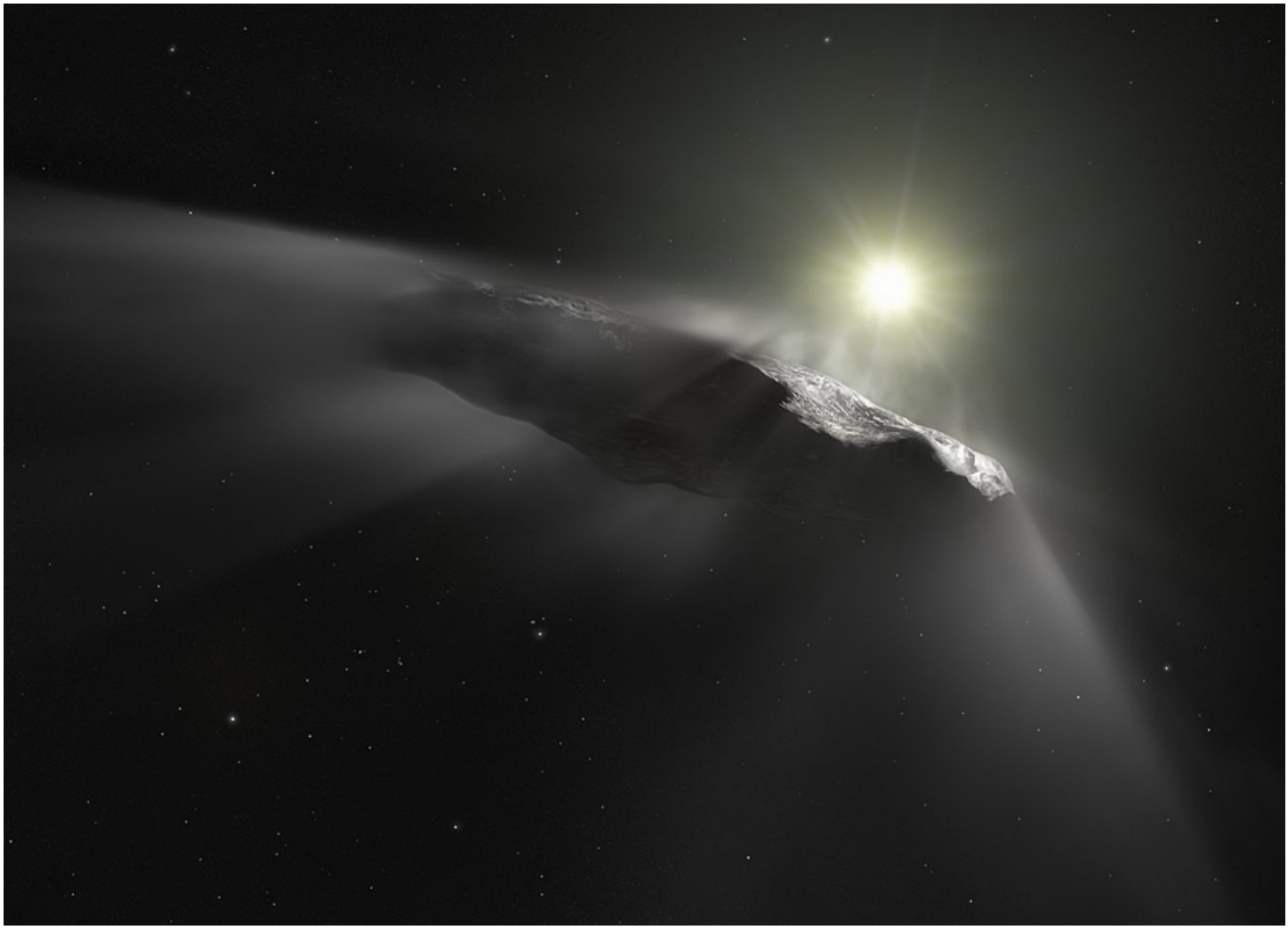
Space News Update

— September 28, 2018 —

Contents

1. Gaia Finds Four Candidate Stars That Could Be 'Oumuamua's Home



Using data from ESA's Gaia stellar surveyor, astronomers have identified four stars that are possible places of origin of 'Oumuamua, an interstellar object spotted during a brief visit to our Solar System in 2017.

The discovery last year sparked a large observational campaign: originally identified as the first known interstellar asteroid, the small body was later revealed to be a comet, as further observations showed it was not slowing down as fast as it should have under gravity alone. The most likely explanation of the tiny variations recorded in its trajectory was that they are caused by gasses emanating from its surface, making it more akin to a comet.

But where in the Milky Way did this cosmic traveller come from?

Comets are leftovers of the formation of planetary systems, and it is possible that 'Oumuamua was ejected from its home star's realm while planets were still taking shape there. To look for its home, astronomers had to trace back in time not only the trajectory of the interstellar comet, but also of a selection of stars that might have crossed paths with this object in the past few million years.

"Gaia is a powerful time machine for these types of studies, as it provides not only star positions but also their motions," explains Timo Prusti, Gaia project scientist at ESA.

To this aim, a team of astronomers led by Coryn Bailer-Jones at the Max Planck Institute for Astronomy in Heidelberg, Germany, dived into the data from Gaia's second release, which was made public in April.

The Gaia data contain positions, distance indicators and motions on the sky for more than a billion stars in our Galaxy; most importantly, the data set includes radial velocities - how fast they are moving towards or away from us - for a subset of seven million, enabling a full reconstruction of their trajectories. The team looked at these seven million stars, complemented with an extra 220 000 for which radial velocities are available from the astronomical literature.

As a result, Coryn and colleagues identified four stars whose orbits had come within a couple of light years of 'Oumuamua in the near past, and with relative velocities low enough to be compatible with likely ejection mechanisms.

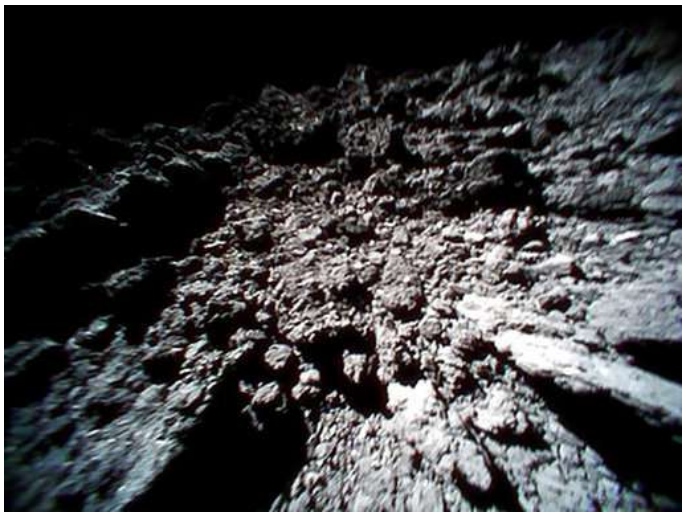
All four are dwarf stars - with masses similar to or smaller than our Sun's - and had their 'close' encounter with the interstellar comet between one and seven million years ago. However, none of them is known to either harbour planets or to be part of a binary stellar system; a giant planet or companion star would be the preferred mechanism to have ejected the small body.

While future observations of these four stars might shed new light on their properties and potential to be the home system of 'Oumuamua, the astronomers are also looking forward to future releases of Gaia data. At least two are planned in the 2020s, which will include a much larger sample of radial velocities, enabling them to reconstruct and investigate the trajectories of many more stars.

"While it's still early to pinpoint 'Oumuamua's home star, this result illustrates the power of Gaia to delve into the history of our Milky Way galaxy," concludes Timo.

Source: Spaceref.com Return to Contents

2. Photos from Japanese Space Rovers Show Asteroid Is ... Rocky



New photos taken on the surface of an asteroid show that it is (drumroll, please) ... rocky.

It may be no surprise, but Japan space agency scientists and engineers are nonetheless thrilled by the images being sent to Earth by two jumping robotic rovers that they dropped onto an asteroid about 280 million kilometers (170 million miles) away.

The Japan Aerospace Exploration Agency posted the latest photos on its website late Thursday. They show slightly tilted close-ups of the rocky surface from different locations.

"I cannot find words to express how happy I am that we were able to realize mobile exploration on the surface of an asteroid," project manager Yuichi Tsuda said on the space agency's website.

It took more than three years for the unmanned Hayabusa2 spacecraft to reach the vicinity of asteroid Ryugu. One week ago, the craft successfully dropped a small capsule with two rovers onto its surface. The rovers, each about the size of circular cookie tin, don't have wheels but jump around the asteroid.

Hayabusa2 is scheduled to drop a German-French lander with four observation devices onto the asteroid next week. It later will attempt to land on the asteroid itself to collect samples to send back to researchers on Earth.

Source: Phys.org Return to Contents

3. Titan First-Ever Detected Dust Storms Proves the Moon [Titan] to be More Earth-like than Ever

Ever since the *Cassini* orbiter entered the Saturn system in July of 2004, scientists and the general public have been treated to a steady stream of data about this ringed giant and its many fascinating moons. In particular, a great deal of attention was focused on Saturn's largest moon Titan, which has many surprising Earth-like characteristics.

These include its nitrogen-rich atmosphere, the presence of liquid bodies on its surface, a dynamic climate, organic molecules, and active prebiotic chemistry. And in the latest revelation to come from the *Cassini* orbiter, it appears that Titan also experiences periodic dust storms. This puts it in a class that has so far been reserved for only Earth and Mars.

The discovery was made by an international team scientists from the Institut de Physique du Globe de Paris (IPGP), the Laboratoire de Planétologie et Géodynamique (LPGNantes), the Southwest Research Institute (SwRI), the John Hopkins University Applied Physics Laboratory (JHUAPL), the European Space Agency, NASA's Jet Propulsion Laboratory and multiple universities and research institutes.

The study was based on data acquired by the *Cassini* probe's Visual and Infrared Mapping Spectrometer (VIMS), which acquired images of Titan during its many flybys between May 2009 and

September 2000. As you can see from the animation above (click to animate), the atmosphere underwent a lot of changes in that time, revealing bright patches that were interpreted as dust storms.

As Sebastien Rodriguez, an astronomer with the IPGP at the Université Paris Diderot and the paper's lead author, explained in a recent NASA press release:

"Titan is a very active moon. We already know that about its geology and exotic hydrocarbon cycle. Now we can add another analogy with Earth and Mars: the active dust cycle, in which organic dust can be raised from large dune fields around Titan's equator."

Already, scientists were aware of the ways in which Titan is similar to Earth. Aside from being the only other celestial object in the Solar System with a substantial nitrogen atmosphere, it is also the only other Solar body where stable bodies of liquid still exist on its surface. And like on Earth, this liquid cycles between the atmosphere and the surface.

But whereas on Earth, this cycle consists of water evaporating, forming clouds, and raining back down onto the surface (i.e. the hydrological cycle); on Titan, the entire process involves methane and ethane. Titan also experiences seasonal variations in weather, much like Earth. At the time when the Sun crosses Titan's equator (the equinox) massive clouds can form in the tropical regions and create methane storms – one of which Cassini witnessed.

Rodriguez and his team first spotted three unusual spots in Titan's equatorial region while analyzing infrared images taken by Cassini in 2009, around the time of the moon's northern equinox. These bright patches were originally mistaken for methane clouds, but further investigation revealed that they had to be something completely different. As Rodriguez explained it:

"From what we know about cloud formation on Titan, we can say that such methane clouds in this area and in this time of the year are not physically possible. The convective methane clouds that can develop in this area and during this period of time would contain huge droplets and must be at a very high altitude — much higher than the 6 miles (10 kilometers) that modeling tells us the new features are located."

Another possibility was that these spots corresponded to features on the surface, such as frozen methane rain or icy lava flows. However, these features would have had a different chemical signature and would have been visible for long periods of time, whereas these spots were only visible for periods ranging from 11 hours to five weeks.

To address this, the team conducted a series of models that revealed that these features were both atmospheric but still close to the surface. They also noticed that the bright spots were located directly above the dune fields around Titan's equator – which are made up of tiny solid organic particles. This left only one explanation, which was that the spots were clouds of dust raised from the dunes.

Granted, the discovery of organic dust clouds is not entirely surprising. For years, scientists have known that this kind of dust forms when organic molecules are caused by the interaction of sunlight with methane in Titan's atmosphere. When they grow large enough, they fall to the surface. In addition, the presence of dunes in the region is indicative of strong winds and the facts that the organic sands can be put in motion.

However, this research is intriguing in that it is the first time that dust storms have ever been observed on Titan. What's more, the knowledge that winds could be transporting organic dust across large distances could also have implications for our understanding of the dynamics on Titan. Basically, Titan may be Earth-like in that it too has a global cycle of organic dust, with similar effects to what it has on Earth.

“We believe that the *Huygens Probe*, which landed on the surface of Titan in January 2005, raised a small amount of organic dust upon arrival due to its powerful aerodynamic wake,” said Rodriguez. “But what we spotted here with *Cassini* is at a much larger scale. The near-surface wind speeds required to raise such an amount of dust as we see in these dust storms would have to be very strong – about five times as strong as the average wind speeds estimated by the *Huygens* measurements near the surface and with climate models.”

Even though the Cassini mission ended on September 15th, 2017, when it was intentionally crashed into Saturn’s atmosphere, scientists are still sifting through the volumes of data it acquired during the 13 years it spent orbiting the ringed gas giant. The discovery that Titan experiences dust storms like Earth and Mars is merely the latest revelation to come from this mission.

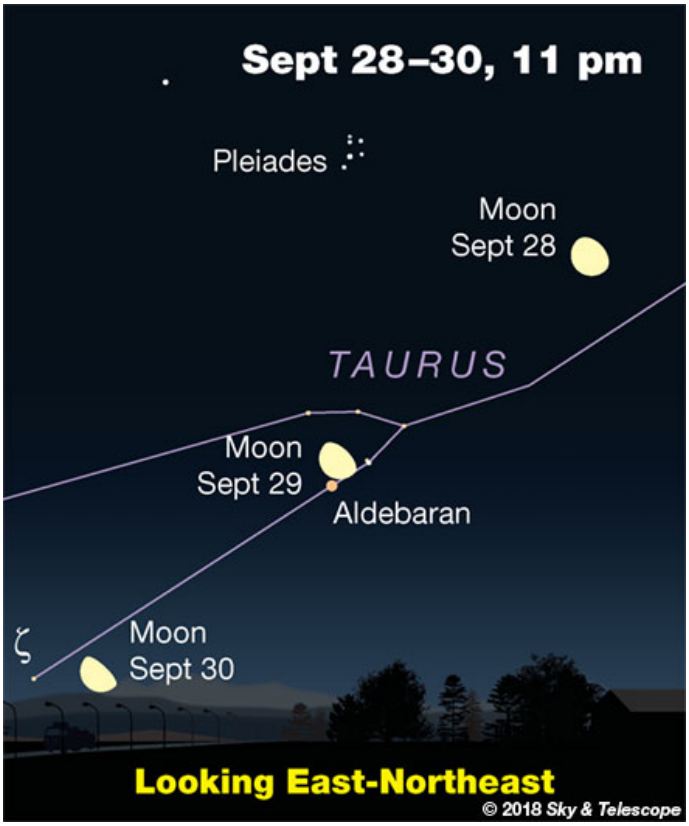
In the future, several robotic missions are being planned for Titan, ranging from balloons and landers, aerial platforms, and helicopters, to paddleboats, and a submarine. Regardless of what form the next mission will take, its objectives will be clear: to learn more about Titan’s dynamic environment and search for evidence of possible life there.

Source: Universe Today Return to Contents

The Night Sky

Friday, September 28

• Late this evening, spot the little Pleiades cluster to the upper left of the Moon, as shown ZT right. When we see the Pleiades climb the eastern sky in autumn, their tiny dipper pattern stands on its handle.



Saturday, September 29

• There's roughly a two-hour window of darkness now between twilight's end and moonrise (for the world's mid-northern latitudes). The window gets longer every night this week. Take the opportunity to work through Jerry Oltion's "Tourist Guide to the Autumn Highlights" for small scopes in the October *Sky & Telescope*, page 28.

• Late tonight when the Moon does rise, it's in company with Aldebaran — though not necessarily quite as shown here. Remember, in these scenes the Moon is always shown three times its actual apparent size, and it's positioned for an observer near the middle of North America (exact for latitude 40° north, longitude 90° west).

By Sunday morning the 30th, the Moon and Aldebaran are shining very high toward the south.

Sunday, September 30

• Algol in Perseus, the prototype eclipsing variable star, should be at its minimum brightness, magnitude 3.4 instead of its usual 2.1, for a couple hours centered on 8:58 p.m. Eastern Daylight Time, when Perseus is in good view from the Eastern time zone well up in the northeast. Algol takes several hours to fade beforehand and to rebrighten after. Comparison-star chart.

Monday, October 1

• The starry W of Cassiopeia stands high in the northeast after dark. The right-hand side of the W (the brightest side) is tilted up. Look along the second segment of the W counting down from the top. It's not quite horizontal. Notice the dim naked-eye stars along that segment (not counting its two ends). The brightest of these, on the right, is Eta Cassiopeiae, magnitude 3.4, a Sun-like star just 19 light-years away with an orange-dwarf companion — a lovely binary in a telescope.

The "one" on the left, fainter, is a naked-eye pair when seen in a dark sky: Upsilon^{1} and Upsilon^{2}Cassiopeiae, 0.3° apart. They're orange giants unrelated to each other, 200 and 400 light-years distant from us. Upsilon^{1} is slightly fainter; that's the farther one.

Source: Sky & Telescope

Return to Contents

ISS Sighting Opportunities

For Denver: No sighting opportunities

Date	Visible	Max Height	Appears	Disappears
Fri Sep 28, 7:48 PM	3 min	15°	13° above NW	10° above NNE
Sat Sep 29, 8:34 PM	1 min	10°	10° above NNW	10° above N
Sun Sep 30, 7:41 PM	2 min	11°	10° above NNW	10° above NNE
Mon Oct 1, 8:27 PM	1 min	10°	10° above N	10° above N

Sighting information for other cities can be found at NASA's Satellite Sighting Information

NASA-TV Highlights

(all times Eastern Daylight Time)

Tuesday, October 2

11 a.m., ISS Expedition 56 In-Flight Educational Event to Wrap Up the "Year of Education on Station" with Flight Engineer Ricky Arnold of NASA (starts at 11:05 a.m.) (all channels)

Watch NASA TV on the Net by going to the NASA website.

Return to Contents

Space Calendar

- Sep 28 - Comet 364P/PANSTARRS At Opposition (0.632 AU)
- Sep 28 - Comet 66P/du Toit At Opposition (1.106 AU)
- Sep 28 - Comet 73P-T/Schwassmann-Wachmann Closest Approach To Earth (1.606 AU)
- Sep 28 - Comet 197P/LINEAR Closest Approach To Earth (1.863 AU)
- Sep 28 - Comet C/2018 R5 (Lemmon) Closest Approach To Earth (2.823 AU)
- Sep 28 - Asteroid 3 Juno Occults 2UCAC 33692420 (12.4 Magntiude Star)
- Sep 28 - Asteroid 4 Vesta Occults 2UCAC 21388198 (11.6 Magnitude Star)
- Sep 28 - Asteroid 1006 Lagrangea Closest Approach To Earth (1.076 AU)
- Sep 28 - Asteroid 78905 Seanokeefe Closest Approach To Earth (1.889 AU)
- Sep 28 - Lecture: Seeking Signs of Life in Ancient Martian Hot Springs, Santa Cruz, California
- Sep 28 - 160th Anniversary (1858), 1st Photograph of a Comet (Donati's Comet by William Usherwood)
- Sep 29 - Asteroid 433 Eros Occults 4U 675-23281 (10.9 Magnitude Star)
- Sep 29 - Aten Asteroid 2015 SO2 Near-Earth Flyby (0.099 AU)
- Sep 29 - Asteroid 4783 Wasson Closest Approach To Earth (1.653 AU)
- Sep 29 - Lecture: The World Above the Tetons, Teton Village, Wyoming
- Sep 29 - 30th Anniversary (1988), STS-26 Launch (Space Shuttle Discovery, TDRS)
- Sep 29 - 80th Anniversary (1938), Benld Meteorite Fall (Hit Car in Illinois)
- Sep 30 - Comet 203P/Korlevic Closest Approach To Earth (3.122 AU)
- Sep 30 - Asteroid 253 Mathilde Occults 2UCAC 25885060 (12.2 Magnitude Star)
- Sep 30 - Asteroid 85047 Krakatau Closest Approach To Earth (0.797 AU)
- Sep 30 - Asteroid 10387 Bepicolombo Closest Approach To Earth (1.346 AU)
- Sep 30 - Asteroid 1772 Gagarin Closest Approach To Earth (1.797 AU)
- Sep 30 - Asteroid 8249 Gershwin Closest Approach To Earth (1.816 AU)
- Sep 30 - Kuiper Belt Object 308933 (2006 SQ372) At Opposition (27.468 AU)
- Sep 30 - Plutino 469372 (2001 QF298) At Opposition (42.486 AU)
- Sep 30 - International Academy of Astronautics (IAA) Academy Day, Bremen, Germany
- Oct 01 - HOT [Sep 25] NASA's 60th Birthday (1958)
- Oct 01 - Atira Asteroid 2017 XA1 Closest Approach To Earth (1.216 AU)
- Oct 01 - Asteroid 293934 MPIA Closest Approach To Earth (1.231 AU)
- Oct 01 - Asteroid 12757 Yangtze Closest Approach To Earth (1.724 AU)
- Oct 01 - Lecture: Exoplanets Across the Spectrum, Ithaca, New York
- Oct 01 - NEW [Sep 27] Colloquium: I Like to Myself Believe That Planet 5 Turns Slowly, Tucson, Arizona
- Oct 01 - 15th Anniversary (2003), Formation of the Japan Aerospace Exploration Agency (JAXA)
- Oct 01 - 150th Anniversary (1868), Lodran Meteorite Fall in Pakistan

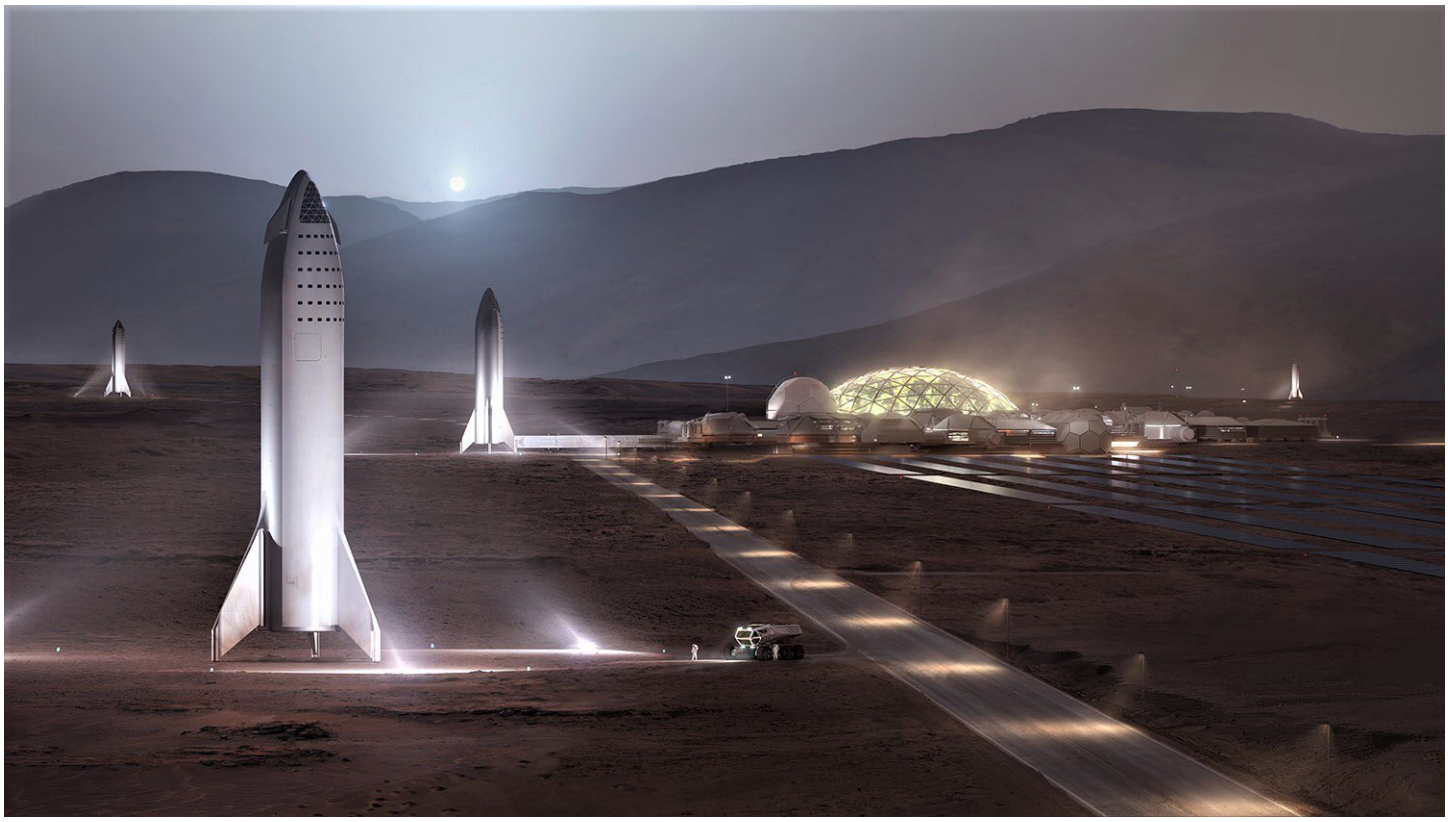
Happy Birthday!

Source: JPL Space Calendar

Return to Contents

Food for Thought

Musk Gives an Update on When a Mars Colony Could be Built



Elon Musk is well-known for his ability to create a media sensation. Scarcely a week goes by that the founder of SpaceX and Tesla doesn't have an announcement or update to make – often via his social media outlet of choice, twitter. And as a major figure in the NewSpace industry, anything he says is guaranteed to elicit reactions (both critical and hopeful) from the space community and general public.

Just last week (on Monday, Sept. 17th), he revealed new information about the *Big Falcon Rocket* (BFR) and who its first passenger would be when it conducts its first lunar mission (which is planned for 2023). And on Friday (Sept. 21st), Musk shared some updated plans on when a SpaceX Martian colony could be established. According to the tweet he posted, his company could build a base on Mars (Mars Base Alpha) as early as 2028.

The discussion that led to this announcement began when Musk posted a new rendering of SpaceX's proposed Martian Base (shown at top). As you can see, the image included updated illustrations of the BFR based on the latest design details that Musk shared during last week's SpaceX press conference. Three of the updated spacecraft are shown on the Martian surface next to Mars Base Alpha.

This prompted Chris Bergin, the chief editor of NASA Space Flight, to ask the question of when such a base might be possible. To this, Musk replied "Probably 2028 for a base to be built". This led to mixed reactions, which naturally included skepticism as well as praise. As with many of Musk's previous announcements, much of the skepticism was focused on the proposed timeline.

To be fair, 2028 is an optimistic appraisal for constructing a Martian base, considering that production of the BFR began this past March and NASA is not even sure if it can conduct a crewed mission to Mars by the 2030s. However, Musk is nothing if not known for his optimistic projections. And while these have been subject to revision in the past, SpaceX has earned a reputation for delivering on its promises.

These include the development of the Falcon 9 rocket, the development of the Falcon Heavy rocket, making both launchers reusable, and the deployment of internet satellites. At present, the first suborbital test flights are planned for 2019 and Musk has stated that he hopes to commence cargo flights as early as 2022, followed by the first crewed flight to Mars by 2024. As it states on their website:

"The objectives for the first mission will be to confirm water resources, identify hazards, and put in place initial power, mining, and life support infrastructure. A second mission, with both cargo and crew, is targeted for 2024, with primary objectives of building a propellant depot and preparing for future crew flights. The ships from these initial missions will also serve as the beginnings of the first Mars base, from which we can build a thriving city and eventually a self-sustaining civilization on Mars."

While these timelines could also be subject to revision, it is clear that Musk is serious in his commitment to conduct regular missions to Mars and establish a human presence there. After all, when Musk founded SpaceX back in 2002, he did so for the express purpose of reducing the cost associated with space travel and enabling the colonization of Mars.

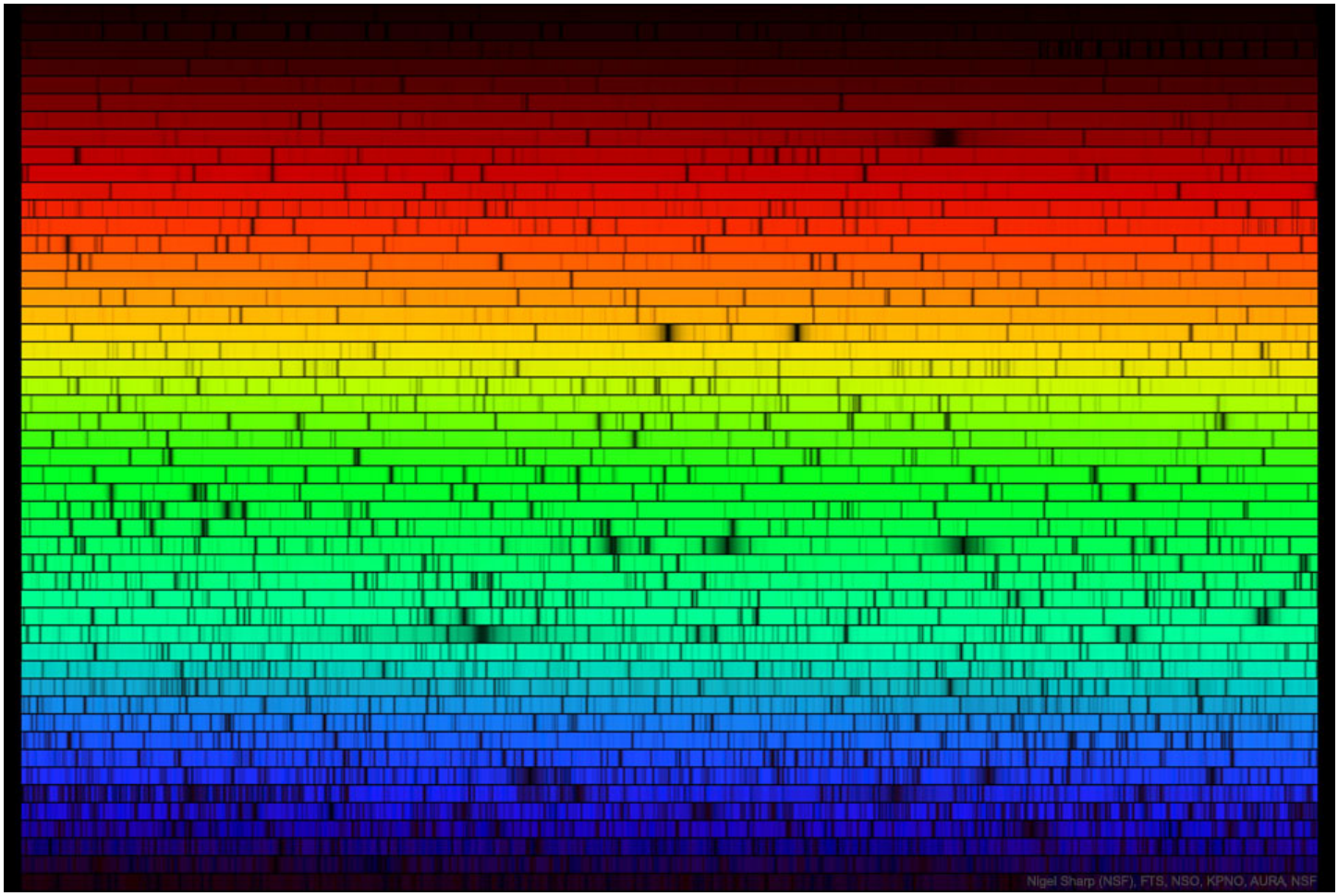
In the meantime, Musk plans to support the development of the BFR system by conducting regular launches that will deliver satellites to Low Earth Orbit (LEO), delivering cargo and crews to the International Space Station (ISS), and conducting a high-profile lunar mission involving a crew of artists.

As for the rest, only time will tell who (if anyone) establishes the first human presence on Mars.

Further Reading: Twitter, SpaceX

Source: Universe Today Return to Contents

Space Image of the Week



The Sun's Spectrum with its Missing Colors

Explanation It is still not known why the Sun's light is missing some colors. Here are all the visible colors of the Sun, produced by passing the Sun's light through a prism-like device. The spectrum was created at the McMath-Pierce Solar Observatory and shows, first off, that although our white-appearing Sun emits light of nearly every color, it does indeed appear brightest in yellow-green light. The dark patches in the above spectrum arise from gas at or above the Sun's surface absorbing sunlight emitted below. Since different types of gas absorb different colors of light, it is possible to determine what gasses compose the Sun. Helium, for example, was first discovered in 1870 on a solar spectrum and only later found here on Earth. Today, the majority of spectral absorption lines have been identified - but not all.

Image credit: Nigel Sharp (NSF), FTS, NSO, KPNO, AURA, NSF

Source: APOD

Return to Contents