Events:

General Meeting :

Monday, March 4, 2019 at the Ronald H. Roberts Temecula Library, Room B, 30600 Pauba Rd, at 7:00 PM. On the agenda this month is "*What's Up*" by Skip Southwick, followed by President Mark Baker on "Memorial to Opportunity - the little rover that could" and "The Future of TVA…". Paul Kreitz will supply the refreshments.

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.

Artist's concept) Rovers Opportunity and Spirit were launched a few weeks apart in 2003 and landed in January 2004 at two sites on Mars. Each rover was built with the mobility and toolkit to function as a robotic geologist. By NASA/JPL/Cornell University, Maas Digital LLC - Public Domain,

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: Vacant
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

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

Cosmic Comments
by President Mark Baker

I think it is fitting that we take the time to recognize the missions of contribution that have left us recently…Kepler, Dawn, and Opportunity.

I'd especially like to recognize the joy Oppy brought to those of us that follow such things…this "90 day" mission started out on its Martian journey in 2004 and gave us 14 plus years of service and science way above and beyond intentions. If it hadn't finally succumbed to a dust storm of global proportions, who knows how long it would have continued on and on and on?? One of the greatest assets of this little rover turned out to be its flexibility…I mean, its research was only thought to be viable for 3 months, yet its mission team kept making adjustments and adapting Oppy for bigger and better things. Heck, the last few years of operation it even drove backwards to protect a suspect wheel…nothing was going to take this simple machine down it seemed. But in the end, Mars won…

I'm especially grateful for all those that worked on the Spirit/Opportunity projects, starting from inception back in the late 90's until the bitter end…the team did good!!! And is another proof positive what people can do when given the chance…

Which is the same for our TVA team…we are given many opportunities to do good in our communities and we do a great job!!! So again, as always, thanks for what you all do to open up the heavens for those who maybe wouldn't otherwise even look up!! You are their Opportunity…and Spirit…and Kepler…and Dawn

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)

ALL TIMES ARE LOCAL PST WILDOMAR/MURRIETA/TEMECULA

Times are given in 24-hour time as: (hh 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)

Moon Phases for the month by date:

Monday the 06th @ 0805 NEW in Aquarius
Tuesday the 14th @ 0328 FIRST QTR in Taurus
Tuesday the 20th @ 1843 FULL in Virgo
Tuesday the 27th @ 2110 THIRD QTR in Sagitarius

Apogee comes on 2019-03-04 @ **0327** – 406, 390 km (252, 520 mi)
Perigee comes on 2019-03-18 @ **2348** – 359, 380 km (223, 309 mi)

2019 has: (13) new moons, (12) 1st Qtr moons, (12) Full moons, (12) 3rd Qtr moons (0) Blue moons and (1) Black moon

Daylight Savings: (Pacific time is Timezone Uniform -8 GMT [-7 GMT PDT])
A great deal of procedural work is required before CA begins observing permanent Daylight Saving. Until then we remain on our previous date changes.
Starts: **2019 MAR 10 Sunday 0200 PST**
Ends: **2019 NOV 03 Sunday 0200 PDT**

Luna: Luna will be peeking above the horizon about fifteen minutes past three in the morning on the first. Luna is heading toward new on the 6th of the month so you should have some dark nights until mid-month, when Luna has gotten around to rising about **1213** local time and won't be setting until **0250+**. Luna will be heading into Full by the 20th. The end of the month we're deep into the third-quarter and dark night viewing will be back. In fact on the 31st Luna has hit the pillow by 1508 and you will have a full dark night for viewing.

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

6 March: Evening – New Moon. 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. (http://SeaSky.org/)

20 March: Evening – March Equinox. The March equinox occurs at 13:58. The Sun will shine directly on the equator and there will be nearly equal amounts of day and night throughout the world. This is also the first day of spring (vernal equinox) in the Northern Hemisphere and the first day of fall (autumnal equinox) in the Southern Hemisphere. (**http://SeaSky.org/**)

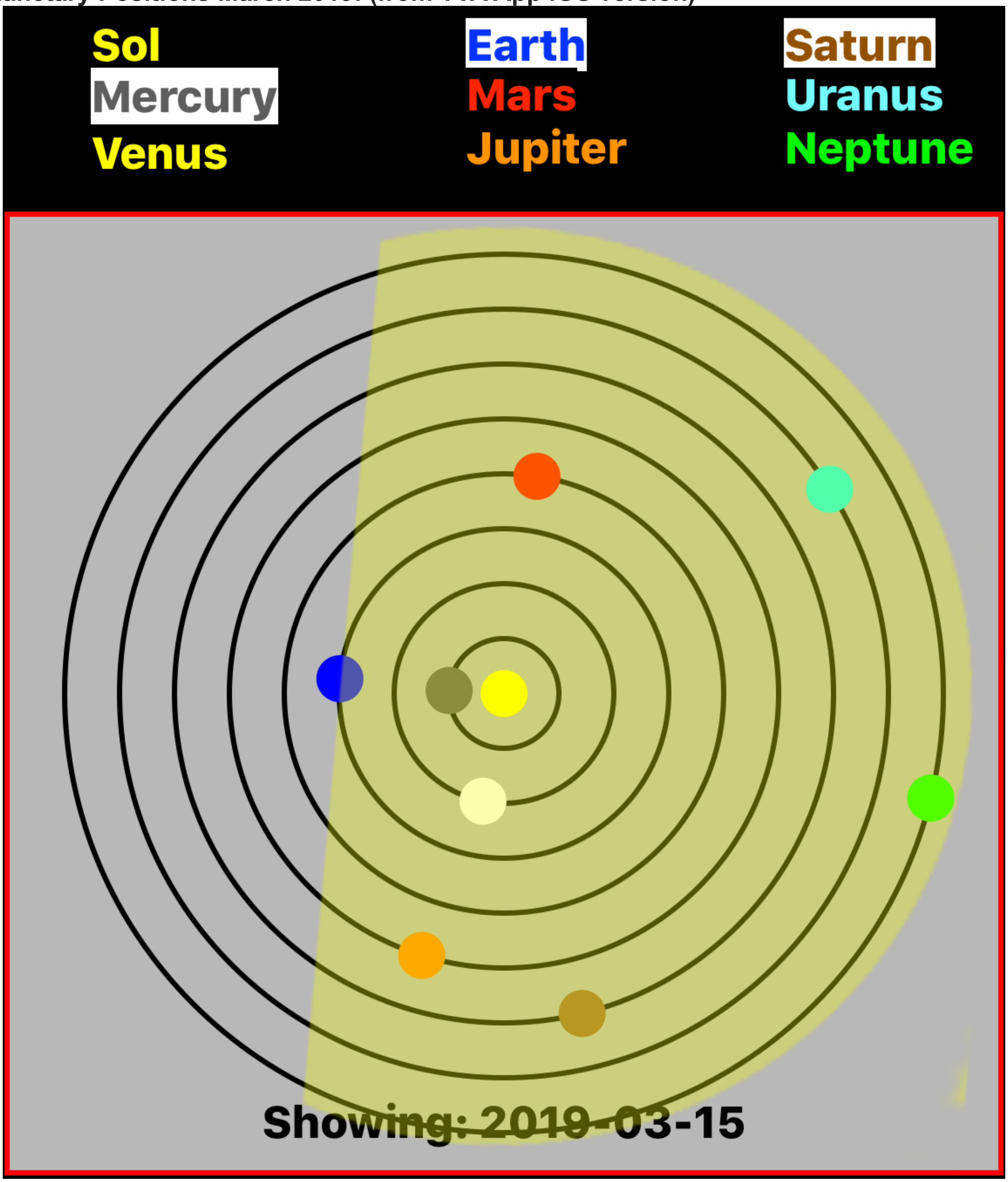
21 March: Evening Full Moon – Supermoon. This full moon was known by early Native American tribes as the Full Worm Moon because this was the time of year when the ground would begin to soften and the earthworms would reappear. This moon has also been known as the Full Crow Moon, the Full Crust Moon, the Full Sap Moon, and the Lenten Moon. This is also the last of three supermoons for 2019. The Moon will be within two days of its closest approach to the Earth and may look slightly larger and brighter than usual. (http://SeaSky.org/)

Algol minima: (All times PST/PDT)

03/01/19	0419
03/04/19	1308
03/07/19	0958
03/10/19	0647
03/13/19	0336
03/16/19	0026
03/18/19	2115
03/21/19	1804
03/24/19	1453
03/27/19	1143
03/30/19	0210

Planets:

Planetary Positions March 2019: (from TVA App iOS version)



Mercury: Mercury is an Evening star on the first of the month visible from about **1800** until it sets at **1910**. The sun sets before Mercury until about the 16th when Mercury becomes a morning star. On the 23rd Mercury will be within 2° 52' 10" of Neptune in the early morning sky at **0551**.

From then until the 31st Mercury will be visible in the early morning sky until just after astronomical dawn.

- **Venus:** Is the Morning Star. Venus is also looping toward the sun and is visible from when she rises at **0411** on the first. By mid-month Venus is rising at **0514** and rising at **0510** by the end off the month.
- **Mars:** Mars is still visible this month rising on the first in the midmorning at about **0855**. Transiting by **1542** and not setting until **2229**. Mid-month finds Mars visible about the same time and setting around **2320**. You will have a Waxing Gibbous Moon to contend with however about 70% illuminated. By the end of March Mars will be rising during daylight and transiting before Astronomical Dusk but doesn't set until **2309**. And the moon will be back where it belongs; so as to set by noon.
- **Jupiter:** Jupiter is back in the evening sky but doesn't rise until **0137** on the first of the month and transiting at **0637**. By mid-month Jove is up at **0148** and transits by **0648**. The end of the month sees a rise time of **0050** and a transit at **0549**. All early morning times but at least Jove is headed in the right direction.
- **Saturn:** Saturn is trailing Jove rising at **0327** on the first and transiting after sunrise. Saturn is rising in the early morning about **0336** by mid-month. By the end of the month you'll get a little longer view of Saturn as it rises at **0236** and won't get washed out until sunrise.
- **Uranus:** Uranus is still a good visual find if somewhat challenging. On the first Uranus will become visible after sunset about **1800**. Uranus will set around **2135**. Uranus is leading Mars to the east about 10° 48' 31". On the ides of March Uranus will be more difficult to find with the Waxing Gibbous Moon shining at 68% illuminated. Still you should be able to find it before it sets at **2143**. By the 31st the moon is once again nearer the sun and you'll be able to find Uranus from sometime sfter sundown until about **2044**.
- **Neptune:** Neptune is lost in the Sun in the beginning of the month. By the 15th Neptune has moved into being a morning object but won't really be visible until around the 26 but even at 7.95 you'll be pushing the resolving power of even moderate sized scopes.
- **Pluto:** Pluto is back as a morning object, rising at **0347** but the sun not rising until **0616**. Mid-month finds Pluto rising at **0353** and the end of the month Pluto rises about **0251** and the sun follows at **0638**.

Asteroids:

- Okay. I searched for asteroids in 2019 with a reasonable magnitude; say less than or equal to +10 in March there is nothing except the regulars: Juno, Vesta. Hebe, Eros and Herculina. So consult your local planetarium software or try https://www.asteroidsnear.com/year?year=2019.

Meteors:

- Nothing really in March. April will see the Lyrids return.

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.
- Unless some bright long period comets are discovered it promises to be a disappointing year for comet enthusiasts. (https://www.ast.cam.ac.uk)

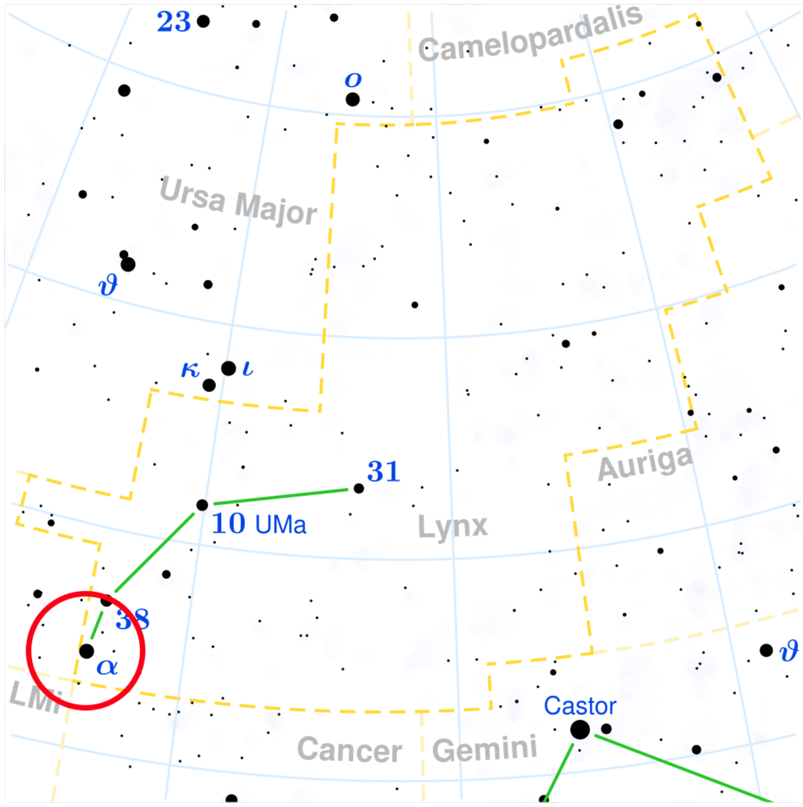
Deep Sky:

Notes:

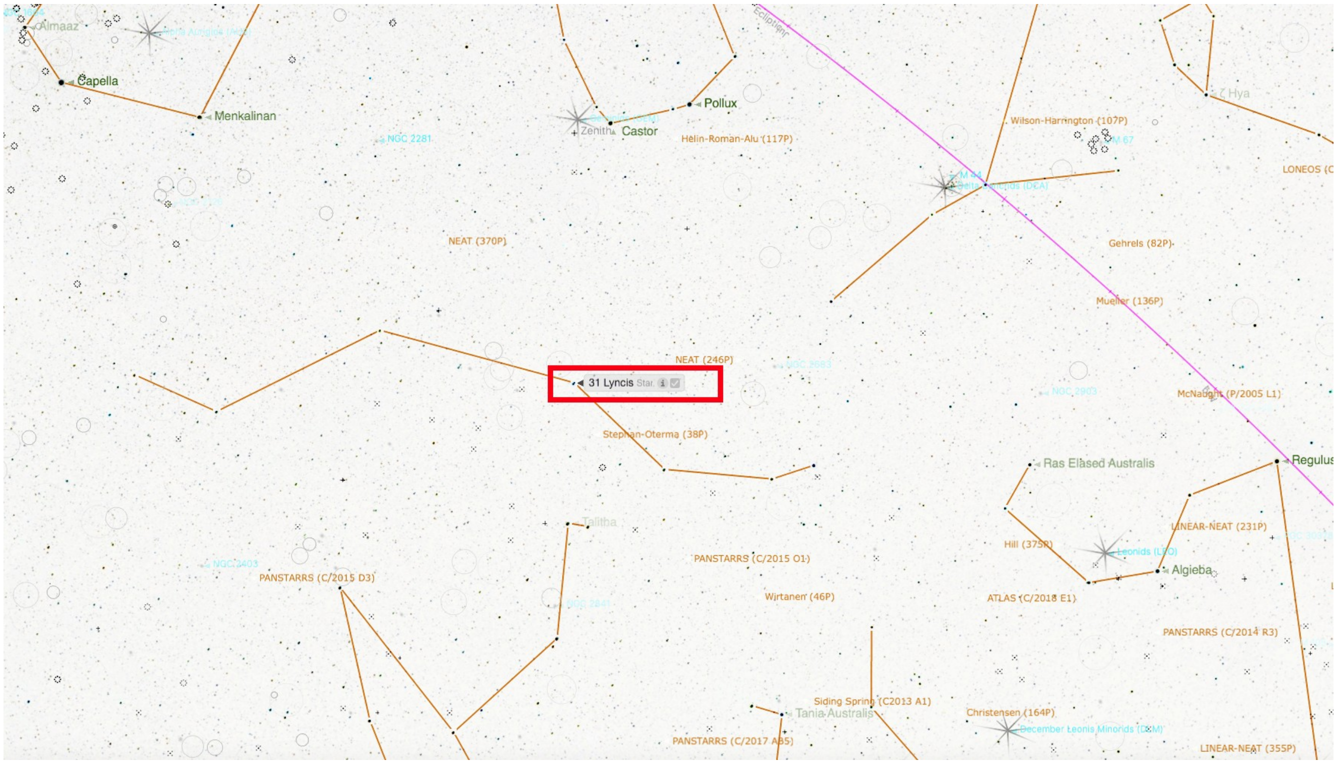
L/Z abbreviation for ALT/AZ
R/D abbreviation for Right Ascension/Declination
α is right ascension
δ is declination
In each case, unless otherwise noted, you should look for the following on or about the 15th Day of March 2019 at 2100 PDT and you will have about 20 minutes of viewing time total.

Lets look for some more unusual objects:

- **Alpha Lyncis:** (α Lyn, α Lyncis) is the brightest star in the northern constellation of Lynx with an apparent magnitude of +3.13. Unusually, it is the only star in the constellation that has a Bayer designation. Based upon parallax measurements, this star is located about 203 light-years (62 parsecs) from the Earth. This is a giant star that has exhausted the hydrogen at its core and has evolved away from the main sequence. It has expanded to about 55 times the Sun's radius and it is emitting roughly 673 times the luminosity of the Sun. The estimated effective temperature of the star's outer envelope is 3,882 K, which is lower than the Sun's effective temperature of 5,778 K, and is giving Alpha Lyncis an orange hue that is characteristic of K-type stars. Alpha Lyncis is a suspected small-amplitude red variable star that changes apparent magnitude from +3.17 up to +3.12. This variability pattern typically occurs in stars that have developed an inert carbon core surrounded by a helium-fusing shell, and suggests that Alpha Lyncis is starting to evolve into a Mira-type variable. (Wikipedia)



Location of α Lyncis (red circle)
Epoch J2000 Equinox J2000
α: 09h 21m 03.30074 δ: +34° 23′ 33.2245″[1



Prepared by:Clark Williams from StarryNight Pro Plus 8

- **31 Lyncis: AKA –** Alsciaukat, is the fourth-brightest star in the constellation of Lynx. It is an orange giant star located about 390 light-years from the Sun. Its apparent magnitude is +4.25 and it belongs to the spectral class K4.5III-IIIb. A 1993 study found that it varied in brightness by 0.05 magnitude over 25 to 30 days. Analysis of HIPPARCOS data showed that it was slightly variable by 0.0055 magnitude (Wikipedia)

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

For now – Keep looking up.

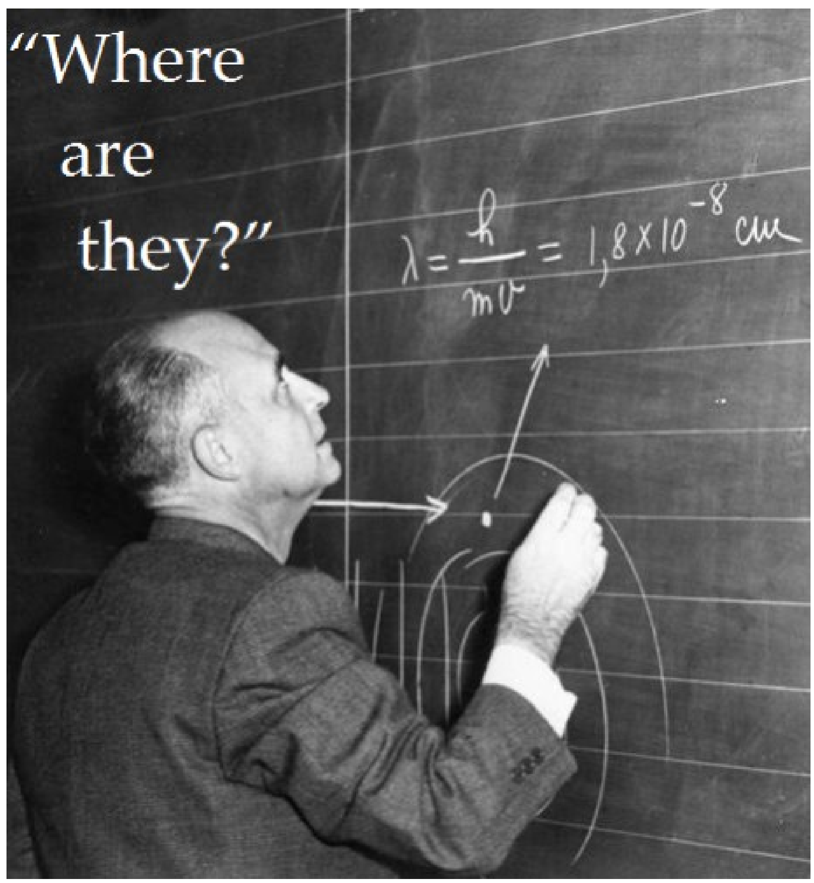
Random Thoughts
by Chuck Dyson

WILL YOUR GRAND KIDS ACTUALLY LAUNCH A ROCKET TO THE STARS?

The first questions that we should probably ask are “Who in the heck gave them permission to do that and who in blue blazes do they think is giving them the money for this crazy lark?” OH, wait, that’s right they will be the adults and in charge not us.

The quest to reach the stars began, for me, on December 2 1942 under the football stadium of the University of Chicago when one of the scientist slowly pulled cadmium rods out of a graphite pile and Geiger counter sensors inside of the pile started clicking like mad. As the rods were reinserted the clicking died away to its background rate. Standing in the corner the pope smiled because he knew exactly what his team had done. The pope was the nickname given to Enrico Fermi because he was almost always correct on his predictions and the pope knew that he had the ability to tap into the power of the atom and could regulate and control the power flux.

Years later (1950 to be exact) at a conference at the Alamogordo labs that Fermi was attending, there was a speaker talking about the size and age of the universe. Later on at the evening dinner Fermi suddenly looked up at the other people at the table and said “Where are they!”. This was the origin of Fermi’s Paradox that asks, at its heart, if the universe is over 13 billion years old and there are at least 100 billion stars in our galaxy alone and our sun is one of the younger suns in the galaxy - why have we not seen evidence of other civilizations. In Fermi’s mind if a civilization had only a billion year head start on us and it took them an extra five hundred million years to get to where we are now and another one hundred millions years to actually achieve interstellar travel then that would still leave this civilization four hundred million years to bop around the galaxy, as it were; so, where are they?



We have three basic options when dealing with this dilemma. First, we can just sit around all day asking ourselves “Where do you think they are?” and actually do nothing. Second, we can sit around all day and night and listen for their radio, television, and cell phone signals. This assumes that they are as crazy about radios, televisions, and cell phones as we are, but it at least has the possibility of proving that they are out there. It cannot however prove that they are not out there. Finally, we can say to ourselves "I don't care if they are or are not out there, I need to go to the stars myself." Sounds simple, but is it?

Let's tackle this problem by asking the following questions; Where do I want to go?, Why do I want to go there?, and How can I get there?

"Where do I want to go" is fairly simple to answer; because stars are so far away I want to go to a nearby star and there are several stars that we can choose between. The two top contenders today (because they are close and have planets - how cool is it that we get to study a star and a planet up close for the price of one star shot) are Barnard's Star at 6 light years away with a 3x Earth mass planet with an estimated surface temperature of -170 Celsius and Proxima Centauri at 4.3 light years away with a planet, Proxima Centauri b, that is 1.27x to possibly 8x Earth masses and a surface temperature of -38 Celsius.

If it were up to me I would go to Proxima Centauri as the star is a little closer, that is if you are willing to call a distance of 16,083,000,000,000 kilometers a little closer, and the Proxima planet is a little warmer and has a small chance of having liquid high salt content water on its surface. The really neat thing about the Proxima planet is that in our solar system we have no planet that is larger than Earth but smaller than Neptune and yet in all of the exoplanets that have been identified to date this is the most common planet size and is well worth studying if only to see what, apparently, the most common planet in the galaxy looks like up close.

The final thing we need to decide on is how long we are willing to sit in a spaceship or, if it is a one way mission, how long are we willing to wait for data. Let's say that we have decided that we would like the mission competed within one human life span. So say we launch when the rocket team is mostly in their late twenties and early thirties and this will be a one way trip. Data to come back by space email. If we launch our probe at *0.1c* (*c*=the speed of light) then it will take 43 years to get to our star and 4.3 years for the data to get back to Earth. If our rocket team person was 30 at launch he or she would now be 77 to 78 years old - mission accomplished. If, however, we want to send a manned probe and return it within one human lifetime we must now increase our speed to *0.2c* and that is quite the big deal

Now that we know where we want to go and why we want to go there and how long we want to take to get there, the next step is to figure out how we can get there. But first, a little equation in the form of the Tsiolkovsky rocket equation:

$$\Delta v = ve \ln \frac{mo}{mf}$$

What this equation tells is how rockets work and this is what it says; the change in the rocket's velocity Δv will be proportional to v_e, the velocity of the rocket exhaust. The faster it comes out, the faster you get to go. In the last element in the equation the $\frac{mo}{mf}$,m_o is the mass of the rocket at the start of the burn and the m_f is the mass of the rocket at the end of the burn. The differences is the amount of fuel that was burned so the more fuel that we burn, the faster we go. There is a catch or a problem however, the $\ln$ that I skipped over says that when you double the fuel load you do not, ever, get to go twice as fast but more like 1.2 times as fast and if you triple the weight of the fuel it is even a smaller increase so in order to get your rocket to go two or three times faster you must have a massive increase in the amount of fuel that you burn or you must find a fuel that gives you a much higher velocity in the rocket's exhaust. This turns out to be the key to faster rockets.

Let's now look at some of our options for our first stellar trip. As we are all familiar with the good old chemical rocket, we will start with that one. The biggest, the baddest, and the fastest rocket to date was the mighty Saturn 5. The Saturn 5 was able to achieve a speed of 40,225 kilometers per hour and that sounds really fast but remember that we are measuring the distance to our target star in light years and light travels 299,792 kilometers per second. If we do the math we see that our rocket is only going 11.736 kilometers per second, looking a little slow.

If we do a little more math we find that our mighty Saturn 5 will arrive at Proxima Centauri in only 109,842 years, this is obviously not going to work out. So, the next question is can we scale up the rocket and make it faster, say 10% of the speed of light, as this would get our rocket to Proxima Centauri in only 43 years. This is where the conservation of momentum equations really ruin our day because *Force = Mass * Acceleration* can also be written as *Acceleration = Force÷ Mass* and this says that as our mass goes way up, our acceleration goes way, way down. Anyway a group of rocket geeks worked out that you could build a Saturn 5 rocket that would achieve a speed that was *0.1c* but the fuel tank would need to be slightly larger than the known universe, next rocket idea please.

NASA has had remarkable success with its Dawn ion engine powered space probe. As a review, ions are atoms or atomic nuclei that have had some or all of their electrons stripped off. If all of the atom's electrons are stripped off, you are left with a naked nuclei and if the environment that that the nuclei are in does not permit the electrons to rejoin the nuclei then we call that a plasma. If some or most of the electrons are drawn out of the plasma, the naked positively charged nuclei are desperate to regain their negative charges. The ion engine works by creating a negatively charged field at one end and the positive nuclei rush towards it at very high speeds. Because most of the mass of an atom is in the nuclei, accelerating the nuclei to very high speeds is a highly efficient way to accelerate your rocket. The problem is the hot excited nuclei all have the same electric charge and definitely do not like to be close to their neighbors.

The result of all of this is you have a low density gas and because the density is low and although each ion nuclei has much higher kinetic energy than each molecule of gas exiting the chemical fuel engine, gas exits the chemical fuel engine at 2.55 kilometers per second and the xenon nuclei exit the Dawn engine at 90 kilometers per second, there are many, many more molecules exiting the liquid rocket engine than the ion engine; so, a chemical rocket is inefficient but produces very high thrust over a period of minutes and an ion engine rocket is efficient but produces very little thrust over a period of days, weeks or months with a resultant higher terminal velocity.

The ion rocket engine that is today's hope is the Variable Specific Impulse Magnitoplasma Rocket, VASIMR for short. The VASIMR engine is still in Earth bound development but it is working and it uses magnetic coils to both compress the plasma and heat the plasma, then eject it out of the engine at very high speeds – 1,020 kilometers per second. The scientists working on this project are certain that VASIMR design rockets will achieve speeds of 201,125 kilometer per hour.

Will this speed get us to the stars? 1,020 kilometers per second is *0.0185c* and that will get us to Proxima Centauri in only 23,069 years. Although the ion rocket will not be the one to get our probes to the stars they probably will be the rockets that are the people and cargo movers for our solar system.

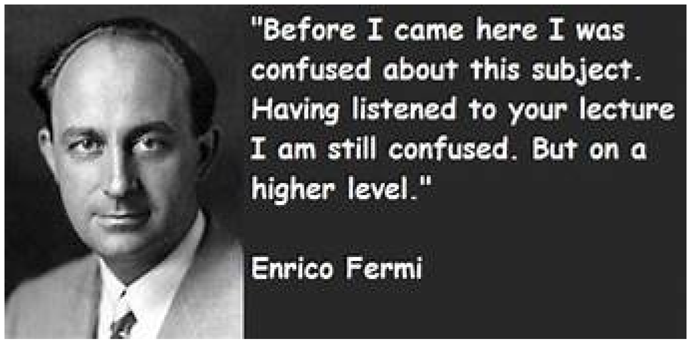
Must we use a star to get to a star? Will fusion rockets get us to the stars?

Several possibilities for this do exist already on Earth. In 2014, at the Lawrence Livermore Laboratories, the National Ignition Facility (NIF) laser fired fusion project did achieve enough fusion in a target to produce more energy than was used to create the fusion. So a fusion powered rocket is possible although most scientists favor the Tokamak magnetic containment vessel over the laser for space use. The problem being that the Tokamak is, as of this writing, stalled at 65% efficiency meaning that it takes 35% more power in than comes out. The other fusion option is to take, I kid-you-not, 300,000 one kiloton hydrogen bombs and set them off one by one in back of your space ship and the ship will ride the pressure waves to at least *0.1c*. There have been designs proposed and worked up for both of these scenarios and they will deliver an unmanned probe to Proxima Centauri in 43 years, doable but at least 50 years off.

It appears that everyone's favorite long term project for manned space flight is the matter/antimatter ship. Why is the idea of an antimatter ship so popular? For starters, since 1955 antimatter has been produced in particle accelerators and also at the NIF by hitting gold foil with the laser, the laser's power level was on crazy high. The CERN facility in Europe has even been able to produce anti-Hydrogen atoms. There has also been remarkable progress in storing antimatter in electronic traps for minutes at a time. With vastly improved production and storage abilities the ion rocket becomes a reality and speeds of *0.3c* and even *0.6c* are a reality. At *0.6c* the stars are definitely within the grasp of humans, but the end point of this project is so far off you will need your binoculars to see it.

Is there any way we could send a probe to Proxima Centauri in the next ten years? Enter Breakthrough Starshot. Breakthrough Starshot is a partially funded project to produce a large but very light weight sail and a small, think one computer sized chip board, chip payload. After a launch into a low Earth orbit by a regular rocket the sail will unfold and be accelerated to Proxima Centauri by, choose one: Earth based, space based, or lunar based, lasers, very powerful lasers. The speed of the craft will depend on the intensity of the lasers and the amount of time they can be focused on the sail. It is expected that the sail will reach *0.05c* to *0.1c* and will not slowdown at the target but be a flyby probe. Because the actual probe is so small dozens could be produced to give us multiple flyby's of our target. This project could possibly launch in the next decade, with a LOT more funding than the $1,000,000 funding that they now have.

Cheers, and keep looking for those aliens
Chuck



Springtime Planet Party
By David Prosper

March brings longer days for Northern Hemisphere observers, especially by the time of the equinox**.** Early risers are treated to the majority of the bright planets dancing in the morning skies, with the Moon passing between them at the beginning and end of the month.

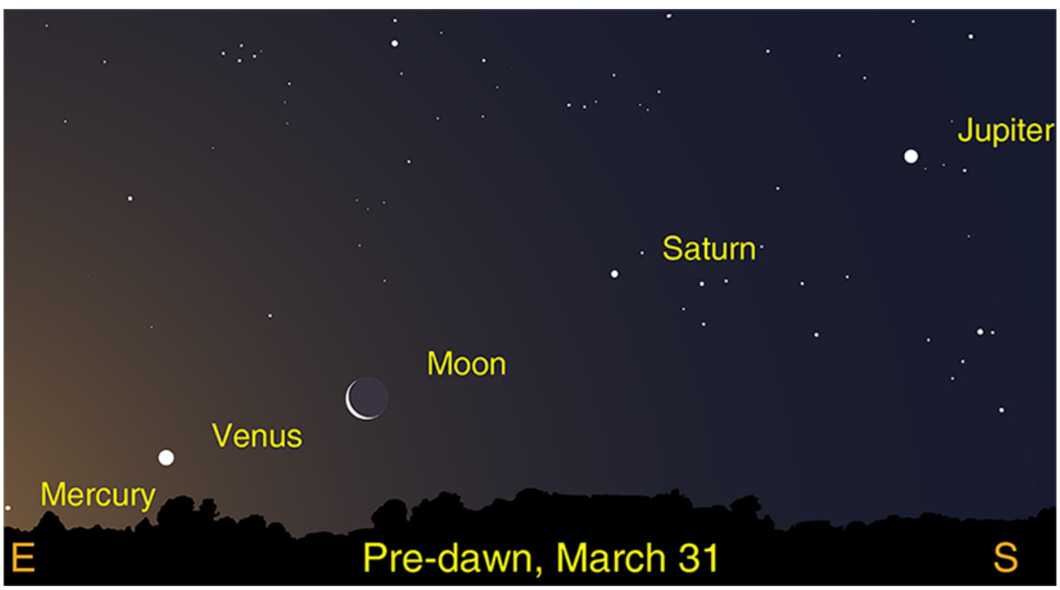
The **vernal equinox** occurs on **March 20**, marking the official beginning of spring for the Northern Hemisphere. Our Sun shines equally on the Northern and Southern Hemispheres during the moment of equinox, which is why the March and September equinoxes are the only times of the year when the Earth's north and south poles are simultaneously lit by sunlight. Exacting astronomers will note that the length of day and night on the equinox are not *precisely* equal; the date when they are closest to equal depends on your latitude, and may occur a few days earlier or later than the equinox itself. One complicating factor is that the Sun isn't a point light source, but a disc. Its edge is refracted by our atmosphere as it rises and sets, which adds several minutes of light to every day. The Sun doesn't neatly wink on and off at sunrise and sunset like a light bulb, and so there isn't a perfect split of day and night on the equinox - but it's very close!

Ruddy **Mars** still shines in the west after sunset. Mars scoots across the early evening skies from Aries towards Taurus and meets the sparkling Pleiades star cluster by month's end.

March opens with the morning planets of **Jupiter**, **Saturn**, and **Venus** spread out over the southeastern horizon before sunrise. A crescent **Moon** comes very close to Saturn on the 1st and occults the ringed planet during the daytime. Lucky observers may be able to spot **Mercury** by the end of the month. March 31 opens with a beautiful set of planets and a crescent Moon strung diagonally across the early morning sky. Start with bright Jupiter, almost due south shortly before dawn. Then slide down and east towards Saturn, prominent but not nearly as bright as Jupiter. Continue east to the Moon, and then towards the beacon that is Venus, its gleam piercing through the early morning light. End with a challenge: can you find elusive Mercury above the eastern horizon? Binoculars may be needed to spot the closest planet to the Sun as it will be low and obscured by dawn's encroaching glow. What a way to close out March!

Discover all of NASA's current and future missions at nasa.gov

Earth from orbit on the March equinox, as viewed by EUMETSAT. Notice how the terminator – the line between day and night - touches both the north and south poles. Additional information can be found at http://bit.ly/earthequinox Image credit: NASA/Robert Simmon



The morning planets on March 31. Image created with assistance from Stellarium.

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.