Space News Update

— July 5, 2019 —

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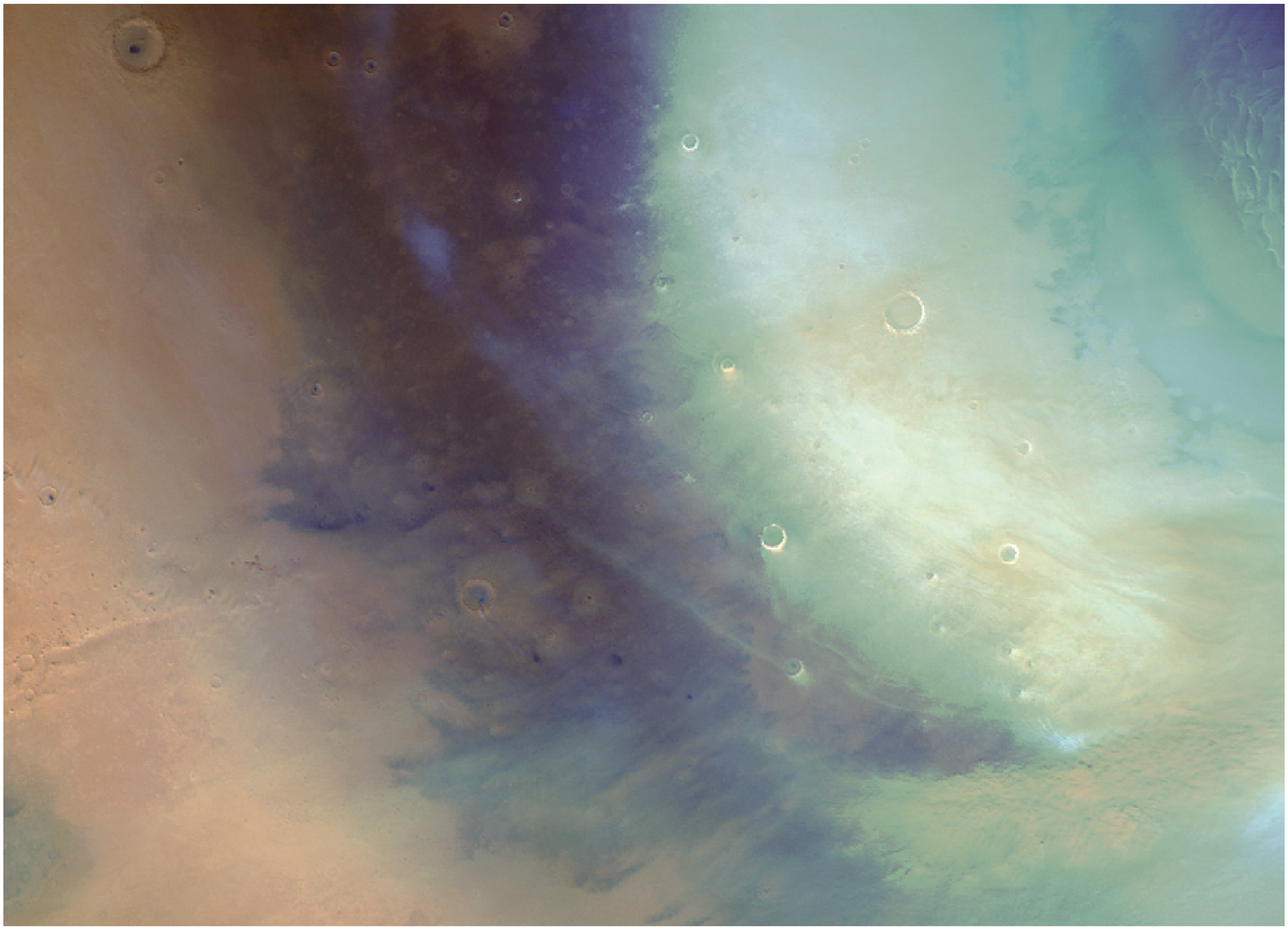
In the News

Departments

1. **Dust Storms Swirl at the North Pole of Mars**



ESA's Mars Express has been keeping an eye on local and regional dust storms brewing at the north pole of the Red Planet over the last month, watching as they disperse towards the equator.

Local and regional storms lasting for a few days or weeks and confined to a small area are common place on Mars, but at their most severe can engulf the entire planet, as experienced last year in a global storm that circled the planet for many months.

It is currently spring in the northern hemisphere of Mars, and water-ice clouds and small dust-lifting events are frequently observed along the edge of the seasonally retreating ice cap.

Many of the spacecraft at Mars return daily weather reports from orbit or from the surface, providing global and local impressions of the changing atmospheric conditions. ESA's Mars Express observed at least eight different storms at the edge of the ice cap between 22 May and 10 June, which formed and dissipated very quickly, between one and three days.

The two cameras onboard the spacecraft, the High Resolution Stereo Camera (HRSC) and the Visual Monitoring Camera (VMC), have been monitoring the storms over the last weeks. The image at the top of this page, taken by HRSC on 26 May, captures a spiral-shaped dust storm, its brown colour contrasting against the white ice of the north polar ice cap below.

Meanwhile the animated sequence (link here) was compiled from images of a different storm captured by the VMC over a period of 70 minutes on 29 May. This particular storm started on 28 May and continued to around 1 June, moving towards the equator during that time.

The montage of images shows three different storms developing on 22 May, on 26 May, and between 6 and 10 June. In the latter case, the cameras watched the storm evolve for several days as it moved in an equatorward direction.

At the same time, wispy patches of light-coloured clouds can be seen at the outer margin of the polar cap and also several thousand kilometres away, close to the volcanoes Elysium Mons and Olympus Mons.

Together with the MARCI camera onboard NASA's Mars Reconnaissance Orbiter, Mars Express observed that when the dust storms reached the large volcanoes, orographic clouds - water ice clouds driven by the influence of the volcano's leeward slope on the air flow - that had previously been developing started to evaporate as a result of the air mass being heated by the influx of dust.

These regional dust storms only last a few days; the elevated dust is transported and spread out by global circulation into a thin haze in the lower atmosphere, around 20-40 km altitude. Some traces of dust and clouds remained in the volcanic province into mid-June.

Look out for dust storms in the daily images provided by the VMC - they are posted to a dedicated Flickr and Twitter account.

Additional images

Source: Spaceref.com

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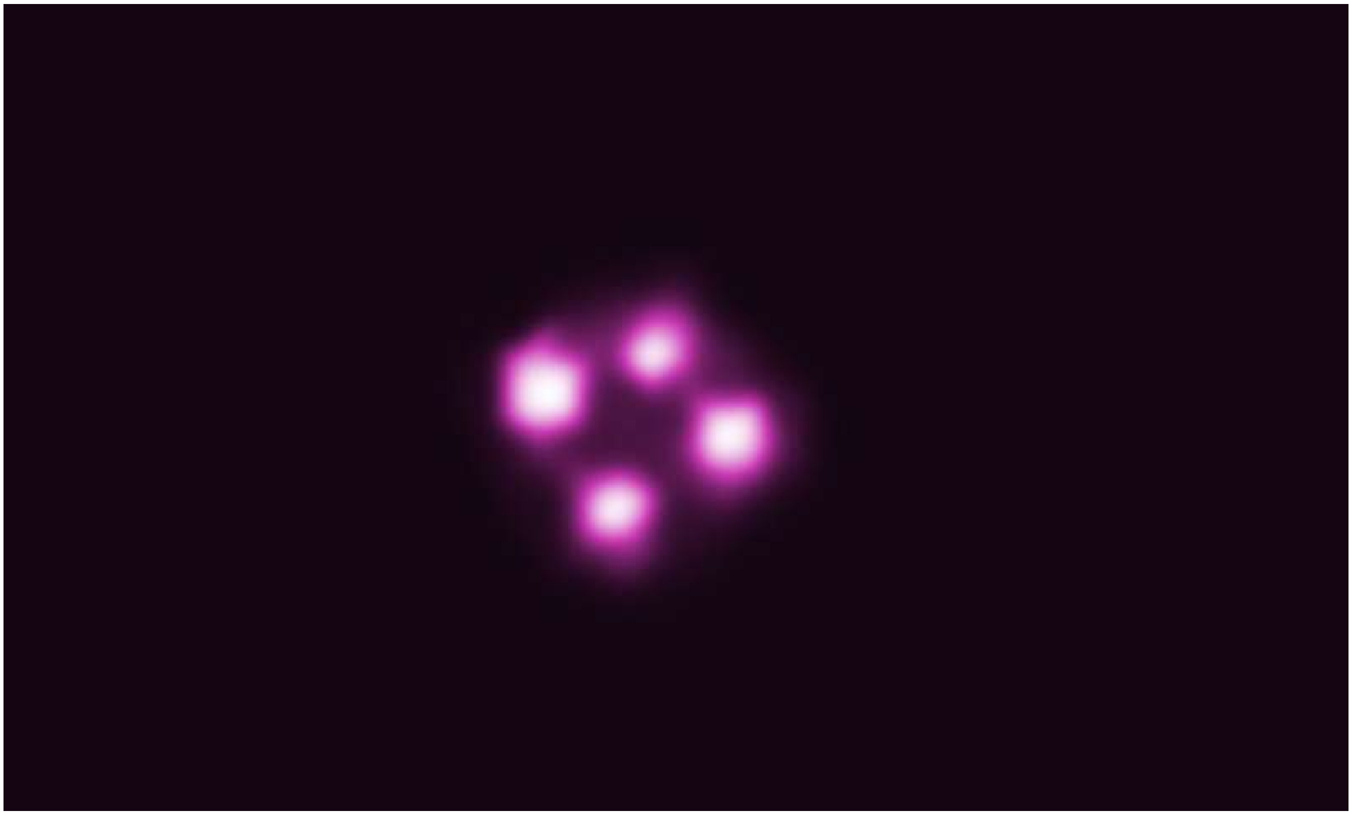
2. X-rays Spot Spinning Black Holes Across Cosmic Sea



Like whirlpools in the ocean, spinning black holes in space create a swirling torrent around them. However, black holes do not create eddies of wind or water. Rather, they generate disks of gas and dust heated to hundreds of millions of degrees that glow in X-ray light.

Using data from NASA's Chandra X-ray Observatory and chance alignments across billions of light-years, astronomers have deployed a new technique to measure the spin of five supermassive black holes. The matter in one of these cosmic vortices is swirling around its black hole at greater than about 70% of the speed of light.

The astronomers took advantage of a natural phenomenon called a gravitational lens. With just the right alignment, the bending of space-time by a massive object, such as a large galaxy, can magnify and produce multiple images of a distant object, as predicted by Einstein.

In this latest research, astronomers used Chandra and gravitational lensing to study six quasars, each consisting of a supermassive black hole rapidly consuming matter from a surrounding accretion disk. Gravitational lensing of the light from each of these quasars by an intervening galaxy has created multiple images of each quasar, as shown by these Chandra images of four of the targets. The sharp imaging ability of Chandra is needed to separate the multiple, lensed images of each quasar.

The key advance made by researchers in this study was that they took advantage of "microlensing," where individual stars in the intervening, lensing galaxy provided additional magnification of the light from the quasar. A higher magnification means a smaller region is producing the X-ray emission.

The researchers then used the property that a spinning black hole is dragging space around with it and allows matter to orbit closer to the black hole than is possible for a non-spinning black hole. Therefore, a smaller emitting region corresponding to a tight orbit generally implies a more rapidly spinning black hole. The authors concluded from their microlensing analysis that the X-rays come from such a small region that the black holes must be spinning rapidly.

The results showed that one of the black holes, in the lensed quasar called the "Einstein Cross," is spinning at, or almost at, the maximum rate possible. This corresponds to the event horizon, the black hole's point of no return, spinning at the speed of light, which is about 670 million miles per hour. Four other black holes in the sample are spinning, on average, at about half this maximum rate. (The 6th did not enable an estimate of spin.)

For the Einstein Cross the X-ray emission is from a part of the disk that is less than about 2.5 times the size of the event horizon, and for the other 4 quasars the X-rays come from a region four to five times the size of the event horizon.

How can these black holes spin so quickly? The researchers think that these supermassive black holes likely grew by accumulating most of their material over billions of years from an accretion disk spinning with a similar orientation and direction of spin, rather than from random directions. Like a merry-go-round that keeps getting pushed in the same direction, the black holes kept picking up speed.

The X-rays detected by Chandra are produced when the accretion disk surrounding the black hole creates a multimillion-degree cloud, or corona, above the disk near the black hole. X-rays from this corona reflect off the inner edge of the accretion disk, and the strong gravitational forces near the black hole distort the reflected X-ray spectrum, that is, the amount of X-rays seen at different energies. The large distortions seen in the X-ray spectra of the quasars studied here imply that the inner edge of the disk must be close to the black holes, giving further evidence that they must be spinning rapidly.

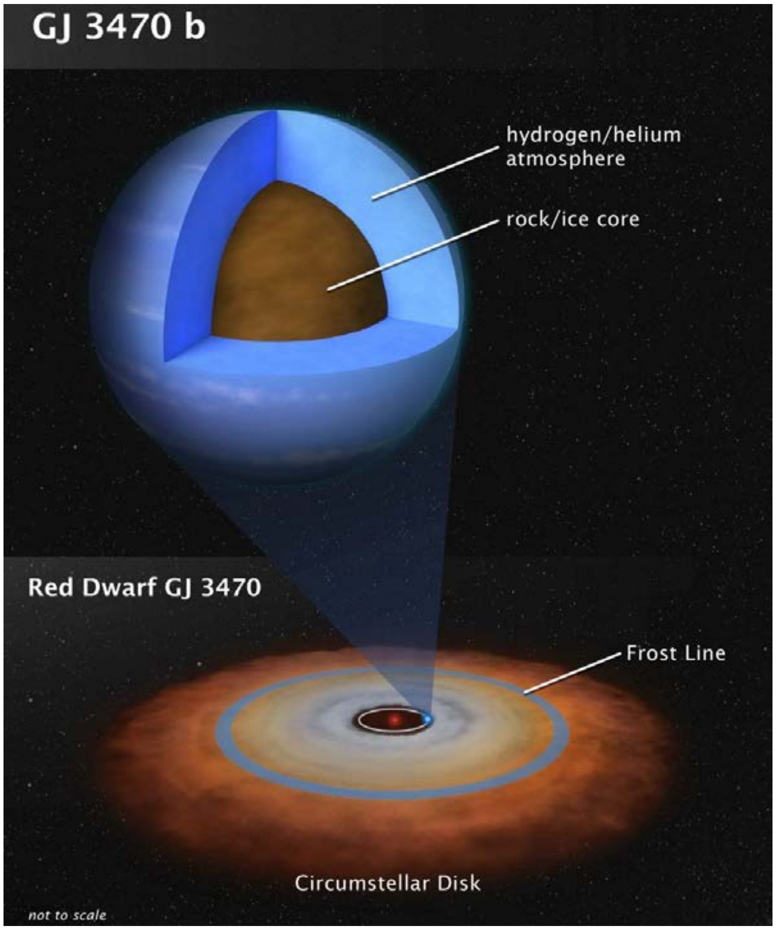
The quasars are located at distances ranging from 8.8 billion to 10.9 billion light-years from Earth, and the black holes have masses between 160 and 500 million times that of the sun. These observations were the longest ever made with Chandra of gravitationally lensed quasars, with total exposure times ranging between 1.7 and 5.4 days.

Explore further

Chandra and XMM-Newton provide direct measurement of distant black hole's spin

Source: Phys.org Return to Contents

3. NASA Telescopes Reveal the Atmosphere of A Strange Hybrid Exoplanet



Out there in space is an unusual exoplanet name Gliese 3470 b (GJ 3470 b.) It's a strange world, kind of like a hybrid between Earth and Neptune. It has a rocky core like Earth, but is surrounded by an atmosphere made of hydrogen and helium. That combination is unlike anything in our own Solar System.

The planet orbits a red dwarf star called Gliese 3470, in the constellation Cancer. GJ 3470 b is about 12.6 Earth masses, meaning it's roughly halfway between Earth and Neptune in mass. (Neptune is about 17 Earth masses.)

Thanks to the Kepler mission, we know that there are many exoplanets in this mass range. It's possible that up to 80% of planets fall in this range, though future exoplanet missions will no doubt clarify that. Until now, astronomers haven't had a good look at the atmosphere of one of these planets, and so their formation is a bit of a mystery.

The Hubble and the Spitzer space telescopes have teamed up to take a close look at the atmosphere of GJ 3470 b, and it's the first time that astronomers have been able to identify the chemical fingerprint of the atmosphere of a planet like this. What they found is that the planet has an almost pristine, primordial atmosphere of hydrogen and helium, without any heavier elements present.

And that presents a bit of a mystery.

Half Star, Half Planet?

GJ 3470 b, with its atmosphere of hydrogen and helium, is more like a star than a planet in some ways. Our own Sun is 73% hydrogen, and the rest is almost all helium. Only a tiny portion of the Sun is heavier elements like oxygen, neon, iron, and carbon. The gas giants Jupiter and Saturn are mostly hydrogen and helium, but they also contain other compounds like methane and ammonia, as well as heavier elements. Those compounds are nearly absent in GJ 3470 b.

"This is a big discovery from the planet-formation perspective. The planet orbits very close to the star and is far less massive than Jupiter – 318 times Earth's mass – but has managed to accrete the primordial hydrogen/helium atmosphere that is largely 'unpolluted' by heavier elements," said Björn Benneke of the University of Montreal in Canada, in a NASA press release. "We don't have anything like this in the solar system, and that's what makes it striking."

The astronomers behind this work combined the multi-wavelength capabilities of both space telescopes to get a good look at GJ 3470 b's atmosphere. They did it by measuring the absorption of starlight as the exoplanet transited in front of its host star. They also measured the loss of reflected light as the exoplanet passed behind the star. Altogether, the pair of space telescopes observed 12 transits and 20 eclipses.

Astronomers use spectroscopy to identify the chemical fingerprints of hydrogen and helium in the atmosphere, and the nature of the planet's atmosphere made this all possible. It's mostly clear with very little haze, meaning they were able to look deeply into the atmosphere. "For the first time we have a spectroscopic signature of such a world," said Benneke.

But that spectroscopy revealed something unexpected. The astronomers thought they'd find a similar chemical composition to the planet Neptune, with heavier elements like oxygen and carbon. But instead they found an atmosphere that resembled the Sun.

"We expected an atmosphere strongly enriched in heavier elements like oxygen and carbon which are forming abundant water vapor and methane gas, similar to what we see on Neptune," said Benneke. "Instead, we found an atmosphere that is so poor in heavy elements that its composition resembles the hydrogen/helium-rich composition of the Sun."

Piecing It Together

Now that astronomers have gotten a good handle on the exoplanet's atmosphere, thanks to the combined power of the Hubble and the Spitzer space telescopes, they can begin to understand how this oddball planet may have formed.

GJ 3470 b is in sharp contrast to other exoplanets. Astronomers think that other exoplanets, for example Hot Jupiters, form at a great distance from their Sun, and then migrate inwards. But astronomers think that this exoplanet formed very close to its red dwarf star, close to where it's positioned today.

It likely formed as a tiny rocky object at first, enmeshed in the center of the protoplanetary disk, around the same time as the star formed. It would have gathered, or accreted, its atmosphere out of the same primordial material in the disk that the star formed from. And that would explain its hydrogen/helium atmosphere, and why it lacks heavier elements.

"We're seeing an object that was able to accrete hydrogen from the protoplanetary disk but didn't run away to become a hot Jupiter," said Benneke. "This is an intriguing regime."

What may have happened is that it was still accreting matter from the disk, but the star grew faster, and the disk dissipated. This prevented GJ 3470 b from growing larger and becoming more like the gas giants in our Solar System, with heavier elements in their atmospheres.

For now, this is where our understanding of this intriguing, oddball exoplanet stands. But once the James Webb Space Telescope (JWST) is up and running, it'll tell us more.

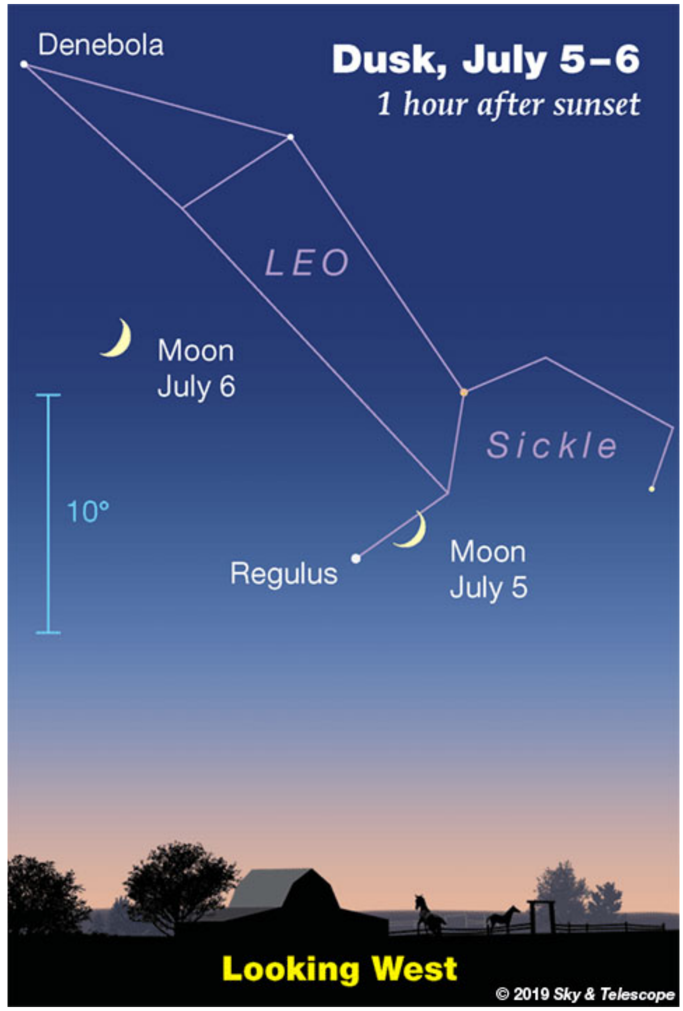
The JWST is a powerful space telescope that can see into the infrared with unprecedented sensitivity. It'll be able to probe the atmosphere of GJ 3470 b, and other exoplanets, and reveal things as yet unseen. In particular, it will observe in wavelengths that render obfuscating hazes almost transparent.

Then, our understanding of all exoplanets, not just this one, will grow in leaps and bounds.

Source: Universe Today Return to Contents

The Night Sky

Friday, July 5



• As twilight fades, look for Regulus to emerge into view 2° or 3° from the crescent Moon, as shown here (for the middle of North America).

Saturday, July 6

• Three doubles at the top of Scorpius. The head of Scorpius — the vertical row of three stars to the right of Jupiter and Antares — is highest in the south after dark this week. The brightest of the three is Delta (δ) Scorpii, the one in the middle.

The top star of the row is Beta (ß) Scorpii, a fine double star for telescopes.

Just 1° below Beta is the very wide naked-eye pair Omega^1 and Omega^2 Scorpii, not quite vertical. Binoculars show their slight color difference. They're spectral types *B*9 and *G*2.

Left of Beta by 1.6° is Nu Scorpii, another fine telescopic double. Or rather triple. High power in good seeing reveals that Nu's brighter component itself is a close binary, separation 2 arcseconds.

Sunday, July 7

• High in the northwest after dark, the Big Dipper hangs down by its handle as it begins its long, slow scoop toward the right.

• Low in the north-northeast, meanwhile, the upright W of Cassiopeia is slowly beginning to tilt and climb.

Monday, July 8

• First-quarter Moon tonight (exactly so at 6:55 a.m. Tuesday morning EDT). As the stars come out, look for Arcturus nearly 30° (about three fists at arm's length) above the Moon, and Spica less than half that far to the Moon's left.

• How old are the craters you see on the Moon with a small scope? Bright, splashy Tycho is young at age 85 million years. The lava-flooded craters in and around the edges of the maria obviously predate the maria, most of which flowed onto the lunar surface between 3 and 3.5 billion years ago. Find the ages of many telescopic favorites with Charles Wood's "How Old Is That Crater?" in the July *Sky & Telescope*, page 52.

Source: Sky & Telescope

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ISS Sighting Opportunities

For Denver:

Date	Visible	Max Height	Appears	Disappears
Sat Jul 6, 3:04 AM	1 min	43°	43° above NNW	25° above NNE
Sat Jul 6, 4:40 AM	3 min	13°	10° above NW	12° above N
Sun Jul 7, 2:17 AM	1 min	25°	25° above NE	11° above NE
Sun Jul 7, 3:50 AM	3 min	16°	11° above WNW	14° above N
Mon Jul 8, 1:29 AM	< 1 min	10°	10° above ENE	10° above ENE
Mon Jul 8, 3:02 AM	2 min	21°	19° above NW	18° above N
Mon Jul 8, 4:39 AM	1 min	10°	10° above NNW	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)

No Special Programming

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

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Space Calendar

- Jul 05 - UPDATED [Jul 04] Meteor-M N2-2/ Ionosfera 3 & 4/ Landmapper BC5/BC6/ MOVE 2b Soyuz-2.1b/Fregat-M Launch
- Jul 05 - Falcon Eye 1 Vega Launch
- Jul 05 - Comet P/2012 K3 (Gibbs) At Opposition (1.108 AU)
- Jul 05 - Comet 350P/McNaught At Opposition (2.969 AU)
- Jul 05 - Asteroid 11945 Amsterdam Closest Approach To Earth (1.774 AU)
- Jul 05 - Apollo Asteroid 471926 Jormungandr Closest Approach To Earth (1.776 AU)
- Jul 05 - Centaur Object 10370 Hylonome At Opposition (23.332 AU)
- Jul 05 - Kuiper Belt Object 307261 (2002 MS4) At Opposition (45.615 AU)
- Jul 06 - Comet 31P/Schwassmann-Wachmann Perihelion (3.425 AU)
- Jul 06 - Apollo Asteroid 10145 (1994 CK1) Near-Earth Flyby (0.099 AU)
- Jul 06 - Asteroid 9133 d'Arrest Closest Approach To Earth (1.504 AU)
- Jul 06 - Asteroid 84566 VIMS Closest Approach To Earth (2.174 AU)
- Jul 06 - Austin Astronomical Society Inks Lake Star Party, Inks Lake State Park, Texas
- Jul 06 - Summer on the Hudson: Stargazing, Manhattan, New York
- Jul 06 - 95th Anniversary (1924), Johnstown Meteorite Fall (Hit House in Colorado)
- Jul 06 - Robert White's 95th Birthday (1924)
- Jul 07 - Mercury Passes 3.8 Degrees from Mars
- Jul 07 - Comet 254P/McNaught Closest Approach To Earth (2.977 AU)
- Jul 07 - Comet P/2013 O2 (PANSTARRS) At Opposition (3.519 AU)
- Jul 07 - Comet 24P/Schaumasse At Opposition (4.028 AU)
- Jul 07 - Comet C/2017 K5 (PANSTARRS) Closest Approach To Earth (6.943 AU)
- Jul 07 - Apollo Asteroid 2016 NO56 Near-Earth Flyby (0.009 AU)
- Jul 07 - NEW [Jul 03] Amor Asteroid 2019 ME3 Near-Earth Flyby (0.032 AU)
- Jul 07 - Apollo Asteroid 2016 OF Near-Earth Flyby (0.033 AU)
- Jul 07 - Aten Asteroid 2013 ND15 (Venus Trojan) Closest Approach To Earth (0.482 AU)
- Jul 07 - Asteroid 4804 Pasteur Closest Approach To Earth (1.664 AU)
- Jul 08 - Comet C/2018 X2 (Fitzsimmons) Perihelion (2.126 AU)
- Jul 08 - NEW [Jul 03] Apollo Asteroid 2019 MT2 Near-Earth Flyby (0.011 AU)
- Jul 08 - Apollo Asteroid 85585 Mjolnir Closest Approach To Earth (0.744 AU)
- Jul 08 - Aten Asteroid 398188 Agni Closest Approach To Earth (1.018 AU)
- Jul 08 - Asteroid 2843 Yeti Closest Approach To Earth (1.483 AU)
- Jul 08 - Asteroid 96193 Edmonton Closest Approach To Earth (1.706 AU)
- Jul 08 - Asteroid 21564 Widmanstatten Closest Approach To Earth (2.137 AU)
- Jul 08 - 25th Anniversary (1994), STS-65 Launch (Space Shuttle Endeavour - Shuttle Radar Laboratory)

Robert M. White

Source: JPL Space Calendar

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Food for Thought

Artificial Gravity Breaks Free from Science Fiction

Artificial gravity has long been the stuff of science fiction. Picture the wheel-shaped ships from films like 2001: A Space Odyssey and The Martian, imaginary craft that generate their own gravity by spinning around in space. Now, a team from CU Boulder is working to make those out-there technologies a reality.

The researchers, led by aerospace engineer Torin Clark, can't mimic those Hollywood creations—yet. But they are imagining new ways to design revolving systems that might fit within a room of future space stations and even moon bases. Astronauts could crawl into these rooms for just a few hours a day to get their daily doses of gravity. Think spa treatments, but for the effects of weightlessness.

The group hopes that its work will one day help keep astronauts healthy as they venture into space, allowing humans to travel farther from Earth than ever before and stay away longer.

But first, Clark's team will need to solve a problem that has plagued proponents of artificial gravity for years: motion sickness. "Astronauts experience bone loss, muscle loss, cardiovascular deconditioning and more in space. Today, there are a series of piecemeal countermeasures to overcome these issues," said Clark, an assistant professor in the Ann and H.J. Smead Department of Aerospace Engineering Sciences. "But artificial gravity is great because it can overcome all of them at once."

Strange sensation

Clark tests it out himself in a room on campus not much bigger than an ordinary office. The engineer lies down on a metal platform that looks like a hospital gurney, part of a machine that engineers call a short-radius centrifuge. After a quick countdown, the platform begins to rotate around the room, first slowly and then faster and faster.

Nicholas Dembiczak, an undergraduate student studying aerospace engineering and research assistant in the lab, watches Clark's progress from a computer monitor in the room next door. "You're coming on 15 rotations per minute now," he announces over a microphone. Clark, however, doesn't seem to mind. "It's fun," he says. It's also the closest that scientists on Earth can get to how artificial gravity in space might work.

Clark explained that the angular velocity generated by the centrifuge pushes his feet toward the base of the platform—almost as if he was standing under his own weight.

But there's a problem with this kind of gravity, one that's familiar to anyone who has visited an amusement park. If Clark turned his head to either side while spinning, he would experience a sensation known as the "cross-coupled illusion"—a disruption of the inner ear that makes you feel like you're tumbling.

"It's a very strange sensation," said Kathrine Bretl, a graduate student in Clark's lab.

So strange that, for decades, engineers considered that kind of motion sickness a deal-breaker for artificial gravity.

Clark and Bretl, however, had other ideas.

Taking it slow

In a series of recent studies, the pair and their colleagues set out to investigate whether queasiness is really the price of admission for artificial gravity. In other words, could astronauts train their bodies to tolerate the strain that comes from being spun around in circles like hamsters in a wheel?

The team began by recruiting a group of volunteers and tested them on the centrifuge across 10 sessions.

But unlike most earlier studies, the CU Boulder researchers took things slow. They first spun their subjects at just one rotation per minute, and only increased the speed once each recruit was no longer experiencing the cross-coupled illusion.

"I present at a conference and everyone says, 'she's the one who spins people and makes them sick,'" Bretl said. "But we try to avoid instances of motion sickness because the whole point of our research is to make it tolerable."

The personalized approach worked. By the end of 10th session, the study subjects were all spinning comfortably, without feeling any illusion, at an average speed of about 17 rotations per minute. That's much faster than any previous research had been able to achieve. The group reported its results in June in the Journal of Vestibular Research.

Clark says that the study makes a strong case that artificial gravity could be a realistic option for the future of space travel.

"As far as we can tell, essentially anyone can adapt to this stimulus," he said.

In ongoing research, the researchers also bumped up the number of training sessions to 50, finding that people could spin even faster with more time.

But they also have a lot more questions to answer before you might see an artificial gravity room perched on top of the International Space Station: How long do the effects of training last, for example, and how much gravity would an astronaut need to offset the loss of muscle and bone?

Bretl, however, hopes that the research will begin to convince scientists that artificial gravity isn't just for summer blockbusters.

"The point of our work is to try to get more people to think that maybe artificial gravity isn't so crazy," she said. "Maybe it has a place outside of science fiction."

Explore further

Testing the value of artificial gravity for astronaut health

Source: Phys.org Return to Contents

Space Image of the Week

La Silla Eclipse Sequence

Explanation The road to the high mountaintop La Silla Observatory in the Chilean Atacama Desert also led in to the path of July 2nd's total solar eclipse. Recorded at regular intervals before and after the total eclipse phase, the frames in this composite sequence include the moment the Moon's dark shadow fell across some of planet Earth's advanced large telescopes. The dreamlike view looks west toward the setting Sun and the approaching Moon shadow. In fact La Silla was a little north of the shadow track's center line, so the region's stunning, clear skies are slightly brighter to the north (right) in the scene.

IImage Credit & Copyright: Petr Horálek

Source: APOD

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