelvin), the corona can reach several millions of degrees Farenheit. Researchers have proposed many explanations involving magneto-acoustic waves and the dissipation of magnetic fields, but none can account for the wide-ranging temperature distribution in the corona, Habbal says.

You too can contribute to science through one of several citizen science projects. For example, you can also help study the corona through the Citizen CATE experiment; help produce a high definition, time-expanded video of the eclipse; use your ham radio to probe how an eclipse affects the propagation of radio waves in the ionosphere; or even observe how wildlife responds to such a unique event.

Otherwise, Habbal still encourages everyone to experience the eclipse. Never look directly at the sun, of course (find more safety guidelines here: https://eclipse2017.nasa.gov/safety). But during the approximately 2.5 minutes of totality, you may remove your safety glasses and watch the eclipse directly—only then can you see the glorious corona. So enjoy the show. The next one visible from North America won't be until 2024.

For more information about the upcoming eclipse, please see:

NASA Eclipse citizen science page
https://eclipse2017.nasa.gov/citizen-science

NASA Eclipse safety guidelines
https://eclipse2017.nasa.gov/safety

Want to teach kids about eclipses? Go to the NASA Space Place and see our article on solar and lunar eclipses! http://spaceplace.nasa.gov/eclipses/

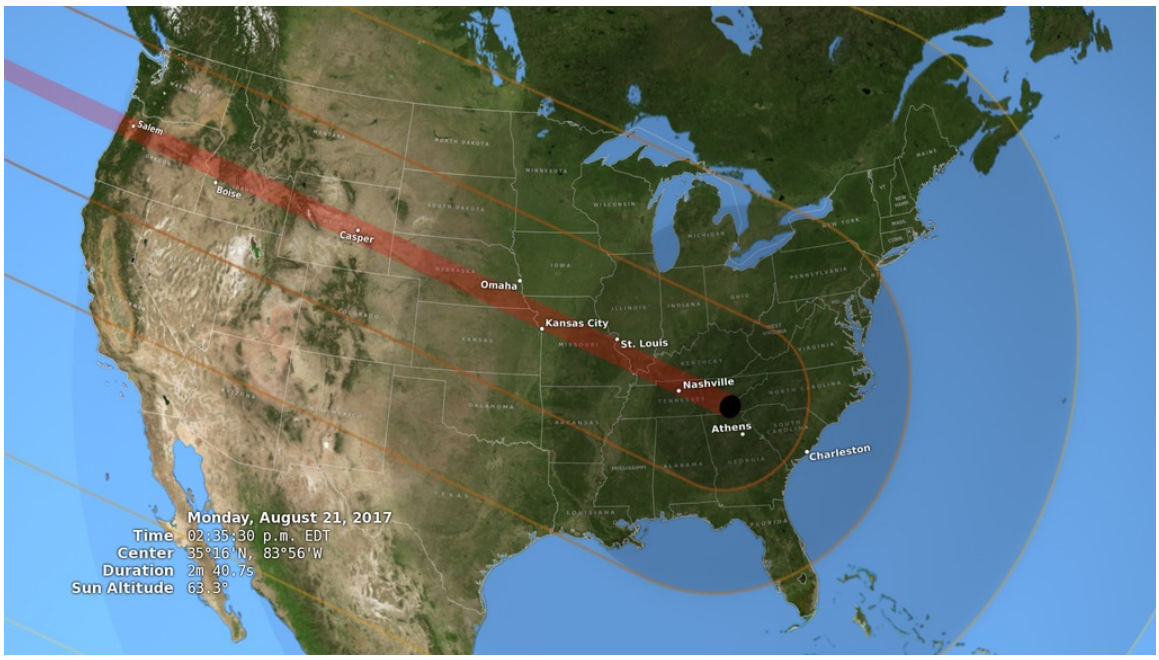


Illustration showing the United States during the total solar eclipse of August 21, 2017, with the umbra (black oval), penumbra (concentric shaded ovals), and path of totality (red) through or very near several major cities. Credit: Goddard Science Visualization Studio, NASA

This Article is provided by NASA Space Place.
With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology.
*Visit **spaceplace.nasa.gov** to explore space and Earth science!*

The TVA is a member club of The Astronomical League.