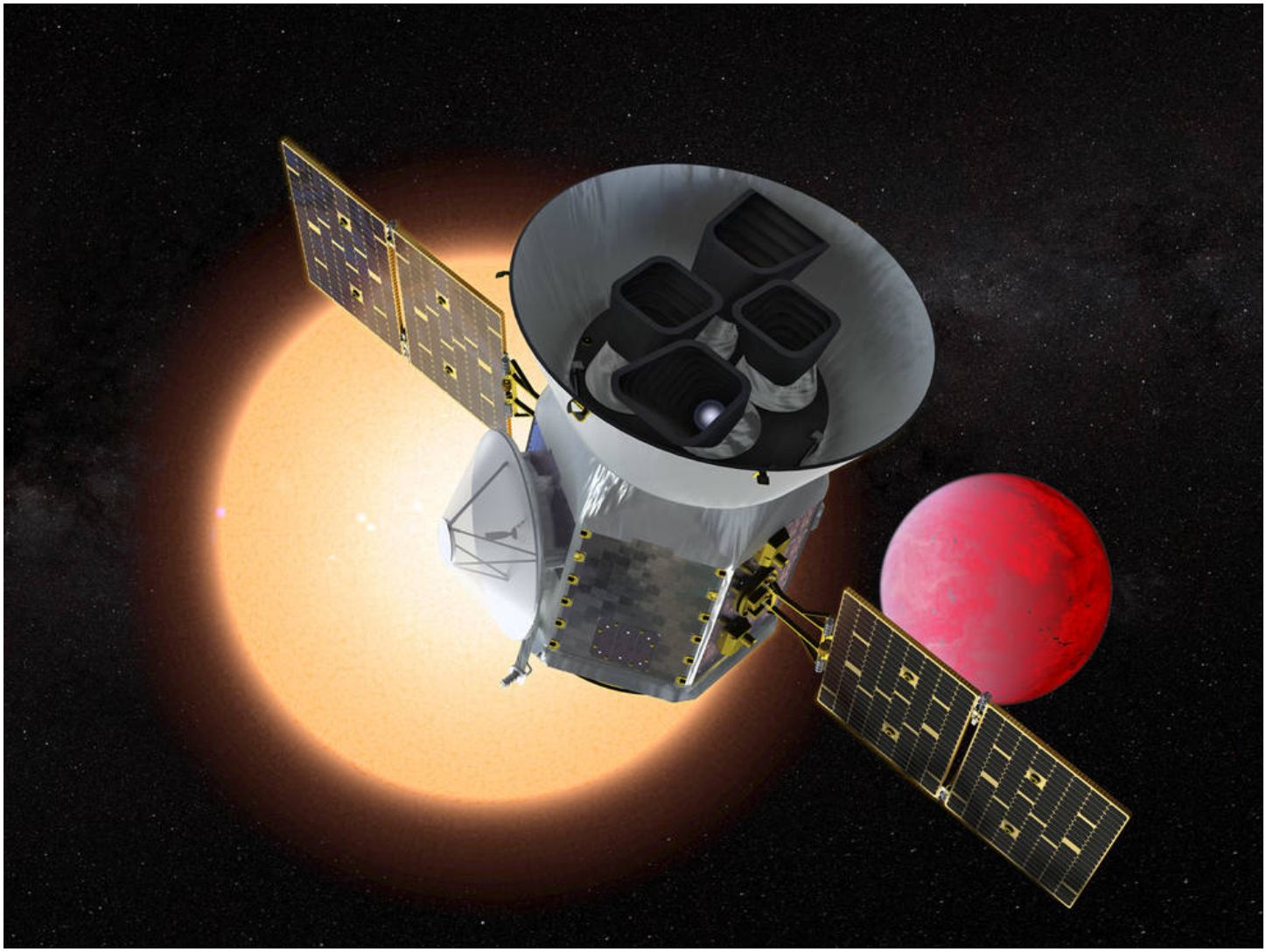
Space News Update

— April 17, 2018 —

Contents

1. TESS Launch Now Targeted for Wednesday



Launch teams are standing down today (Tues., 4/17) to conduct additional Guidance Navigation and Control analysis, and teams are now working towards a targeted launch of the Transiting Exoplanet Survey Satellite (TESS) on Wednesday, April 18. The TESS spacecraft is in excellent health, and remains ready for launch. TESS will launch on a Falcon 9 rocket from Space Launch Complex 40 at Cape Canaveral Air Force Station in Florida.

TESS Builds on Success of the 'Transit Method' of Planet Detection

As the first space-based, all-sky surveyor in search of exoplanets, TESS is poised to provide tantalizing new clues in the search for planets outside our solar system that could harbor life. Like the successful Kepler mission before it, TESS will watch for signs of planets passing in front of the stars they orbit.

When a planet crosses in front of its star, that's called a **transit** – and it results in a short-lived flicker in the starlight seen by an observer. (Check out NASA's TESS Mission Overview for more about the transit method of detecting planets.)

Kepler, which launched in 2009, focused on one portion of the sky and sought to find Earth-like planets. TESS, on the other hand, will look for stars 30 to 100 times brighter than those observed by Kepler. TESS also will scan a far larger area: it will spend about a month at a time focusing on one swath of sky, eventually covering

the entire sky, as it searches for terrestrial planets outside of our solar system — yet close enough for follow-up study using ground-based telescopes.

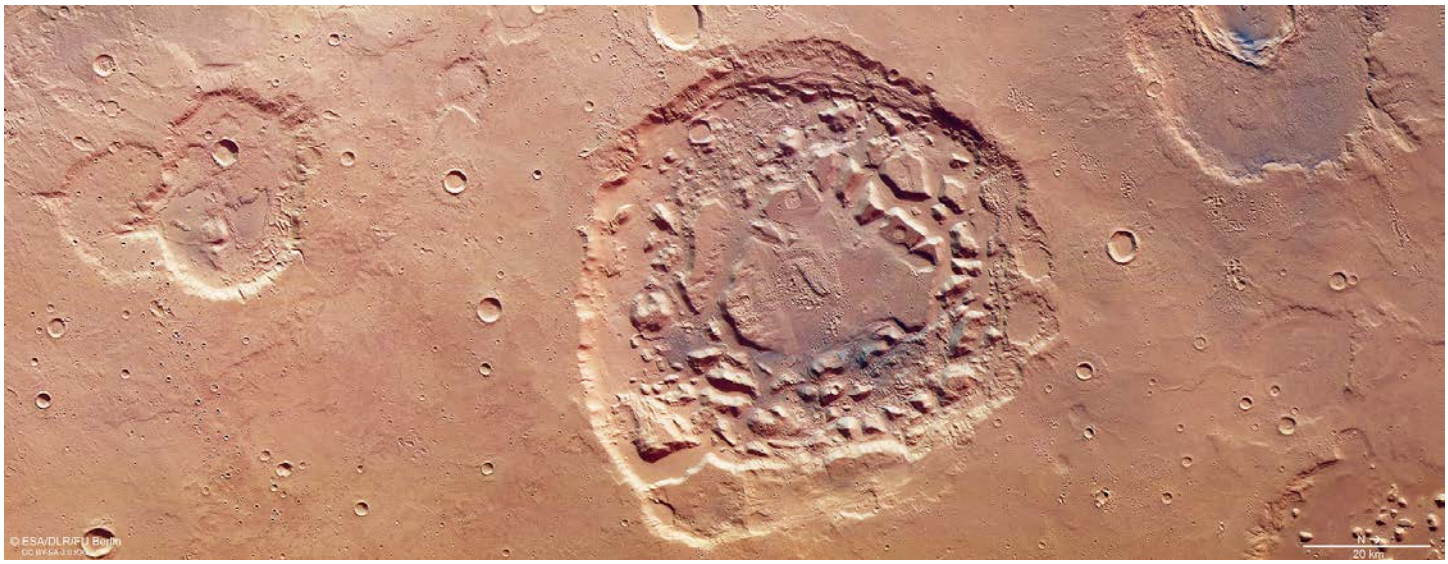
TESS is designed for the stability it will need in order to focus its cameras on the stars it will monitor. The spacecraft is based on Orbital ATK's LEOStar-2 platform, previously used on several NASA observatory missions, including NuSTAR and Orbiting Carbon Observatory-2.

Partners on the TESS mission team include the Massachusetts Institute of Technology, the Kavli Institute for Astrophysics and Space Research, NASA's Goddard Space Flight Center, MIT's Lincoln Laboratory, Orbital ATK, NASA's Ames Research Center, the Harvard-Smithsonian Center for Astrophysics, and the Space Telescope Science Institute.

For additional details about the TESS mission, the search for exoplanets and more, visit https://www.nasa.gov/tess.

Source: NASA Return to Contents

2. Mars Impact Crater or Supervolcano?



These images from ESA's Mars Express show a crater named Ismenia Patera on the Red Planet. Its origin remains uncertain: did a meteorite smash into the surface or could it be the remnants of a supervolcano?

Ismenia Patera – patera meaning 'flat bowl' in Latin – sits in the Arabia Terra region on Mars. This a transition area between the planet's northern and southern regions – an especially intriguing part of the surface.

Mars' topography is clearly split into two parts: the northern lowlands and the southern highlands, the latter sitting up to a few kilometres higher. This divide is a key topic of interest for scientists studying the Red Planet. Ideas for how this dramatic split formed suggest either a massive single impact, multiple impacts or ancient plate tectonics as seen on Earth, but its origin remains unclear.

Ismenia Patera is some 75 km across. Its centre is surrounded by a ring of hills, blocks and lumps of rock thought to have been ejected and flung into the crater by nearby impacts.

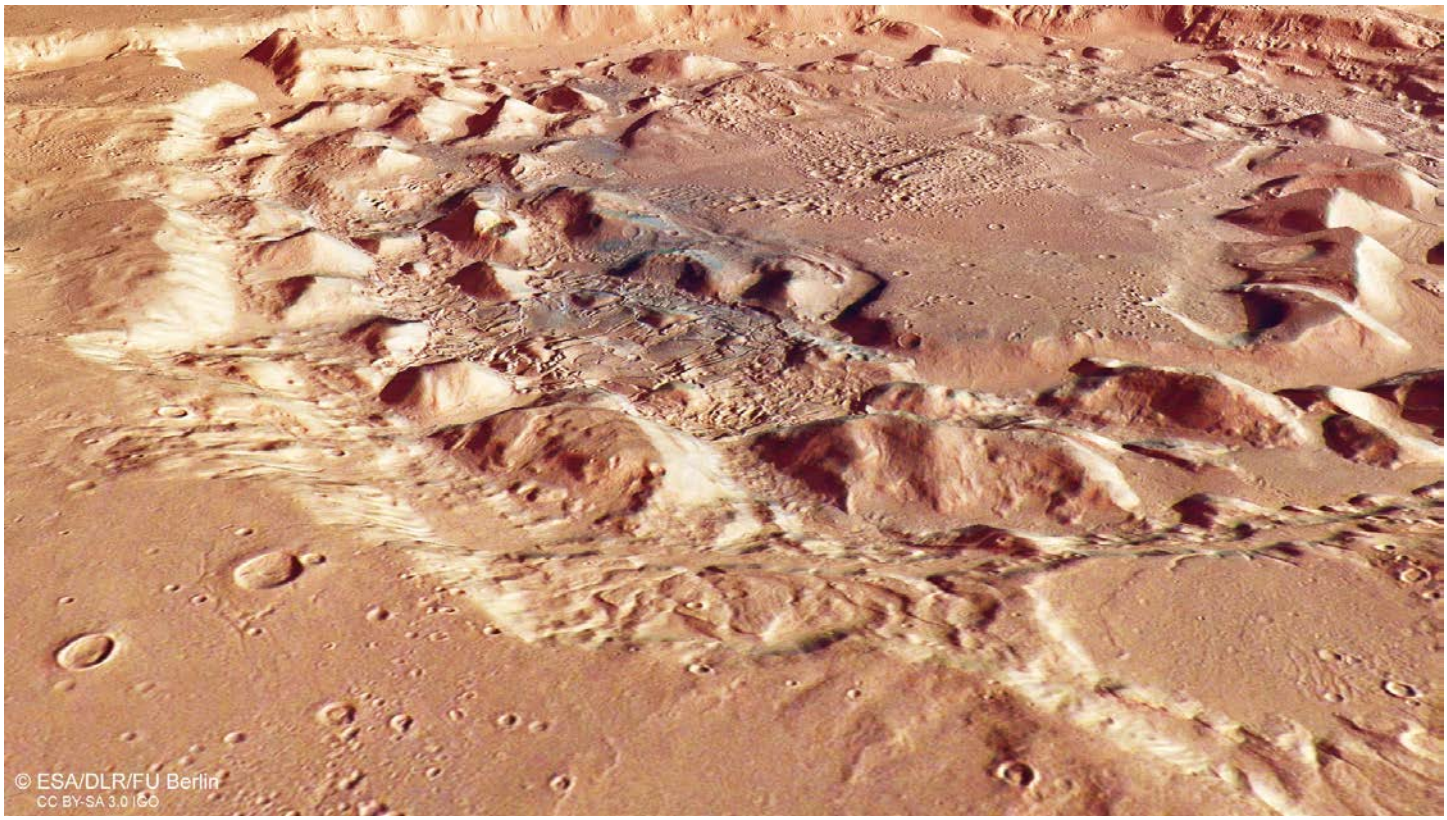
The material thrown off from these events also created small dips and depressions that can be seen within Ismenia Patera itself. Gullies and channels snake down from the crater rim to the floor, which is covered by flat, icy deposits that show signs of flow and movement – these are likely akin to rocky, ice-rich glaciers, which have built up over time in the cold and arid climate.

These images were taken on 1 January by the high-resolution stereo camera on Mars Express, which has been circling the planet since 2003.

Such high-resolution and detailed images shed light on numerous aspects of Mars – for example, how the features seen scarring the surface formed in the first place, and how they have evolved in the many millions of years since. This is a key question for Ismenia Patera: how did this depression form?

There are two leading ideas for its formation. One links it to a potential meteorite that collided with Mars. Sedimentary deposits and ice then flowed in to fill the crater until it collapsed to form the fissured, uneven landscape seen today.

The second idea suggests that, rather than a crater, Ismenia Patera was once home to a volcano that erupted catastrophically, throwing huge quantities of magma out into its surroundings and collapsing as a result.



Volcanoes that lose such huge amounts of material in a single eruption are termed supervolcanoes. Scientists remain undecided on whether or not these existed on Mars, but the planet is known to host numerous massive and imposing volcanic structures, including the famous Olympus Mons – the largest volcano ever discovered in the Solar System.

Arabia Terra also shows signs of being the location of an ancient and long-inactive volcanic province. In fact, another supervolcano candidate, Siloe Patera, also lies in Arabia Terra (seen in the context view of Ismenia Patera).

Certain properties of the surface features seen in Arabia Terra suggest a volcanic origin: for example, their irregular shapes, low topographic relief, their relatively uplifted rims and apparent lack of ejected material that would usually be present around an impact crater.

However, some of these features and irregular shapes could also be present in impact craters that have simply evolved and interacted with their environment in particular ways over time.

More data on the interior and subsurface of Mars will further our understanding and shed light on structures such as Ismenia Patera, revealing more about the planet's complex and fascinating history.

Source: ESA

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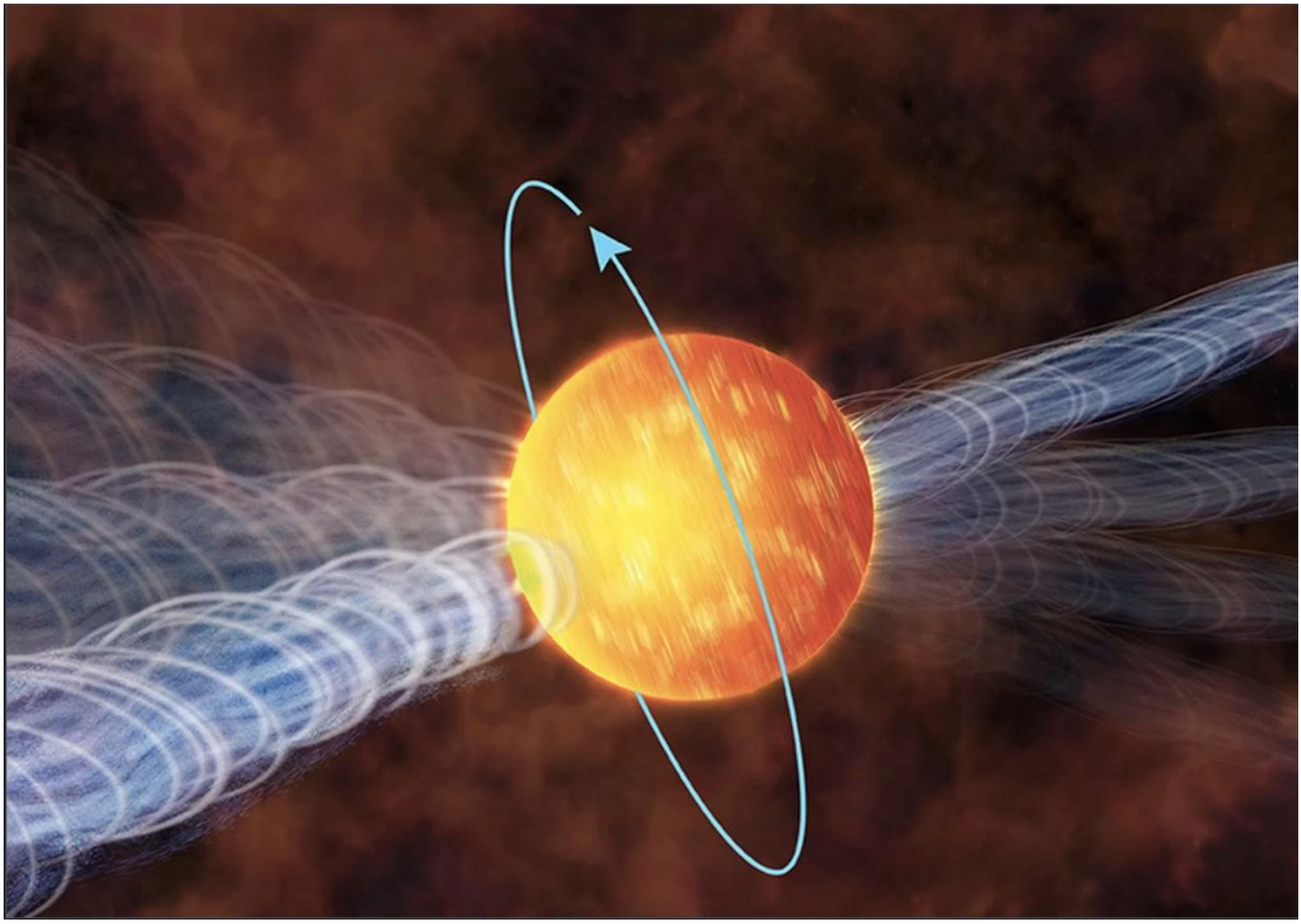
3. NASA's Got a Plan for a 'Galactic Positioning System'



Outer space glows with a bright fog of X-ray light, coming from everywhere at once. But peer carefully into that fog, and faint, regular blips become visible. These are millisecond pulsars, city-sized neutron stars rotating incredibly quickly, and firing X-rays into the universe with more regularity than even the most precise atomic clocks. And NASA wants to use them to navigate probes and crewed ships through deep space.

A telescope mounted on the International Space Station (ISS), the Neutron Star Interior Composition Explorer (NICER), has been used to develop a brand new technology with near-term, practical applications: a galactic positioning system, NASA scientist Zaven Arzoumanian told physicists Sunday (April 15) at the April meeting of the American Physical Society.

With this technology, "You could thread a needle to get into orbit around the moon of a disant planet instead of doing a flyby," Arzoumian told Live Science. A galactic positioning system could also provide "a fallback, so that if a crewed mission loses contact with the Earth, they'd still have navigation systems on board that are autonomous."

Right now, the kind of maneuvers that navigators would need to put a probe in orbit around distant moons are borderline impossible. In the vastness of outer space, it's just not possible to figure out a ship's location precisely enough to engine-firing just right. That's a big part of why so many of the most famous planetary missions NASA has managed — Voyager 1, Juno, and New Horizons among them — have been flybys, where spacecraft have flown close to, but just past, major planetary objects.

Relying on Earth for navigation is also a problem for crewed missions, Arzoumian said. If that signal, connecting Earth and a distant spacecraft like a long and tenuous thread, gets somehow lost, astronauts would be hard-pressed to find their way home from Mars.

Here's how the galactic positioning system would work

A galactic positioning system would go a long way toward solving that problem, Arzoumian said, though he cautioned he's more a pulsar expert than a navigator. And it would work a great deal like the Global Positioning System (GPS) on your smartphone.

When your phone tries to determine its position in space, as Live Science has previously reported, it listens with its radio to the precise ticking of clock signals coming from a fleet of GPS satellites in Earth orbit. The phone's GPS then uses the differences between those ticks to figure out its distance from each satellite, and uses that information to triangulate its own location in space.

Your phone's GPS works fast, but Arzoumian said the galactic positioning system would work slower —taking the time needed to traverse long stretches of deep space. It would be a small, swivel-mounted X-ray telescope, which would look a lot like the big, bulky NICER stripped down to its barest minimum components. One after another, it would point at at least four millisecond pulsars, timing their X-ray "ticks" like a GPS times the ticks of satellites. Three of those pulsars would tell the spacecraft its position in space, while the fourth would calibrate its internal clock to make sure it was measuring the others properly.

Arzoumian noted that the underlying concept behind the galactic positioning system isn't new. The famous Golden Record mounted on both Voyager spacecraft contained a pulsar map that points any aliens who one day encounter it back to planet Earth.

But this would be the first time humans have actually used pulsars to navigate. Already, Arzoumian said, his team has managed to user NICER to track the ISS through space.

NASA's Station Explorer for X-Ray Timing and Navigation (SEXTANT) program, the team behind the Galactic Positioning System, had the goal of tracking the ISS to within 6.2 miles (10 kilometers) over the course of two weeks, Arzoumian said.

"What the demonstration back in November achieved was more like 7 kilometers [4.3 miles] in two days," he said.

The next goal for the program is to track the station to within 1.9 miles (3 km) he said. He said that eventually the team hopes to get under 0.6 miles [1 kilometer] of precision.

"I think we can get beyond that, but I don't know how far," he said.

And that's all in low-Earth orbit, he said, with the station wheeling in wild, unpredictable circles and half the sky blocked out by a giant planet, covering different pulsars every 45 minutes. In deep space, with a functionally unlimited field of view and where things mostly move in predictable, straight lines, he said, the task will be much easier.

Already, Arzoumian said, other teams within NASA have expressed interest in building the galactic positioning system into their projects. He declined to say which, not wanting to speak for them. But it seems likely that we might see such a futuristic device in action in the very near future.

Source: Space.com Return to Contents

The Night Sky

Tuesday, April 17

• Venus and a super-thin crescent Moon form a lovely pair low in the west as twilight fades, as shown here. They're about 5° apart at the time of twilight for the longitudes of the Americas.

• Saturn is at aphelion and the in fact farthest it's been from the Sun (by a trace) since 1959.

Wednesday, April 18

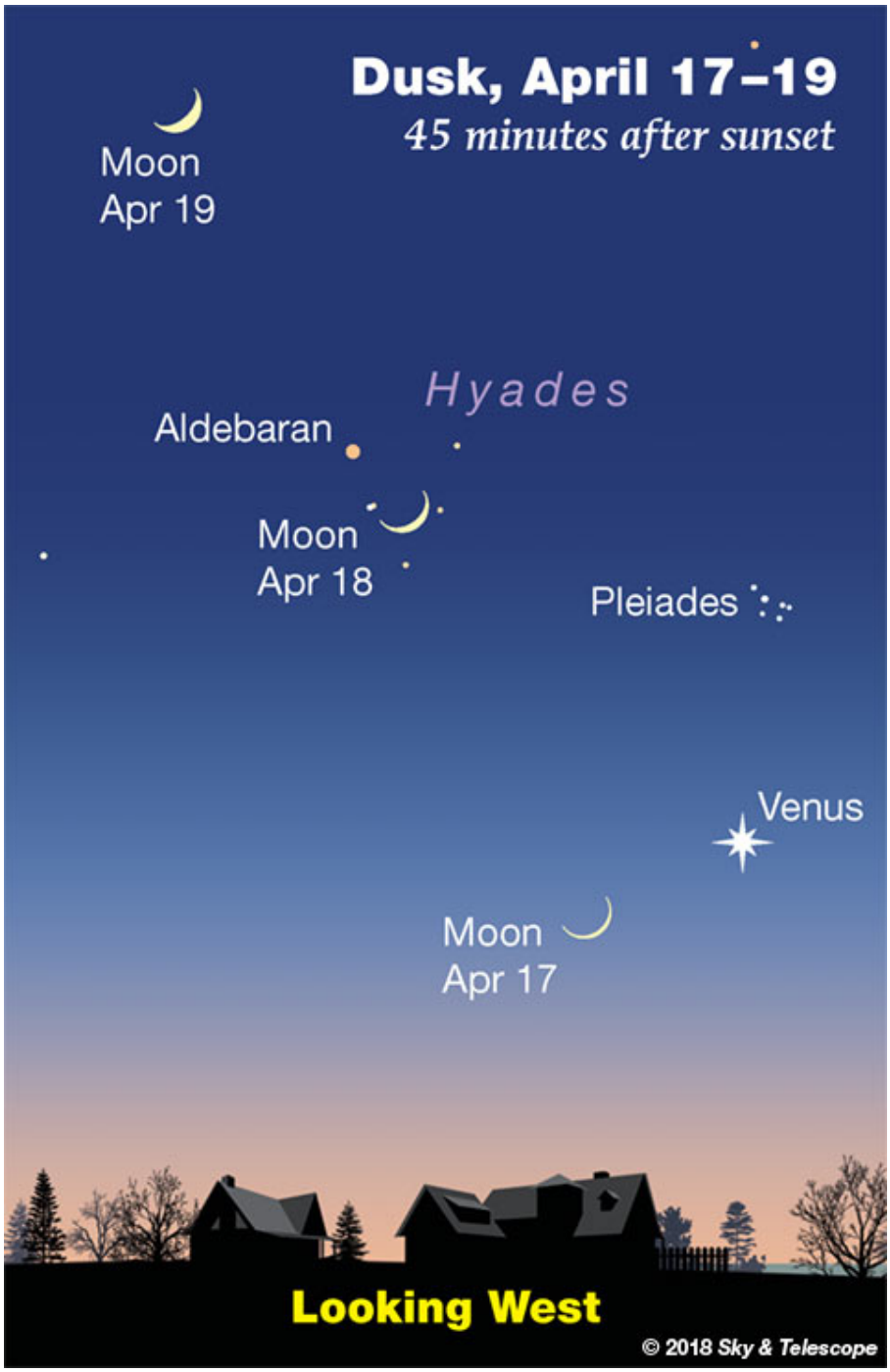
• Now the crescent Moon hangs close to Aldebaran at dusk, cradled in the Hyades for skywatcher in North America (as shown here). The Moon occults Aldebaran for parts of northern Canada.

Thursday, April 19

• Arcturus shines brightly in the east these evenings. The Big Dipper, high in the northeast, points its curving handle lower-right down around toward it. Arcturus forms the pointy end of a long, narrow kite asterism formed by the brightest stars of Boötes, the Cowherd. The kite is currently lying on its side to Arcturus's left, as shown here. The kite is 23° long, about two fist-widths at arm's length.

Friday, April 20

• This evening the dark limb of the crescent Moon will occult 4th-magnitude multiple star Nu Geminorum for parts of the southern U.S. and points south. For rough time estimates at your location, interpolate between the time predictions in the April *Sky & Telescope*, page 48.



Source: Sky & Telescope

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ISS Sighting Opportunities

For Denver:

No sightings for Denver

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

NASA-TV Highlights

(all times Eastern Daylight Time)

TBD, Wednesday, April 18 - TESS (Transiting Exoplanet Survey Satellite) Launch Coverage (all channels)

10:30 a.m., Wednesday, April 18 - ISS Expedition 55 Educational In-Flight Event with the Brookwood Elementary School in Houston, Texas and Flight Engineers Ricky Arnold and Scott Tingle of NASA (all channels)

10:30 a.m., Thursday, April 19 - ISS Expedition 55 Educational In-Flight Event with the South River High School in Edgewater, Maryland and Flight Engineers Ricky Arnold and Drew Feustel of NASA (starts at 10:35 a.m.) (all channels)

5:30 a.m., Friday, April 20 - Live Media Interviews: "Hubble Space Telescope Celebrates 28 Years of Unraveling the Mysteries of the Universe" (starts at 5:40 a.m.) (NTV-3 (Media))

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

Space Calendar

- Apr 17 - Comet C/2018 E1 (ATLAS) Perihelion (2.705 AU)
- Apr 17 - NEW [Apr 16] Apollo Asteroid 2018 GK4 Near-Earth Flyby (0.015 AU)
- Apr 17 - NEW [Apr 13] Amor Asteroid 2018 GC2 Near-Earth Flyby (0.023 AU)
- Apr 17 - NEW [Apr 16] Apollo Asteroid 2018 GP4 Near-Earth Flyby (0.029 AU)
- Apr 17 - Asteroid 21 Lutetia Closest Approach To Earth (1.644 AU)
- Apr 17 - 20th Anniversary (1998), STS-90 Launch (Space Shuttle Columbia, Spacelab)
- Apr 17-18 - EO in Space 4.0 Workshop, Noordwijk, The Netherlands
- Apr 18 - UPDATED [Apr 17] Transiting Expoplanet Survyey Satellite (TESS) Falcon 9 Launch
- Apr 18 - Comet 62P/Tsuchinshan At Opposition (1.130 AU)
- Apr 18 - Comet 186P/Garradd Closest Approach To Earth (3.632 AU)
- Apr 18 - Apollo Asteroid 2015 XE352 Near-Earth Flyby (0.070 AU)
- Apr 18 - NEW [Apr 16] Apollo Asteroid 2018 GW3 Near-Earth Flyby (0.081 AU)
- Apr 19 - UPDATED [Apr 13] CICERO/ Outernet 1/ Lemur-2 Electron Launch
- Apr 19 - Moon Occults Aldebaran
- Apr 19 - Comet 160P/LINEAR At Opposition (3.427 AU)
- Apr 19 - Comet P/2015 Q1 (Scotti) At Opposition (3.995 AU)
- Apr 19 - Apollo Asteroid 2014 JG15 Near-Earth Flyby (0.050 AU)
- Apr 19 - NEW [Apr 16] Aten Asteroid 2018 GU3 Near-Earth Flyby (0.058 AU)
- Apr 19 - Apollo Asteroid 2015 HD10 Near-Earth Flyby (0.098 AU)
- Apr 19 - Asteroid 6312 Robheinlein Closest Approach To Earth (1.272 AU)
- Apr 19 - Asteroid 42776 Casablanca Closest Approach To Earth (2.039 AU)
- Apr 19 - Asteroid 193 Ambrosia Closest Approach To Earth (2.129 AU)
- Apr 19 - Lecture: What Are We Protecting Mars From - And Why Do We Bother?, Menlo
- Apr 19 - 5th Anniversary (2013), Wolcott Meteorite Fall (Hit House in Connecticut)
- Apr 19-20 - Meeting: Exoplanet Science Strategy, Irvine, California
- Apr 20 - Comet P/2000 R2 (LINEAR) At Opposition (2.634 AU)
- Apr 20 - Comet 162P/Siding Spring At Opposition (3.884 AU)
- Apr 20 - NEW [Apr 16] Apollo Asteroid 2018 GS3 Near-Earth Flyby (0.022 AU)
- Apr 20 - Aten Asteroid 2016 JP Near-Earth Flyby (0.031 AU)
- Apr 20 - Apollo Asteroid 2010 JO33 Near-Earth Flyby (0.060 AU)
- Apr 20 - Atira Asteroid 164294 (2004 XZ130) Closest Approach To Earth (0.667 AU)
- Apr 20 - Asteroid 25399 Vonnegut Closest Approach To Earth (1.454 AU)
- Apr 20 - Asteroid 234750 Amymainzer Closest Approach To Earth (2.437 AU)
- Apr 20 - Asteroid 2906 Caltech Closest Approach To Earth (2.645 AU)
- Apr 20 - Kai Seigbahn's 100th Birthday (1918)

Source: JPL Space Calendar

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Food for Thought

We think we're the first advanced earthlings—but how do we really know?

Imagine if, many millions of years ago, dinosaurs drove cars through cities of mile-high buildings. A preposterous idea, right? Over the course of tens of millions of years, however, all of the direct evidence of a civilization—its artifacts and remains—gets ground to dust. How do we really know, then, that there weren't previous industrial civilizations on Earth that rose and fell long before human beings appeared?

It's a compelling thought experiment, and one that Adam Frank, a professor of physics and astronomy at the University of Rochester, and Gavin Schmidt, the director of the NASA Goddard Institute for Space Studies, take up in a paper published in the *International Journal of Astrobiology*.

"Gavin and I have not seen any evidence of another industrial civilization," Frank explains. But by looking at the deep past in the right way, a new set of questions about civilizations and the planet appear: What geological footprints do civilizations leave? Is it possible to detect an industrial civilization in the geological record once it disappears from the face of its host planet? "These questions make us think about the future and the past in a much different way, including how any planetary-scale civilization might rise and fall."

In what they deem the "Silurian Hypothesis," Frank and Schmidt define a civilization by its energy use. Human beings are just entering a new geological era that many researchers refer to as the Anthropocene, the period in which human activity strongly influences the climate and environment. In the Anthropocene, fossil fuels have become central to the geological footprint humans will leave behind on Earth. By looking at the Anthropocene's imprint, Schmidt and Frank examine what kinds of clues future scientists might detect to determine that human beings existed. In doing so, they also lay out evidence of what might be left behind if industrial civilizations like ours existed millions of years in the past.

Human beings began burning fossil fuels more than 300 years ago, marking the beginnings of industrialization. The researchers note that the emission of fossil fuels into the atmosphere has already changed the carbon cycle in a way that is recorded in carbon isotope records. Other ways human beings might leave behind a geological footprint include:

- Global warming, from the release of carbon dioxide and perturbations to the nitrogen cycle from fertilizers
- Agriculture, through greatly increased erosion and sedimentation rates
- Plastics, synthetic pollutants, and even things such as steroids, which will be geochemically detectable for millions, and perhaps even billions, of years
- Nuclear war, if it happened, which would leave behind unusual radioactive isotopes

"As an industrial civilization, we're driving changes in the isotopic abundances because we're burning carbon," Frank says. "But burning fossil fuels may actually shut us down as a civilization. What imprints would this or other kinds of industrial activity from a long dead civilization leave over tens of millions of years?"

The questions raised by Frank and Schmidt are part of a broader effort to address climate change from an astrobiological perspective, and a new way of thinking about life and civilizations across the universe. Looking at the rise and fall of civilizations in terms of their planetary impacts can also affect how researchers approach future explorations of other planets.

"We know early Mars and, perhaps, early Venus were more habitable than they are now, and conceivably we will one day drill through the geological sediments there, too," Schmidt says. "This helps us think about what we should be looking for."

Schmidt points to an irony, however: if a civilization is able to find a more sustainable way to produce energy without harming its host planet, it will leave behind less evidence that it was there.

"You want to have a nice, large-scale civilization that does wonderful things but that doesn't push the planet into domains that are dangerous for itself, the civilization," Frank says. "We need to figure out a way of producing and using energy that doesn't put us at risk."

That said, the earth will be just fine, Frank says. It's more a question of whether humans will be.

Can we create a version of civilization that doesn't push the earth into a domain that's dangerous for us as a species?

"The point is not to 'save the earth,'" says Frank. "No matter what we do to the planet, we're just creating niches for the next cycle of evolution. But, if we continue on this trajectory of using fossil fuels and ignoring the climate change it drives, we human beings may not be part of Earth's ongoing evolution."

Source: Phys.org Return to Contents

Space Image of the Week

Hubble Catches a Colossal Cluster

This NASA/ESA Hubble Space Telescope image shows a massive galaxy cluster glowing brightly in the darkness. Despite its beauty, this cluster bears the distinctly unpoetic name of PLCK G308.3-20.2.

Galaxy clusters can contain thousands of galaxies all held together by the glue of gravity. At one point in time they were believed to be the largest structures in the universe — until they were usurped in the 1980s by the discovery of superclusters. These massive formations typically contain dozens of galaxy clusters and groups and span hundreds of millions of light-years. However, clusters do have one thing to cling on to: superclusters are not held together by gravity, so galaxy clusters still retain the title of the biggest structures in the universe bound by gravity.

One of the most interesting features of galaxy clusters is the stuff that permeates the space between the constituent galaxies: the intracluster medium (ICM). High temperatures are created in these spaces by smaller structures forming within the cluster. This results in the ICM being made up of plasma — ordinary matter in a superheated state. Most luminous matter in the cluster resides in the ICM, which is very luminous in X-rays. However, the majority of the mass in a galaxy cluster exists in the form of non-luminous dark matter. Unlike plasma, dark matter is not made from ordinary matter such as protons, neutrons and electrons. It is a hypothesized substance thought to make up 80% of the universe's mass, yet it has never been directly observed.

This image was taken by Hubble's Advanced Camera for Surveys and Wide Field Camera 3 as part of an observing program called RELICS (Reionization Lensing Cluster Survey). RELICS imaged 41 massive galaxy clusters with the aim of finding the brightest distant galaxies for the forthcoming James Webb Space Telescope to study.

Source: NASA Return to Contents