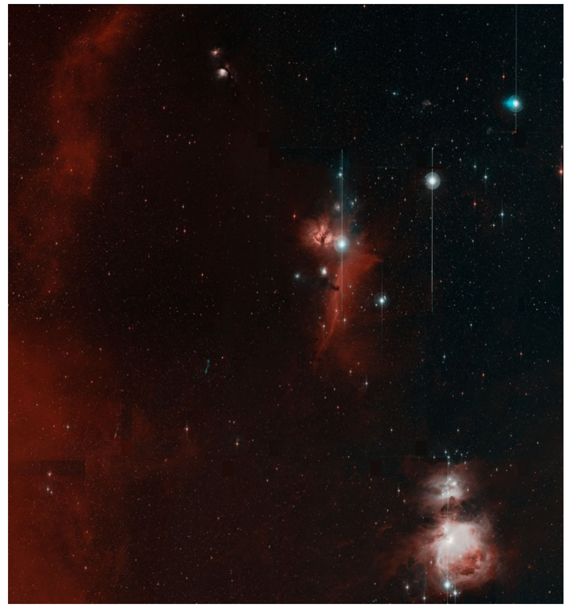
Temecula Valley Astronomer
The monthly newsletter of the Temecula Valley Astronomers May 2018

Events:

General Meeting :
Monday, May 7, 2018 at the Temecula Library, Room B, 30600 Pauba Rd, at 7 pm.
After opening comments by President Mark Baker, Vice President Skip Southwick will present "What's Up".
Our own Chuck Dyson will give a talk entitled "Let's Gain Some Insight".

Please consider helping out at one of the many Star Parties coming up over the next few months. For the latest schedule, check the Calendar on the web page.



Zwicky Transient Facility took this "first-light" image on Nov. 1, 2017 at Palomar Observatory. The image is more than 24,000 pixels by 24,000 pixels. Each ZTF image covers a sky area equal to 247 full moons. The Orion nebula is at lower right.

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.

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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

OUTREACH…

I'm so glad to have Star Party season back in full swing again. It seems like this year we have had significantly fewer events than in years past, but that could just be me. I know I have the honor of supporting CalTech Palomar Observatory in a docent capacity, and I enjoy my involvement with NASA JPL as a Solar System Ambassador, but my real "fix" for Astronomy and Space Sciences comes from the hands on aspects of Star Parties. Club meetings go a long way as well, and I can't remember ever missing a meeting before, and this year I've missed TWO…!!! I learn so much from our "ground floor" activities, and the youth and adults that bring so much to our table…I guess Joy would be a good description in my case.

I hope our "regulars" enjoy these moments as much as I do, and I am not afraid to admit the advent of Planets back on the observing scene will make it easier for us to enthrall the crowds even more. I invite any and all TVA members, with scope or not, to come join us as we inspire our community members to **"Look Up"**. We can always use mentoring in the long lines if nothing else…and the WOW's or WHOA's you hear are more than worth your sacrifice to be there.

As always, I appreciate all you do to promote partaking of the Celestial beauties all around us.

Clear, Dark Skies my Friends…

Looking Up Redux
by Clark Williams

ALL TIMES ARE LOCAL PST WILDOMAR

*Times are given in 24-hour time either as hh:mm:ss or hhmmss. A time given as hhmm**+** indicates that it is the hour of the next day. Similarly a time hhmm− indicates a time in a previous day.*

Moon Phases for the month by date:

Monday the 7th @ 19:09:49 PDT LAST QTR
Tuesday the 15th @ 04:48:50 PDT NEW
Monday the 21st @ 20:50:20 PDT FIRST QTR
Tuesday the 29th @ 07:20:51 PDT FULL

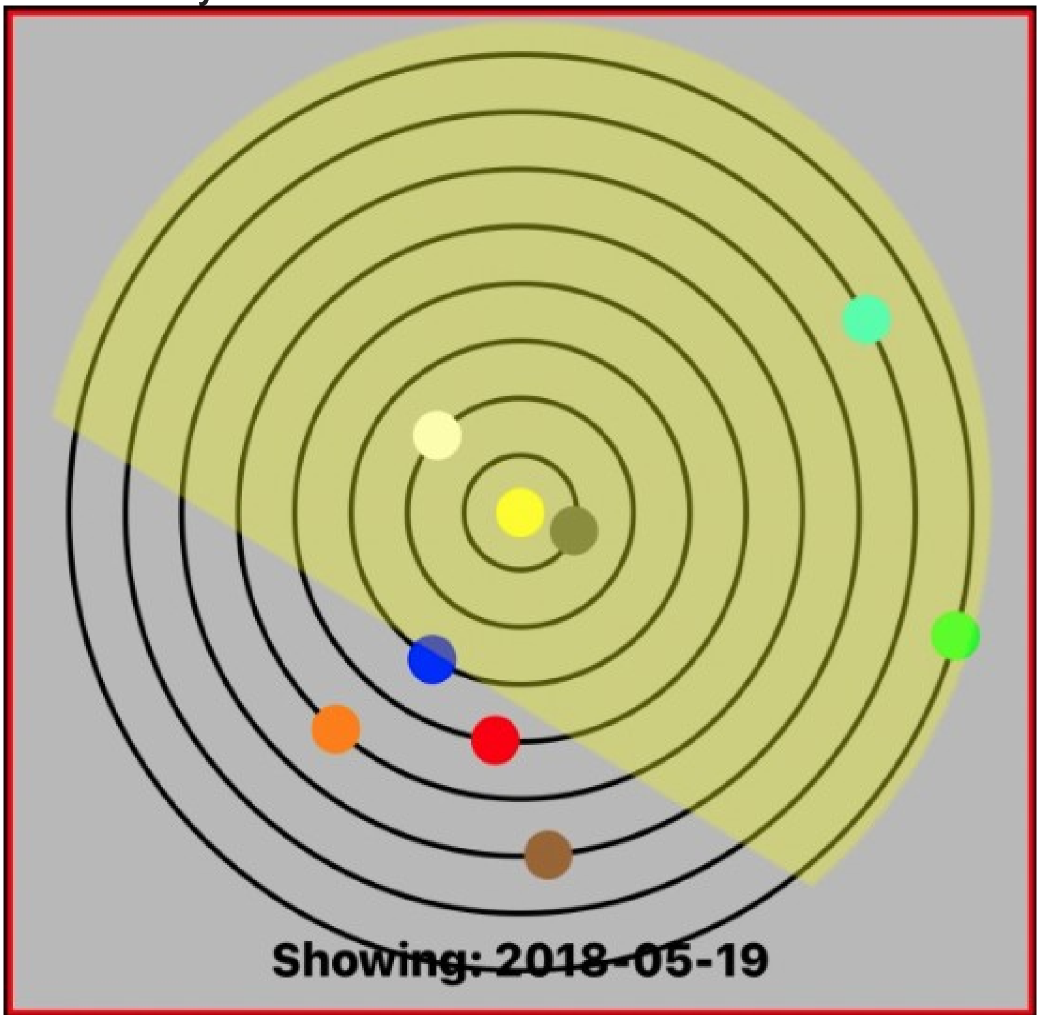
Perigee comes on 2018-05-17 @ 14:04 363,776 km (226,040 mi)
Apogee comes on 2018-05-05 @ 05:35 404,457 km (251,318 mi)

2018 has: (12) new moons, (12) 1st Qtr moons, (14) Full moons, (13) 3rd Qtr moons
(2) Blue moons and (1) Black moon

Luna:

The Lunar phases alternate between Monday and Tuesday this month. Luna can be found rising in Ophiuchus at the beginning of the month chasing Jupiter in Libra. Luna rises at about 2120. It is waning gibbous at about 16 days old and near 90% illuminated. In the middle of the month Luna is new and setting about 2009 in Taurus. Luna closes out the month rising in Sagittarius around 2150 LCL. It is once again about 90% illuminated and is waning gibbous about 16 days old.

Planets:
Planetary Positions May 2018:



- **Mercury:** Mercury reached its greatest elongation on the 29th of last month but it is still too close to the Sun for good viewing.
- **Venus:** Venus is shining at magnitude –3.9 this month and grows only a little in angular diameter (11½″ to 13″) while reducing just a little in phase (89% to 80% illuminated). Venus's altitude is improving during May increasing about 3-degrees from 24° to 27°. Venus sets more than 2½ hours after Sunset by the end of the month.
- **Mars:** The glorious warrior is starting its summer display during May. On the 14th Mars will pass only 18 arc-minutes below the globular cluster M75, while it moves into Capricornus. Mars will be about 6 light-minutes from Earth and the cluster at 68,000 light-years from Earth, will both appear grouped tight enough that even in a small telescope's eyepiece can capture both at the same time. Mars will continue to increase in both brightness and size as Earth appears to catch up to Mars during opposition in late July. At the beginning of the month the Red Planet rises above the east-southeast horizon a little before 1:30 a.m. local time. Just about the same time that Jupiter is at its highest in the southern sky. By the end of the month Mars will be rising a little after midnight. Mars will continue to move eastward in direct motion,

passing Sagittarius into Capricornus by mid-month. Mars' magnitude is growing as May ages growing from –0.4 to a very bright –1.2 by month's end. Its apparent diameter will increase from 11″ to 15″ allowing us to view many if the Martian surface features on nights with exceptional viewing conditions: calm winds, clear, dark nights. But if you find those conditions, even with telescopes as small as 6 inches the features will be visible. Spring begins on May 22nd for the southern hemisphere of Mars. The south polar ice cap will be tilting into slightly better view in the months ahead although the south polar ice-cap is shrinking right now.

- **Jupiter**: Jupiter reaches opposition on the evening of May 8th. All month long the planet shines at magnitude –2.5 and appears more than 44″ across at its equator. Old Jove continues its slow retrograde movement (moving west against the starry background) throughout May. It appears 4° north of the wide double star α-Librae at the start of the month and less than 1° from the double star at the end of the month. Jupiter will be a good Star Party Outreach planet throughout the summer.
- **Saturn:** Saturn rises a little after midnight at the beginning of the month and about two hours earlier by the end of May. The stunningly beautiful ringed world floats about 4° to the upper left of the zenith most star in the Teapot of Sagittarius (λ-Sagittarii). Saturn's magnitude increases from +0.3 to +0.2 in May. Saturn will be at opposition in June. Saturn's apparent diameter is also growing this month. It will be over 18″ wide by late May. Saturn's position is far south in the heavens this year giving us some spectacular views of both the body and tilted rings of the beige giant. This is especially true at it's highest for the night, which occurs at about 0500 in early May and a little before 0300 by the end of the month. Saturn's summer show is just beginning.
- **Uranus:** Uranus has slipped into Sol's glare.
- **Neptune:** is just barely high enough for a very early morning twilight viewing. It is better left until later in the year of observing.
- **Pluto:** My favorite PLANET (besides Earth of course) was unfortunately blasted out of the Solar System completely on the 1st of last month (see April's ***Looking Up*** **Redux**). So we will be waiting for a viewing return later this year.

Jupiter is at opposition this month while Saturn is at opposition in June and Mars in July! Venus is at greatest elongation in August. Four months in a row of great planetary viewing.

Meteors:

- Often the Eta Aquariids are touted during May. This annual shower comes from Halley's Comet. The grains are small and fast. But this shower rarely has good viewing in the Northern Hemisphere. It is just too close to the horizon and this year a fat gibbous moon will kill any really good viewing. If you do go to a really good dark viewing site you may be able to see some really long fiery streaks. The shower rises a couple of hours before dawn on May 6th.

Comets:

- 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 may 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.
- 2018 will see three comets within the range of binocular viewing. Two of them are short period comets and one Halley type comet. Both of the short period comets have the potential to enter the realms of naked eye visibility. The first will be in June: Giacobini-Zinner's comet; the second 38p/Stephen-Oterma will be around August through January 2029; the third is 46P/Wirtanen and will also be returning in the December time-frame.
- There are always at least 5 comets in the night sky but their magnitudes prevent visual observing. We'll look at comet Giacobini-Zinner next month.

Deep Sky:

In each case you should look for the following on or about the 15th Day of May 2018 at 2100 PDT and you will have about 20 minutes of viewing time total.

The one thing May brings us is clear spring skies (usually):

- **Jupiter** is not a deep sky object but it is at opposition on Tuesday May 8th at 1728 and is visible to the naked eye from just about all of Southern California.
- **M5** – a globular cluster in the constellation Serpens. Discovered by the German astronomer Gottfried Kirch in 1702 when he was observing a comet. Charles Messier also noted it in 1764, but thought it a nebula without any stars associated with it. William Herschel was the first to resolve individual stars in the cluster in 1791, counting roughly 200.
- **M87** – French astronomer Charles Messier discovered M87 in 1781, cataloguing it as a nebulous feature. Famous or perhaps notorious. for its narrow plasma jet, which is powered by the accretion disk surrounding the galaxy's central, super-massive black hole. Amateur astronomers would love to see this beast and what is more astonishing is that many have succeeded. This isn't an undertaking for the easily frustrated. Those amateurs who have succeeded are for the most part accomplished observers working under perfect skies and using magnifications of about 400×. Most utilized 20-inch and larger telescopes although some have claimed success with scopes as small as 12½ inches.
- **M94** – a spiral galaxy in the constellation Canes Venatici sometimes known as the Cat's Eye Galaxy. It was discovered by Pierre Méchain in 1781 and catalogued by Charles Messier two days later. Some references describe M94 as a barred spiral galaxy but the "bar" structure appears to be more oval-shaped. The galaxy has two ring structures.

May is great for both planetary and deep sky viewing and imaging. Spend some time outside wth your scope. Summer is coming.

For now – Keep looking up.

Random Thoughts
by Chuck Dyson

HOW OLD AM I?

It is just amazing to me how science can take a simple question and turn it into a complex nightmare.

Let me give you just one such example. In 1540 Garcia Lopez de Cardenas was leading an expedition in Arizona that was looking for the cities of gold (Cibola) and his group happened to stumble on a rather large ditch. As there is very little surface water in northern Arizona and there appeared to be a small stream at the bottom of this ditch, Cardenas and his lieutenants had estimated that the ditch was maybe two miles wide and possibly a quarter mile deep, Cardenas sent several groups of men into the ditch to get water. Several days later and just before dying of thirst the groups of men managed to climb out of the ditch and informed Cardenas that his estimate of the size of the ditch was off just a little bit, OK it sucked completely.

Cardenas's ditch was of course the Grand Canyon and it was vastly larger and deeper than his estimate but lacking a range finder and someone with the math training to use it Cardenas was unable to determine distances that he could not measure directly and thus the simple question "How big am I?" became a very difficult and challenging question for him.

It is exactly the same with the seemingly simple question that asks "How old am I?". In the short term the question is easy to answer. I can reasonably assume that I am 72½ years old as I have a birth certificate and both parents and grandparents have told me that I was born in August of 1945. However, on the wall in my den I have a silhouette portrait of a direct ancestor of mine, seven generations removed, I have only a general idea of when this ancestor was born, the late 1700's if we go by 30 years per generation and as the silhouette is of a fully grown man so it could have been made in the early 1800's better than this I cannot do unless I engage in some serious genealogy research. This problem of figuring out how old something is and its personal history is a major challenge. By the way I have absolutely no idea how long my ancestor lived, how many times he married, how many children he had, or what his profession was and that was less than two hundred years ago. How are astronomers, geologists, and paleontologists able to date events that happened millions and even billions of years ago?

Well according to Archbishop Ussher (in 1650) it's not a problem because he worked out from the dates in the bible that the Earth was only 5500 years old and everything we see was created on the first day. Benoit de Maillet attempted to mess up the story by finding sea shells on mountain tops and claims that for the shells to be there the entire Earth must have been covered by water and it has slowly evaporated over time - de Maillet estimated two billion years. Professor Abraham Gottlob Werner also believed that the Earth was formed under an all-encompassing sea in a single catastrophic event that resulted in layers (strata) that were fixed by the universal event and the subsequent withdrawal of the ocean from the land although Werner is never able to explain exactly how the ocean goes away and to where it goes.

About the same time as Werner, there was a retired British farmer/businessman who noticed that there was erosion in his fields and that sand was being deposited at the mouth of streams and he set about finding out if, in fact, the earth was being continuously transformed. In another part of England a canal digger noticed that there were strata of rock (a strata is a horizontal band of sedimentary rock that has different grain size and composition than the strata above and below it) that seemed to appear in different parts of the canal and yet appeared to be related and interestingly enough to have the same types of fossils embedded in them.

These two gentlemen, James Hutton and William Smith, gave us a new model for understanding how the Earth worked. This model that said that the land was built up by volcanoes then torn down by erosion, converted into sedimentary rock strata, and then recycled was the basic working geology model until the mid-20th century. Hutton also just happened to mention that he had discovered unconformities in the strata. An unconformity is an area of the rock record that has been disrupted so that the record is not complete and/or continuous. This scrambling of the rock record over time by natural forces led to some very interesting geology meetings, but gradually a coherent picture of the evolution of the earth emerged and geologists and paleontologists were able to say that this strata and fossil assemblage were younger or older than that strata and fossil assemblage but exactly how old each strata and assemblage was it was not possible to say.

It was not until the mid-twentieth century that geologists were able to use radiometric dating of rocks and establish actual ages and not just relative ages. Radiometric dating works by having a radioactive element and knowing both its original sample size and its half-life, the time that it takes 50% of that element to decay into other stable elements. A good example of this is half of a sample of Uranium 238 decays into Lead 206 over a period of 4.46 billion years and half of a sample of Uranium 235 will decay into lead 207 over a period of 703 million years; each element and each isotope of that element has a unique half life and unique end product.

The reason the same element can have different atomic weights is because the element is determined by the number of protons that it has, but an element can have different numbers of neutrons and that is what gives it a different atomic weight. Elements with atoms of different atomic weights are called isotopes of each other and a good example of this is carbon as there are three isotopes of carbon; C-12 withsix protons and six neutrons, C-13 with six protons and seven neutrons, C-14 with six protons and eight neutrons. The latter is is just a touch unstable. This is how the radiometric dating system works : when the rocks are molten their molecules that are the same tend to want to be together in structures that we call crystals, the longer it takes for the rocks to cool the larger the crystals grow and the crystals will accept some other molecules and elements into their structure and not others. In the case of zircon its crystal structure is compatible with uranium atoms but absolutely not with lead atoms; so, when a zircon crystal with uranium in it is analyzed the ratios of the two different uranium isotopes compared to the ratios of their lead isotopes gives the age of the crystal that they are in and we have a real date for the formation of that rock structure. By using several different radiometric techniques over the years geologists have been able to accurately date the different strata and thus determine the actual ages of the various fossil gropes. By being able to identify what they think are some of the oldest sedimentary rocks on the planet and by extracting the zircons that are in particular rocks from Australia (we can use sedimentary rocks in this case because we want to know the age of the zircon crystals and not the rocks that they are in), we can show that the Earth is 4.4 billion years old.

The next questions that we need to ask is this date for the Earth compatible with the age of the solar system and how can we measure the age of the solar system? If you go walking in an area that just has had an intense thunder storm you just may be lucky enough to find a fulgurite tube, this is a bit of sand or soil that has been fused into a rock tube by the extreme heat of a lightning bolt. In the very early days of the solar system the proto-sun was spinning very fast and generating enormous flairs and lightning bolts that interacted with dust in the planetary disk and these lightning bolts would have melted the dust particles and when cooled they would have formed little globules, chondrites, and some of these chondrites formed meteors that fell to earth. The radiometric analysis of these meteors indicate that the solar system is 4.6 billion years old so the earth based zircon readings are plausible.

What about dating solar system bodies other than earth? Until recently dating was done by counting the number of meteor craters per square mile and the areas with the most craters was the oldest and the area with the fewest was the youngest. In the case of the moon all of that changed with the Apollo missions. The astronauts were given basic courses in geology so that they could recognize different types of rocks. They found ancient basaltic samples that could be radiometrically dated and these samples gave an age of 4.4 billion years lending credence to the Earth/asteroid impact theory of the origin of the Moon. As for the planet Mars we have lots of data on the surface structure of the planet and a good idea of the chemical composition of the rocks, thanks to the rovers, but when it comes to the age of things and the tectonic history, if any, of the planet we are still at the counting craters stage; although, we do know there are volcanoes on Mars and some of them look as though they traveled over a hot spot so radiometric analysis of the volcanic rocks could really open up the geologic history of the planet for us and that will be exciting.

In the meantime go out and pet a rock and thank it for helping us understand the history of our own planet.

Cheers
Chuck

What's It Like Inside Mars?

By 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 is launching 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.

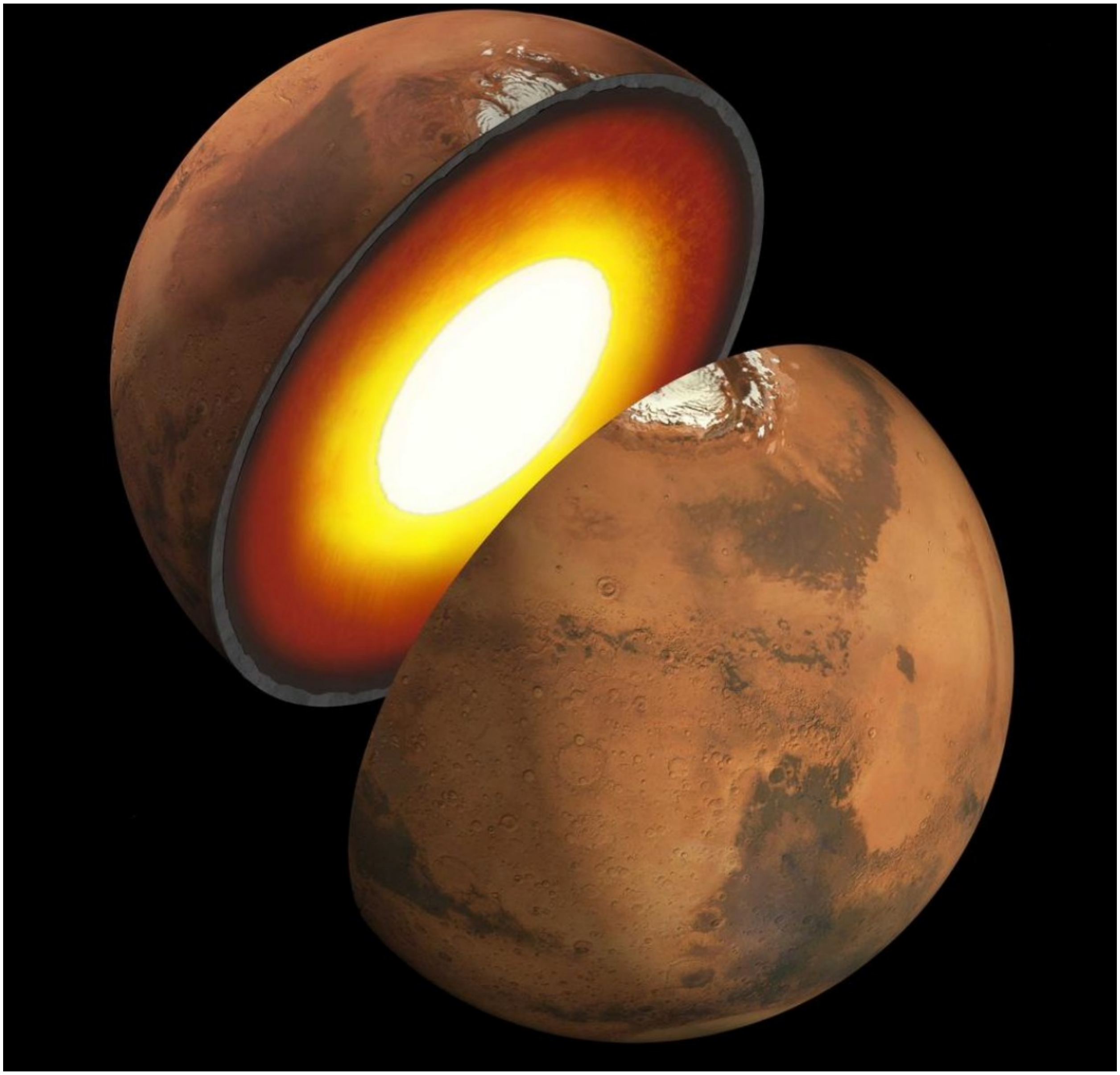
InSight will also carry a heat probe that will take the temperature on Mars. The heat probe will dig almost 16 feet below Mars' surface. After it burrows into the ground, the heat probe will measure the heat coming from the interior of Mars. These measurements can also help us understand where Mars' 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



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

The TVA is a member club of The Astronomical League.