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Space Image of the Week
While Hurricane Arthur was still a hurricane, the new Global Precipitation Measurement (GPM) Core Observatory flew over the storm last week and captured its structure in 3-D. This was a good test of the new satellite, which is supposed to help NASA track these Atlantic storms to better precision than before. The joint NASA-Japanese Aerospace Exploration Agency mission allowed researchers to do better forecasting because they could track the precipitation to 1,000 feet vertically and three miles horizontally (305 meters and five kilometers). “Hurricane features pop out more. They’re sharper, there’s more clarity to the structures,” stated NASA Goddard hurricane researcher Scott Braun. “Being able to see the structures more clearly may allow for better determination of the structure of the eye wall and rainbands, thereby providing clues about the likelihood of a storm intensifying or weakening.” For more information on the findings, check out this [NASA web page](https://www.nasa.gov/). 

Source: [Universe Today](https://www.universetoday.com/)

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NASA's Wow! Even from interstellar space, the plucky Voyager 1 can still listen in to activities from our Sun. Whenever the Sun has a large amount of activity, the waves of energy it sends out bashes into the charged gas particles or plasma surrounding the NASA spacecraft, which has been sailing away from Earth since 1977. There have been three events so far from our Sun (which is in solar maximum), with each one confirming scientists’ findings that interstellar space is where the spacecraft is, NASA said. “Normally, interstellar space is like a quiet lake,” stated Voyager project scientist Ed Stone of the California Institute of Technology. “But when our sun has a burst, it sends a shock wave outward that reaches Voyager about a year later. The wave causes the plasma surrounding the spacecraft to sing.” “The tsunami wave rings the plasma like a bell,” added Stone. “While the plasma wave instrument lets us measure the frequency of this ringing, the cosmic ray instrument reveals what struck the bell — the shock wave from the Sun.” The discovery of this wave front confirms the previous assertion that Voyager 1 is indeed in interstellar space, NASA added. Winds from the sun push against the plasma at the edge of interstellar space, making it denser (40 times denser than what was measured before Voyager reached the milestone in 2012, in fact.) NASA’s announcement in 2013 that Voyager 1 is in interstellar space was accompanied by intense discussion about whether it is in or out of the Solar System (it still hasn’t reached the shell of the Oort Cloud that hosts comets, a milestone that won't be possible for 300 years). Prior to the announcement, several scientific papers had also weighed in on Voyager 1’s status, with some saying it was interstellar space and some not.
NASA Mars rover Curiosity has driven out of the ellipse, approximately 4 miles wide and 12 miles long (7 kilometers by 20 kilometers), that was mapped as safe terrain for its 2012 landing inside Gale Crater. The High Resolution Imaging Science Experiment (HiRISE) camera on NASA's Mars Reconnaissance Orbiter photographed the rover on June 27 at the end of a drive that put Curiosity right on the ellipse boundary. An image from that observation is online at: http://www.jpl.nasa.gov/spaceimages/details.php?id=PIA18399

The landing ellipse is the area within which the rover had a very high probability of touching down when it arrived at Mars on Aug. 5, 2012, PDT (Aug. 6, UTC). The area needed to meet requirements for providing access to scientifically interesting sites while presenting few landing hazards, such as steep slopes or large boulders. Many areas of scientific interest have slopes ineligible for landing safety, and Curiosity was designed to have the capability of driving far enough to get to slopes outside of the landing ellipse. Since landing, Curiosity has driven slightly more than 5 miles (8 kilometers). NASA's Mars Science Laboratory Project is using Curiosity to assess ancient habitable environments and major changes in Martian environmental conditions. NASA's Jet Propulsion Laboratory, a division of the California Institute of Technology, Pasadena, manages the Mars Reconnaissance Orbiter and Mars Science Laboratory projects for NASA's Science Mission Directorate in Washington. HiRISE is operated by the University of Arizona, Tucson. The instrument was built by Ball Aerospace & Technologies Corp., Boulder, Colorado. For more information about the Mars Reconnaissance Orbiter, which has been studying Mars from orbit since 2006, visit: http://www.nasa.gov/mro. For more information about Curiosity, visit: http://www.jpl.nasa.gov/msl, http://www.nasa.gov/msl and http://mars.jpl.nasa.gov/msl/
The Night Sky

Tuesday, July 8
The Moon's latest daily shift eastward brings it left of Saturn and upper right of Antares at nightfall. Closer below the Moon are Beta and Delta Scorpii (as seen from North America).

Wednesday, July 9
Can your scope separate a double star 1.0 arcsecond wide? High overhead, 44 Bootis provides a fine test. And one of its components is a weird variable star. See the article and chart in the July Sky & Telescope, page 52.

Thursday, July 10
Vega is the brightest star very high in the east these evenings. The brightest to its lower left is Deneb. Farther to Vega's lower right is Altair. These make up the big Summer Triangle.

Friday, July 11
Mars and Spica form a striking pair in the southwestern sky at dusk! They're now just under 2° apart. On Sunday evening they'll be at their minimum separation, 1.3°. Watch them change day by day. Full Moon tonight and Saturday night (exactly full at 7:25 a.m. Saturday morning Eastern Daylight Time.) This evening the Moon shines in northern Sagittarius. Tomorrow evening it's in western Capricornus.

Saturday, July 12
Look far above the still-full Moon this evening, and a bit left, to spot Altair. Continue a similar distance in roughly the same direction, and there's brighter Vega.

Source: Sky & Telescope
ISS Sighting Opportunities
For Denver:

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

NASA-TV Highlights
(all times Eastern Daylight Time)

12 p.m., Tuesday, July 8 - ISS Mission Control On-Console Interview with the Digital Learning Network (all channels)

9:30 a.m., Wednesday, July 9 - ISS Expedition 40 In-Flight Interviews with Time.com and Time Warner Cable, Albany, N.Y (all channels)

4 p.m., Thursday, July 10 - Orbital Sciences/Cygnus-2 Science and Technology Cargo News Conference - WFF (all channels)
5 p.m., Thursday, July 10 - Orbital Sciences/Cygnus-2 Pre-Launch News Conference - WFF (all channels)

12:30 p.m., Friday, July 11 - Video B-Roll Feed of Processing of the Orbital Sciences Antares Rocket and Cygnus Cargo Craft - (all channels)
1 p.m., Friday, July 11 - Coverage of the Launch of the Orbital Sciences/Cygnus-2 Resupply Mission to the ISS (Launch scheduled at 1:40 p.m. EDT) (all channels)
3 p.m., Friday, July 11 - Orbital Sciences/Cygnus-2 Post-Launch News Conference - WFF (all channels)

Watch NASA TV online by going to the NASA website.
Space Calendar

- Jul 08 - Meteor M-2/ M3MSat/ TechDemoSat 1 (TDS 1)/ AISSat 2/ Baumanets-2/ Monika (Relek)/ Venta-1/ UKube 1/ DX 1/ SkySat 2 Soyuz 2-1b-Fregat Launch
- Jul 08 - Olymp 1 Proton-M Briz-M Launch
- Jul 08 - Moon Occults Saturn
- Jul 08 - Comet P/2007 V2 (Hill) At Opposition (2.702 AU)
- Jul 08 - Comet P/1999 J6 (SOHO) At Opposition (3.901 AU)
- Jul 08 - Asteroid 2013 AG99 Near-Earth Flyby (0.007 AU)
- Jul 08 - Asteroid 2014 MF19 Near-Earth Flyby (0.099 AU)
- Jul 08 - Asteroid 5231 Verne Closest Approach To Earth (1.808 AU)
- Jul 08 - Asteroid 10637 Heimlich Closest Approach To Earth (2.258 AU)
- Jul 08 - Asteroid 2246 Bowell Closest Approach To Earth (3.047 AU)
- Jul 09 - Rosetta, Trajectory Correction Maneuver
- Jul 09 - Asteroid 2014 MF6 Near-Earth Flyby (0.023 AU)
- Jul 09 - Asteroid 2009 BD Closest Approach To Earth (0.300 AU)
- Jul 09 - Asteroid 11195 Woomera Closest Approach To Earth (1.537 AU)
- Jul 09 - Asteroid 7853 Confucius Closest Approach To Earth (2.304 AU)
- Jul 09 - Asteroid 1345 Potomac Closest Approach To Earth (3.707 AU)
- Jul 09 - 35th Anniversary (1979), Voyager 2, Jupiter Flyby
- Jul 10 - O3b Soyuz-STB/Fregat Launch
- Jul 10 - Gaofen 2 (GF 2)/ Heweliusz CZ-4B Launch
- Jul 10 - Comet C/2013 U4 (Catalina) Closest Approach To Earth (0.315 AU)
- Jul 10 - Comet 67P/Churyumov-Gerasimenko At Opposition (2.742 AU)
- Jul 10 - Asteroid 30581 (2001 PY2) Occults HIP 113705 (6.5 Magnitude Star)
- Jul 10 - Asteroid 34978 (1901 T-3) Occults HIP 61296 (5.6 Magnitude Star)
- Jul 10 - Asteroid 114703 North Dakota Closest Approach To Earth (1.703 AU)
- Jul 11 - Cygnus CRS Orb-2/ MicroMAS Antares Launch (International Space Station)
- Jul 11 - Comet 72P/Denning-Fujikawa Perihelion (0.784 AU)
- Jul 11 - Asteroid 4417 Lecar Occults HIP 77634 (3.9 Magnitude Star)
- Jul 11 - Asteroid 2014 NG3 Near-Earth Flyby (0.059 AU)
- Jul 11 - Asteroid 1034 Mozartia Closest Approach To Earth (0.773 AU)
- Jul 11 - 35th Anniversary (1979), Skylab Re-Enters Into Earth's Atmosphere
- Jul 12 - Mercury At Its Greatest Western Flongation (21 Degrees)
- Jul 12 - Comet P/2005 S3 (Read) At Opposition (4.254 AU)
- Jul 12 - Comet C/2010 S1 (LINEAR) At Opposition (5.639 AU)
- Jul 12 - Asteroid 2014 LX21 Near-Earth Flyby (0.067 AU)
- Jul 12 - Asteroid 881 Athene Closest Approach To Earth (1.111 AU)
- Jul 12 - Asteroid 3752 Camillo Closest Approach To Earth (1.613 AU)

Source: JPL Space Calendar

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A newly discovered planet in a binary, or twin, star system located 3,000 light-years from Earth is expanding astronomers' notions of where Earth-like -- and even potentially habitable -- planets can form, and how to find them. At twice the mass of Earth, the planet orbits one of the stars in the binary system at almost exactly the same distance at which Earth orbits the sun. However, because the planet's host star is much dimmer than the sun, the planet is much colder than Earth -- a little colder, in fact, than Jupiter's icy moon Europa. Four international research teams, led by professor Andrew Gould of The Ohio State University in Columbus, published their discovery in the July 4 issue of the journal Science. The research is partly funded by NASA. The study provides the first evidence that terrestrial planets can form in orbits similar to Earth's, even in a binary star system where the stars are not very far apart. Although this planet itself is too cold to be habitable, the same planet orbiting a sun-like star in such a binary system would be in the so-called "habitable zone" -- the region where conditions might be right for life. "This greatly expands the potential locations to discover habitable planets in the future," said Scott Gaudi, professor of astronomy at Ohio State. "Half the stars in the galaxy are in binary systems. We had no idea if Earth-like planets in Earth-like orbits could even form in these systems." Earlier evidence that planets form in binary star systems came from NASA's Kepler and Spitzer space telescopes, but the planets and dust structures in those studies were not similar to those of Earth. The technique astronomers use to find the planet, called OGLE-2013-BLG-0341LBb, is called gravitational microlensing. In this method, the light of a distant star is magnified by a closer star that happens to pass in front -- if a planet is also present around the foreground star, it will further alter and distort the light of the background star. The telescopes used in this study are part of several projects, including the OGLE (Optical Gravitational Lensing Experiment), MOA (Microlensing Observations in Astrophysics), MicroFUN (the Microlensing Follow Up Network), and the Wise Observatory. Searching for planets within binary systems is tricky for most techniques, because the light from the second star complicates the interpretation of the data. "But in gravitational microlensing," Gould explained, "we don't even look at the light from the star-planet system. We just observe how its gravity affects light from a more distant, unrelated star. This gives us a new tool to search for planets in binary star systems." NASA's proposed WFIRST-AFTA (Wide-Field Infrared Survey Telescope - Astrophysics Focused Telescope Assets) mission would use the microlensing technique to find and characterize hundreds of thousands of planets in binary systems. Read the full news release from Ohio State at: http://news.osu.edu/news/2014/07/03/planet-discovery-expands-search-for-earthlike-planets/
Manhattanhenge: A New York City Sunset

Explanation: This coming Saturday, if it is clear, well placed New Yorkers can go outside at sunset and watch their city act like a modern version of Stonehenge. Manhattan's streets will flood dramatically with sunlight just as the Sun sets precisely at each street's western end. Usually, the tall buildings that line the gridded streets of New York City's tallest borough will hide the setting Sun. This effect makes Manhattan a type of modern Stonehenge, although only aligned to about 30 degrees east of north. Were Manhattan's road grid perfectly aligned to east and west, today's effect would occur on the Vernal and Autumnal Equinox, March 21 and September 21, the only two days that the Sun rises and sets due east and west. Pictured above in this horizontally stretched image, the Sun sets down 34th Street as viewed from Park Avenue. If Saturday's sunset is hidden by clouds do not despair -- the same thing happens twice each year: in late May and mid July. On none of these occasions, however, should you ever look directly at the Sun.

Image Credit & Copyright: Neil deGrasse Tyson (AMNH)