Space News Update

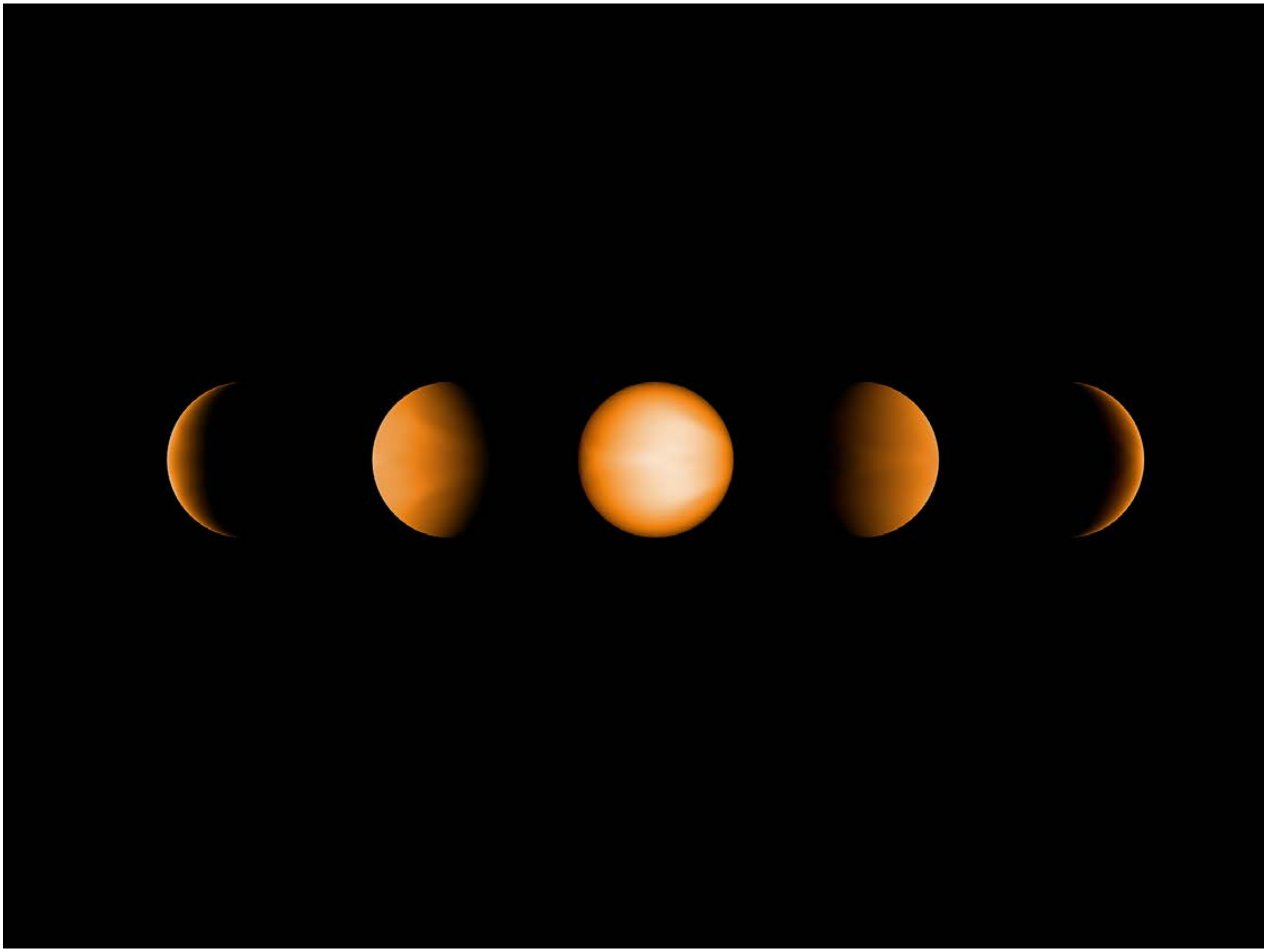
— August 10, 2018 —

Contents

In the News

Departments

1. Water is Destroyed, Then Reborn in Ultrahot Jupiters



Imagine a place where the weather forecast is always the same: scorching temperatures, relentlessly sunny, and with absolutely zero chance of rain. This hellish scenario exists on the permanent daysides of a type of planet found outside our solar system dubbed an "ultrahot Jupiter." These worlds orbit extremely close to their stars, with one side of the planet permanently facing the star.

What has puzzled scientists is why water vapor appears to be missing from the toasty worlds' atmospheres, when it is abundant in similar but slightly cooler planets. Observations of ultrahot Jupiters by NASA's Spitzer and Hubble space telescopes, combined with computer simulations, have served as a springboard for a new theoretical study that may have solved this mystery.

According to the new study, ultrahot Jupiters do in fact possess the ingredients for water (hydrogen and oxygen atoms). But due to strong irradiation on the planet's daysides, temperatures there get so intense that water molecules are completely torn apart.

"The daysides of these worlds are furnaces that look more like a stellar atmosphere than a planetary atmosphere," said Vivien Parmentier, an astrophysicist at Aix Marseille University in France and lead author of the new study. "In this way, ultrahot Jupiters stretch out what we think planets should look like."

While telescopes like Spitzer and Hubble can gather some information about the daysides of ultrahot Jupiters, the nightsides are difficult for current instruments to probe. The new paper proposes a model for what might be happening on both the illuminated and dark sides of these planets, based largely on observations and analysis of the ultrahot Jupiter known as WASP-121b, and from three recently published studies, coauthored by Parmentier, that focus on the ultrahot Jupiters WASP-103b, WASP-18b and HAT-P-7b, respectively. The new study suggests that fierce winds may blow the sundered water molecules into the planets' nightside hemispheres. On the cooler, dark side of the planet, the atoms can recombine into molecules and condense into clouds, all before drifting back into the dayside to be splintered again.

Water is not the only molecule that may undergo a cycle of chemical reincarnation on these planets, according to the new study. Previous detections of clouds by Hubble at the boundary between day and night, where temperatures mercifully fall, have shown that titanium oxide (popular as a sunscreen) and aluminum oxide (the basis for ruby, the gemstone) could also be molecularly reborn on the ultrahot Jupiters' nightsides. These materials might even form clouds and rain down as liquid metals and fluidic rubies.

Star-planet hybrids

Among the growing catalog of planets outside our solar system -- known as exoplanets -- ultrahot Jupiters have stood out as a distinct class for about a decade. Found in orbits far closer to their host stars than Mercury is to our Sun, the giant planets are tidally locked, meaning the same hemisphere always faces the star, just as the Moon always presents the same side to Earth. As a result, ultrahot Jupiters' daysides broil in a perpetual high noon. Meanwhile, their opposite hemispheres are gripped by endless nights. Dayside temperatures reach between 3,600 and 5,400 degrees Fahrenheit (2,000 and 3,000 degrees Celsius), ranking ultrahot Jupiters among the hottest exoplanets on record. Nightside temperatures are around 1,800 degrees Fahrenheit cooler (1,000 degrees Celsius), cold enough for water to re-form and, along with other molecules, coalesce into clouds.

Hot Jupiters, cousins to ultrahot Jupiters with dayside temperatures below 3,600 degrees Fahrenheit (2,000 Celsius), were the first widely discovered type of exoplanet, starting back in the mid-1990s. Water has turned out to be common in their atmospheres. One hypothesis for why it appeared absent in ultrahot Jupiters has been that these planets must have formed with very high levels of carbon instead of oxygen. Yet the authors of the new study say this idea could not explain the traces of water also sometimes detected at the dayside-nightside boundary.

To break the logjam, Parmentier and colleagues took a cue from well-established physical models of the atmospheres of stars, as well as "failed stars," known as brown dwarfs, whose properties overlap somewhat with hot and ultrahot Jupiters. Parmentier adapted a brown dwarf model developed by Mark Marley, one of the paper's coauthors and a research scientist at NASA's Ames Research Center in Silicon Valley, California, to the case of ultrahot Jupiters. Treating the atmospheres of ultrahot Jupiters more like blazing stars than conventionally colder planets offered a way to make sense of the Spitzer and Hubble observations.

"With these studies, we are bringing some of the century-old knowledge gained from studying the astrophysics of stars, to the new field of investigating exoplanetary atmospheres," said Parmentier.

Spitzer's observations in infrared light zeroed in on carbon monoxide in the ultrahot Jupiters' atmospheres. The atoms in carbon monoxide form an extremely strong bond that can uniquely withstand the thermal and radiational assault on the daysides of these planets. The brightness of the hardy carbon monoxide revealed that the planets' atmospheres burn hotter higher up than deeper down. Parmentier said verifying this temperature difference was key for vetting Hubble's no-water result, because a uniform atmosphere can also mask the signatures of water molecules.

"These results are just the most recent example of Spitzer being used for exoplanet science -- something that was not part of its original science manifest," said Michael Werner, project scientist for Spitzer at NASA's Jet Propulsion Laboratory in Pasadena, California. "In addition, it's always heartening to see what we can discover when scientists combine the power of Hubble and Spitzer, two of NASA's Great Observatories."

Although the new model adequately described many ultrahot Jupiters on the books, some outliers do remain, suggesting that additional aspects of these worlds' atmospheres still need to be understood. Those exoplanets not fitting the mold could have exotic chemical compositions or unanticipated heat and circulation patterns. Prior studies have argued that there is a more significant amount of water in the dayside atmosphere of WASP-121b than what is apparent from observations, because most of the signal from the water is obscured. The new paper provides an alternative explanation for the smaller-than-expected water signal, but more studies will be required to better understand the nature of these ultrahot atmospheres.

Resolving this dilemma could be a task for NASA's next-generation James Webb Space Telescope, slated for a 2021 launch. Parmentier and colleagues expect it will be powerful enough to glean new details about the daysides, as well as confirm that the missing dayside water and other molecules of interest have gone to the planets' nightsides.

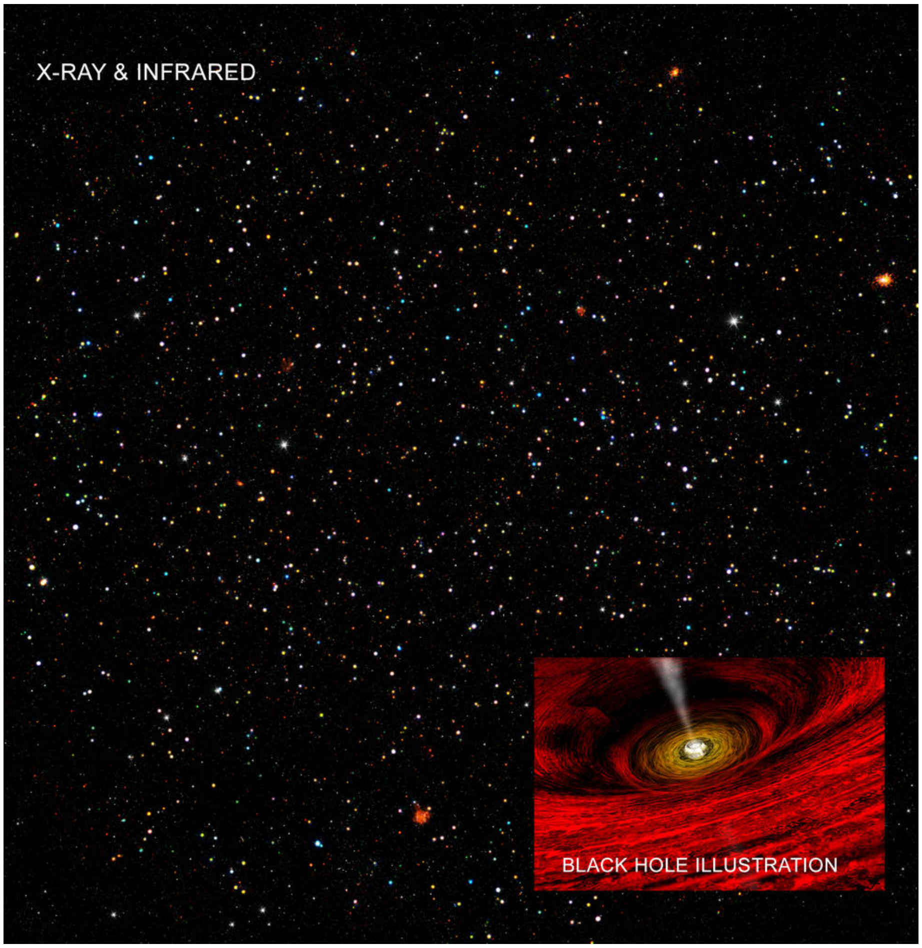
"We now know that ultrahot Jupiters exhibit chemical behavior that is different and more complex than their cooler cousins, the hot Jupiters," said Parmentier. "The studies of exoplanet atmospheres is still really in its infancy and we have so much to learn."

The new study is forthcoming in the journal Astronomy and Astrophysics.

Source: JPL

Return to Contents

2. Finding the Happy Medium of Black Holes



Scientists have taken major steps in their hunt to find black holes that are neither very small nor extremely large. Finding these elusive intermediate-mass black holes could help astronomers better understand what the "seeds" for the largest black holes in the early Universe were.

The new research comes from two separate studies, each using data from NASA's Chandra X-ray Observatory and other telescopes.

Black holes that contain between about one hundred and several hundred thousand times the mass of the Sun are called "intermediate mass" black holes, or IMBHs. This is because their mass places them in between the well-documented and frequently-studied "stellar mass" black holes on one end of the mass scale and the "supermassive black holes" found in the central regions of massive galaxies on the other.

While several tantalizing possible IMBHs have been reported in recent years, astronomers are still trying to determine how common they are and what their properties teach us about the formation of the first supermassive black holes.

One team of researchers used a large campaign called the Chandra COSMOS-Legacy survey to study dwarf galaxies, which contain less than one percent the amount of mass in stars as our Milky Way does. (COSMOS is an abbreviation of Cosmic Evolution Survey.) The characterization of these galaxies was enabled by the rich dataset available for the COSMOS field at different wavelengths, including data from NASA and ESA telescopes.

The Chandra data were crucial for this search because a bright, point-like source of X-ray emission near the center of a galaxy is a telltale sign of the presence of a black hole. The X-rays are produced by gas heated to millions of degrees by the enormous gravitational and magnetic forces near the black hole.

"We may have found that dwarf galaxies are a haven for these missing middleweight black holes," said Mar Mezcua of the Institute of Space Sciences in Spain who led one of the studies. "We didn't just find a handful of IMBHs — we may have found dozens."

Her team identified forty growing black holes in dwarf galaxies. Twelve of them are located at distances more than five billion light years from Earth and the most distant is 10.9 billion light years away, the most distant growing black hole in a dwarf galaxy ever seen. One of the dwarf galaxies is the least massive galaxy found to host a growing black hole in its center.

Most of these sources are likely IMBHs with masses that are about ten thousand to a hundred thousand times that of the Sun. One crucial result of this research is that the fraction of galaxies containing growing black holes is smaller for less massive galaxies than for their more massive counterparts.

A second team led by Igor Chilingarian of the Harvard-Smithsonian Center for Astrophysics (CfA) in Cambridge, Mass., found a separate, important sample of possible IMBHs in galaxies that are closer to us. In their sample, the most distant IMBH candidate is about 2.8 billion light years from Earth and about 90% of the IMBH candidates they discovered are no more than 1.3 billion light years away.

With data from the Sloan Digital Sky Survey (SDSS), Chilingarian and his colleagues found galaxies with the optical light signature of growing black holes and then estimated their mass. They selected 305 galaxies with properties that suggested a black hole with a mass less than 300,000 times that of the Sun was lurking in the central regions of each of these galaxies.

Only 18 members of this list contained high quality X-ray observations that would allow confirmation that the sources are black holes. Detections with Chandra and with XMM-Newton were obtained for ten sources, showing that about half of the 305 IMBH candidates are likely to be valid IMBHs. The masses for the ten sources detected with X-ray observations were determined to be between 40,000 and 300,000 times the mass of the Sun.

"This is the largest sample of intermediate mass black holes ever found," said Chilingarian. "This black hole bounty can be used to address one of the biggest mysteries in astrophysics."

IMBHs may be able to explain how the very biggest black holes, the supermassive ones, were able to form so quickly after the Big Bang. One leading explanation is that supermassive black holes grow over time from smaller black holes "seeds" containing about a hundred times the Sun's mass. Some of these seeds should merge to form IMBHs. Another explanation is that they form very quickly from the collapse of a giant cloud of gas with a mass equal to hundreds of thousands of times that of the Sun.

Mezcua and her team may be seeing evidence in favor of the direct collapse idea, because this theory predicts that the less massive galaxies in their sample should be less likely to contain IMBHs.

"Our evidence is only circumstantial because it's possible that the IMBHs are just as common in the smaller galaxies but they're not consuming enough matter to be detected as X-ray sources", says Mezcua's co-author Francesca Civano of the CfA.

Chilingarian's team has a different conclusion.

"We're arguing that just the presence of intermediate mass black holes in the mass range we detected suggests that smaller black holes with masses of about a hundred Suns exist," says Chilingarian's co-author Ivan Yu. Katkov of Moscow State University in Russia. "These smaller black holes could be the seeds for the formation of supermassive black holes."

Another possibility is that both mechanisms actually occur. Both teams agree that to make firm conclusions much larger samples of black holes are needed using data from future satellites. The paper by Mar Mezcua and colleagues was published in the August issue of the Monthly Notices of the Royal Astronomical Society and is available online. The paper by Igor Chilingarian was recently accepted for publication in The Astrophysical Journal and is available online.

Source: NASA Return to Contents

3. Pairs of small colliding galaxies may seed future stars

A pair of dwarf galaxies closely circling the Milky Way, the Large and Small Magellanic Clouds, were in the throes of merging into one when they fell into our galaxy. The duo is thought to hold enough gas to replenish half of the Milky Way's supply of star-making fuel, and now, a study in the *Monthly Notices of the Royal Astronomical Society* offers new insights into how galaxies like ours are able to capture this gas so easily.

"You have this enormous reserve of star formation fuel sitting there ready to be stripped by another system," says study coauthor Mary Putman, an astronomer at Columbia University.

Home to millions of stars, dwarf galaxies are outshined by bigger galaxies like the Milky Way with hundreds to thousands of times more stars. But what dwarf galaxies lack in brightness, they make up for in their sheer abundance of star-making fuel. The hydrogen gas swirling through the Large and Small Magellanic Clouds and dwarf galaxies like them are thought to play a key role in birthing new stars and other small galaxies.

To explore the star-making potential of dwarf galaxy pairs, a research team led by then-Columbia graduate student Sarah Pearson turned to a remote pair—NGC 4490 and NGC 4485—23 million light years away. Similar to the Large Magellanic Cloud, NGC 4490 is several times larger than its companion galaxy. But its isolated location allowed the researchers to simulate its eventual merger with NGC 4485 without interference from the Milky Way's gravitational pull.

In their simulations, they watched the bigger galaxy, NGC 4490, peel off gas from its smaller sibling, a gravitational effect due to their lopsided difference in size. As the pair circled ever closer to each other, the smaller galaxy's tail of gas was swept farther and farther away, a finding that supports a study earlier this year that fingerprinted the gas streaming from the Magellanic Clouds into the Milky Way as belonging to the Small Magellanic Cloud.

Long after NGC 4490 collided with its smaller companion and merged into one in the researchers' simulation, their gas footprint continue to expand, the researchers found. In five billion years, they found, the pair's gas tails would extend over a distance of 1 million light years, nearly twice its current length. "After 5 billion years, 10 percent of the gas envelope still resides more than 260,000 light years from the merged remnant, suggesting it takes a very long time before all the gas falls back to the merged remnant, " says Pearson, who is now a fellow at the Flatiron Institute's Center for Computational Astrophysics.

When the researchers compared their results to real-world observations of NGC 4490/4485 made by telescope, the results matched, indicating their model was accurate.

Their findings are also consistent with what astronomers know about the recycling of gas in the universe. As gas clouds grow more extended, the looser the gas becomes, thus making it easier for a bigger galaxy to come along and gobble it up. The simulation suggests that this dispersal process has helped the Milky Way efficiently strip gas from the Small Magellanic Cloud, and that this sort of gas-transfer may be fairly common elsewhere in the universe.

"Our study suggests that similar dwarf pairs exist out there," says Pearson. "Because their gas is so extended, if they fall into something like the Milky Way, their gas is easily shed."

The study further suggests that declining gas density on the outskirts of colliding dwarf galaxies makes it hard for new stars to form, a conclusion matched by observations. The researchers plan to continue studying other pairs of dwarf galaxy collisions to refine their model.

Source: Phys.org Return to Contents

The Night Sky

Friday, August 10
• **It's Perseid weekend!** The annual Perseid meteor shower should peak late Sunday night August 12th. Already the meteors are increasing in number, and conditions this year are ideal. See Sunday below.

• Four bright planets remain in view at once during twilight all week. From right to left, they're Venus low in the west, Jupiter higher in the southwest, Saturn at about the same height in the south-southeast, and brilliant Mars low in the southeast. Best view: about 45 minutes after sunset.

Saturday, August 11
• The W of Cassiopeia, tilted by not very much, is up in the northeast these evenings above Perseus. The upper, right-hand side of the W is the brightest. Watch Cas rise higher and tilt further through the night and through the next few months.

• August is prime Milky Way time — if you have a dark sky. After nightfall is complete, the Milky Way now runs from Sagittarius in the south, up and left across Aquila and through the big Summer Triangle very high in the east, and on down through Cassiopeia to Perseus rising low in the north-northeast.

• New Moon (exact at 5:58 a.m. EDT August 11th).

Sunday, August 12
• The **Perseid meteor shower** should be at its peak tonight. Conditions are excellent; there's no moonlight, *and* the shower's predicted exact peak (usually lasting roughly 12 hours) falls during nighttime for Europe and North America.

You'll probably see the most meteors when the shower's radiant is high: from about midnight to dawn. With a really dark sky, you may see one or two meteors a minute on average during this time. There will be fewer in the evening, but the ones you do see when the radiant is low will be "Earthgrazers" skimming the upper atmosphere in long, graceful flight paths.

Monday, August 13
• In twilight, spot the thin waxing crescent Moon very low in the west. Venus shines about a fist-width at arm's length to its left, as shown here. High above them shines Arcturus (out of the frame).

Tuesday, August 14
• The waxing crescent Moon shines over Venus in twilight. Closer to the moon is the telescopic binary star Gamma Virginis (Porrima), as shown here. Its twin components are currently 2.8 arcseconds apart.

Look left of the Moon for fainter Spica. Farther upper left of Spica shines bright Jupiter (out of the frame here). The Moon will march eastward above these celestial landmarks for the next three nights.

Source: Sky & Telescope Return to Contents

ISS Sighting Opportunities

For Denver:

Date	Visible	Max Height	Appears	Disappears
Fri Aug 10, 9:27 PM	1 min	10°	10° above WSW	10° above SW
Sat Aug 11, 8:35 PM	3 min	20°	17° above WSW	10° above S

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

NASA-TV Highlights

(all times Eastern Daylight Time)

August 10, Friday
6 a.m. – Live interviews from Kennedy Space Center on upcoming launch of Parker Solar Probe (All Channels)
11:30 a.m., 3 p.m., 6 p.m., 8:30 p.m., 10 p.m. - Parker Solar Probe Programming (All Channels)
12 p.m., 4 p.m., 11 p.m. – Replay of the Parker Solar Probe Preview Science Briefing (All Channels)
1 p.m., 5 p.m. – Replay of the Parker Solar Probe Pre-Launch Mission Briefing (All Channels)
2 p.m., 9 p.m. - Replay of NASA names unique solar mission after University of Chicago physicist Eugene Parker (All Channels)
6:30 p.m. – NASA Edge: Live Tower Rollback for Parker Solar Probe (All Channels)
7:30 p.m. – Sunset Show: How Parker Solar Probe helps NASA – Live from Kennedy Space Center (All Channels)

August 11, Saturday
TBD - Parker Solar Probe Post-Launch News Briefing (All Channels)
12 a.m. - Parker Solar Probe Programming (All Channels)
1 a.m. – Replay of the Parker Solar Probe Preview Science Briefing (All Channels)
2 a.m. – Replay of the Parker Solar Probe Pre-Launch Mission Briefing (All Channels)
3:00 a.m. - Parker Solar Probe Launch Coverage (65-minute launch window opens at 3:33 a.m.) (All Channels)
8 a.m., 1 p.m., 5 p.m., 9 p.m. – Replay of SpaceCast Weekly (All Channels)
9 a.m., 2 p.m., 6 p.m., 10 p.m. – Replay of the Parker Solar Probe Launch (All Channels)
10 a.m.,3 p.m., 7 p.m., 11 p.m. – Replay of the Parker Solar Probe Post-Launch News Briefing (All Channels)

August 12, Sunday
8 a.m., 1 p.m., 6 p.m. – Replay of SpaceCast Weekly (All Channels)
9 a.m., 2 p.m., 7 p.m., 10 p.m. – Replay of the Parker Solar Probe Launch (All Channels)
10 a.m., 3 p.m., 8 p.m., 11 p.m. – Replay of the Parker Solar Probe Post-Launch News Briefing - Kennedy Space Center (All Channels)

August 13, Monday
11:15 a.m. – Space Station In-Flight Event with the Microsoft Youth Spark Event in Houston, Texas, and NASA astronaut Ricky Arnold (All Channels)

August 14, Tuesday
3:20 p.m. – RS-25 Rocket Engine Test at the Stennis Space Center with NASA Administrator Jim Bridenstine (All Channels)

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

Return to Contents

Space Calendar

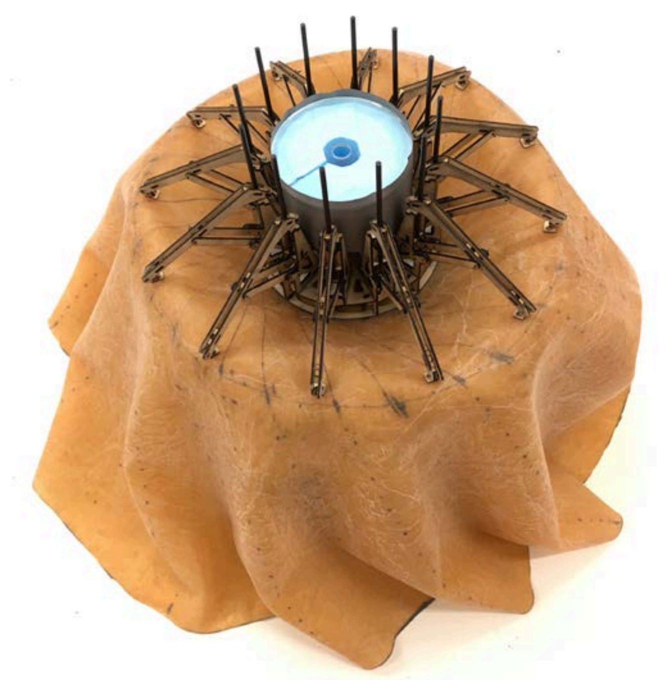
- Aug 10 - Comet 105P/Singer Brewster Perihelion (2.045 AU)
- Aug 10 - Comet C/2016 M1 (PANSTARRS) Perihelion (2.211 AU)
- Aug 10 - Comet 129P/Shoemaker-Levy At Opposition (3.625 AU)
- Aug 10 - Apollo Asteroid 11500 Tomaiyowit Closest Approach To Earth (0.462 AU)
- Aug 10 - Apollo Asteroid 1566 Icarus Closest Approach To Earth (0.551 AU)
- Aug 10 - Asteroid 1951 Lick Closest Approach To Earth (0.668 AU)
- Aug 10 - Amor Asteroid 3352 McAuliffe Closest Approach To Earth (1.531 AU)
- Aug 10 - Asteroid 58221 Boston Closest Approach To Earth (2.039 AU)
- Aug 10 - Asteroid 1941 Wild Closest Approach To Earth (2.070 AU)
- Aug 10 - Asteroid 1069 Planckia Closest Approach To Earth (2.382 AU)
- Aug 10 - 15th Anniversary (2003), 1st Person to Marry in Space (Yuri Malenchenko)
- Aug 10 - 50th Anniversary (1968), Piancaldoli Meteorite Fall (Hit House in Italy)
- Aug 11 - HOT [Aug 04] Partial Solar Eclipse
- Aug 11 - HOT [Aug 04] Parker Solar Probe (Solar Probe Plus) Delta 4H Launch
- Aug 11 - Asteroid 96205 Ararat Closest Approach To Earth (1.100 AU)
- Aug 11 - Asteroid 100267 JAXA Closest Approach To Earth (1.321 AU)
- Aug 11 - Asteroid 8000 Isaac Newton Closest Approach To Earth (1.820 AU)
- Aug 11 - Asteroid 624 Hektor (Jupiter Trojan) Closest Approach To Earth (4.362 AU)
- Aug 12 - Perseids Meteor Shower Peak
- Aug 12 - Comet 73P-S/Schwassmann-Wachmann Perihelion (1.028 AU)
- Aug 12 - Comet P/2013 R3 (Catalina-PANSTARRS) Closest Approach To Earth (1.300 AU)
- Aug 12 - Comet 48P/Johnson Perihelion (2.005 AU)
- Aug 12 - NEW [Aug 09] Amor Asteroid 2018 PT7 Near-Earth Flyby (0.067 AU)
- Aug 12 - Asteroid 4226 Damiaan Closest Approach To Earth (1.186 AU)
- Aug 12 - Asteroid 81203 Polynesia Closest Approach To Earth (1.853 AU)
- Aug 12 - Apollo Asteroid 306367 Nut Closest Approach To Earth (3.399 AU)
- Aug 12 - Centaur Object 52872 Okyrhoe At Opposition (9.793 AU)
- Aug 12 - 40th Anniversary (1978), ISEE-3 (ICE) Launch
- Aug 12-17 - Cassini Science Symposium 2018, Boulder, Colorado
- Aug 13 - Apollo Asteroid 2008 AG4 Near-Earth Flyby (0.094 AU)
- Aug 13 - Aten Asteroid 2013 ND15 (Venus Trojan) Closest Approach To Earth (0.143 AU)
- Aug 13 - Asteroid 498 Tokio Closest Approach To Earth (1.083 AU)
- Aug 13 - Asteroid 10051 Albee Closest Approach To Earth (1.186 AU)
- Aug 13 - Asteroid 17942 Whiterabbit Closest Approach To Earth (1.310 AU)
- Aug 13 - Asteroid 2034 Bernoulli Closest Approach To Earth (1.450 AU)
- Aug 13 - Asteroid 2404 Antarctica Closest Approach To Earth (1.905 AU)
- Aug 13 - Kuiper Belt Object 2015 UH87
- Aug 13-17 - Workshop: Model Coupling and Data Driven Simulations of Solar Eruptions, Boulder, Colorado
- Aug 13-17 - 2018 Community Earth System Model (CESM) Polar Modeling Workshop, Boulder, Colorado
- Aug 14 - Comet 3D/Biela Perihelion (0.803 AU)
- Aug 14 - Comet 245P/WISE Closest Approach To Earth (1.637 AU)
- Aug 14 - Comet P/2013 W1 (PANSTARRS) At Opposition (4.004 AU)
- Aug 14 - Asteroid 9000 Hal Closest Approach To Earth (0.781 AU)
- Aug 14 - Asteroid 4798 Mercator Closest Approach To Earth (1.088 AU)
- Aug 14 - Asteroid 4134 Schutz Closest Approach To Earth (1.352 AU)
- Aug 14 - Asteroid 9621 Michaelpalin Closest Approach To Earth (1.464 AU)

Source: JPL Space Calendar

Return to Contents

Food for Thought

Ph.D. student develops spinning heat shield for future spacecraft



A University of Manchester PhD student has developed a prototype flexible heat shield for spacecraft that could reduce the cost of space travel and even aid future space missions to Mars.

Heat shields are essentially used as the brakes to stop spacecraft burning up and crashing on entry and re-entry into a planet's atmosphere. This design is the first in the world to utilise centrifugal forces that stiffen lightweight materials to prevent burnup.

Current spacecraft heat shield methods include huge inflatables and mechanically deployed structures that are often heavy and complicated to use.

Rui Wu, from Manchester's School of Mechanical, Aerospace and Civil Engineering, says as well as being lightweight in design is prototype is also "self-regulating". This means there is no need for any additional machinery, reducing the weight of spacecraft even further and allowing for low-cost scientific research and recovery of rocket parts.

He says: "Spacecraft for future missions must be larger and heavier than ever before, meaning that heat shields will become increasingly too large to manage."

To address this demand Wu and his team have developed a flexible heat shield that is shaped like a skirt and spins like a sycamore seed. Planets with atmospheres, such as Earth and Mars, allow spacecraft to utilise aerodynamic drag to slow down and the prototype's design uses this to enable atmospheric entry.

"This is similar to high board diving, where the drag from water decelerates your body before you reach the bottom of the swimming pool," Wu explains.

The fast entry into Earth's atmosphere generates so much heat - over 10,000 ?C - that the air around the spacecraft can burn into plasma. For safe atmospheric entry, spacecraft need a front end, or shield, that tolerates high heat as well as an aerodynamic shape that generates drag.

However, Unlike Earth, the Martian atmosphere is very thin. "If Earth re-entry is like diving into thick honey, Mars entry would be like diving into water," Wu says.

To carry heavy equipment and astronauts, a high drag area is needed. When entering Earth's or Mars' atmospheres, spacecraft require highly designed shields to avoid burnup, generate drag, and support heavy loads.

Wu's design potentially solves both issues.

The prototype is made of a flexible material that allows for easy storage on board spacecraft. This material, while foldable, is strong and has a high temperature tolerance.

The shield is also stitched along a special pattern that allows it to spin up during flight, inducing centrifugal force.

Wu sees his design helping with space-based scientific research and rescue missions in the future. He adds: "More and more research is being conducted in space, but this is usually very expensive and the equipment has to share a ride with other vehicles.

"Since this prototype is lightweight and flexible enough for use on smaller satellites, research could be made easier and cheaper. The heat shield would also help save cost in recovery missions, as its high induced drag reduces the amount of fuel burned upon re-entry."

Source: EurekAlert Return to Contents

Space Image of the Week

Spiral Galaxy NGC 6744
Image Credit & Copyright: Martin Pugh

Explanation: Beautiful spiral galaxy NGC 6744 is nearly 175,000 light-years across, larger than our own Milky Way. It lies some 30 million light-years distant in the southern constellation Pavo and appears as only a faint, extended object in small telescopes. We see the disk of the nearby island universe tilted towards our line of sight. This remarkably detailed galaxy portrait covers an area about the angular size of the full moon. In it, the giant galaxy's elongated yellowish core is dominated by the light from old, cool stars. Beyond the core, grand spiral arms are filled with young blue star clusters and speckled with pinkish star forming regions. An extended arm sweeps past a smaller satellite galaxy at the upper left. NGC 6744's galactic companion is reminiscent of the Milky Way's satellite galaxy the Large Magellanic Cloud.

Source: APOD

Return to Contents