Space News Update

— September 12, 2017 —

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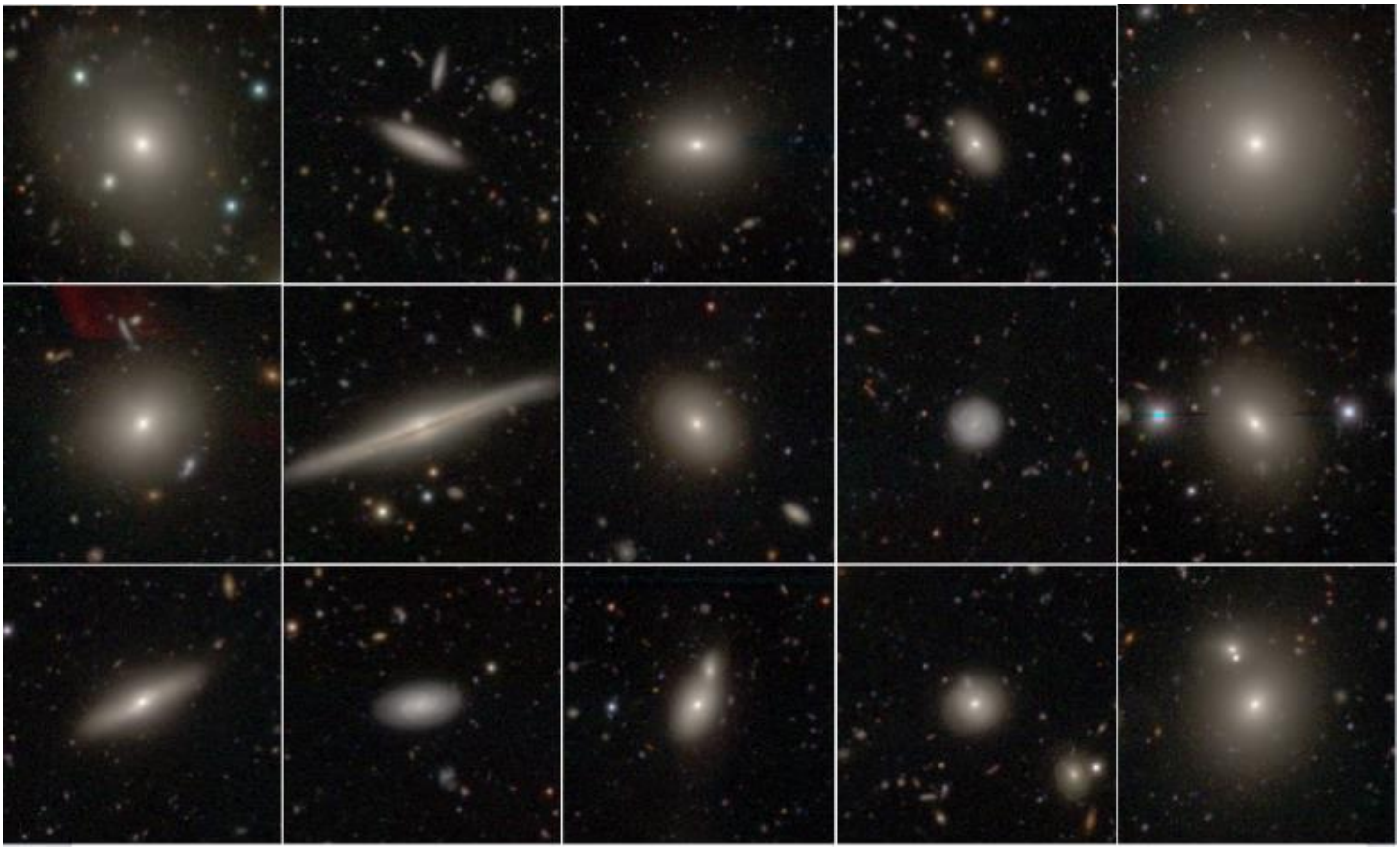
In the News

Departments

1. Astronomers spun up by galaxy-shape finding



For the first time astronomers have measured how a galaxy's spin affects its shape.

It sounds simple, but measuring a galaxy's true 3D shape is a tricky problem that astronomers first tried to solve 90 years ago.

"This is the first time we've been able to reliably measure how a galaxy's shape depends on any of its other properties - in this case, its rotation speed," said research team leader Dr Caroline Foster of the University of Sydney, who completed this research while working at the Australian Astronomical Observatory.

The study is published today in the journal *Monthly Notices of the Royal Astronomical Society* at https://doi.org/10.1093/mnras/stx1869

Galaxies can be shaped like a pancake, a sea urchin or a football, or anything in between.

Faster-spinning galaxies are flatter than their slower-spinning siblings, the team found.

"And among spiral galaxies, which have disks of stars, the faster-spinning ones have more circular disks," said team member Professor Scott Croom of the University of Sydney.

The team made its findings with SAMI (the Sydney-AAO Multi-object Integral field unit), an instrument jointly developed by The University of Sydney and the Australian Astronomical Observatory with funding from CAASTRO, the ARC Centre of Excellence for All-sky Astrophysics.

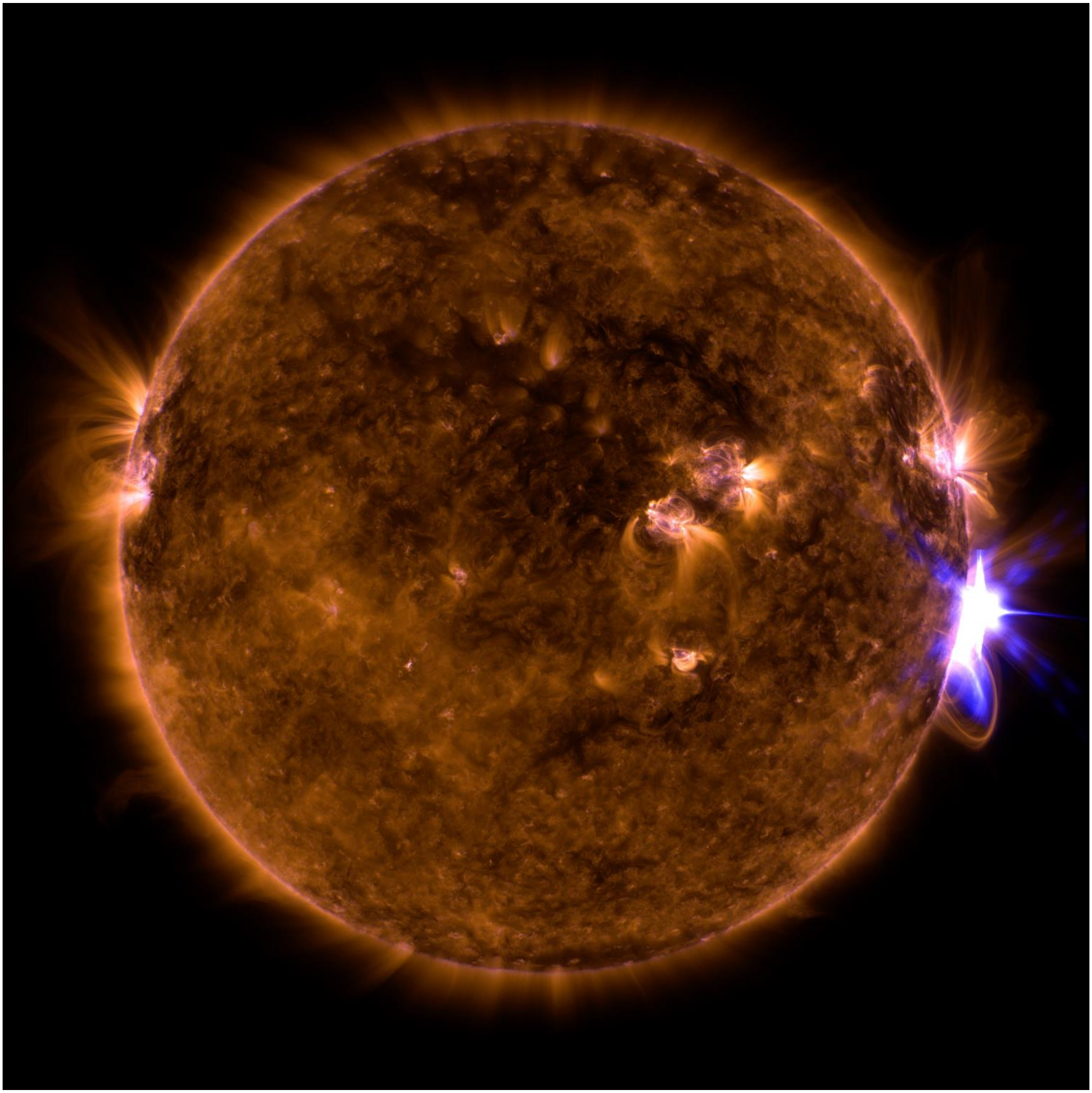
SAMI gives detailed information about the movement of gas and stars inside galaxies. It can examine 13 galaxies at a time and so collect data on huge numbers of them.

Dr Foster's team used a sample of 845 galaxies, over three times more than the biggest previous study. This large number was the key to solving the shape problem.

Because a galaxy's shape is the result of past events such as merging with other galaxies, knowing its shape also tells us about the galaxy's history.

Source: EurekAlert Return to Contents

2. Unexpected Solar Flare is also the Largest in Twelve Years



The past summer has been a pretty terrible time in terms of weather. In addition to raging fires in Canada's western province of British Columbia, the south-eastern United States has been pounded by successive storms and hurricanes – i.e. Tropical Storm Emily and Hurricanes Franklin, Gert, Harvey and Irma. As if that wasn't enough, solar activity has also been picking up lately, which could have a serious impact on space weather.

This past week, researchers from the University of Sheffield in the UK and Queen's University Belfastdetected the largest solar flare in 12 years. This massive burst of radiation took place on Wednesday, September 6th, and was one of three observed over a 48-hour period. While this latest solar flare is harmless to humans, it could pose a significant hazard to communications and GPS satellites.

The flare was also the eighth-largest detected since solar flare activity began to be monitored back in 1996. Like the two previous flares which took place during the same 48-hour period, this latest burst was an X-Class flare – the largest type of flare known to scientists. It occurred at 13:00 GMT (06:00 PDT; 09:00 EST) and was measured to have an energy level of X9.3.

Essentially, it erupted with the force of one billion thermonuclear bombs and drove plasma away from the surface at speeds of up to 2000 km/s (1243 mi/s). This phenomena, known as Coronal Mass Ejections (CMEs), are known to play havoc with electronics in Low Earth Orbit (LEO). And while Earth's magnetosphere offers protection from these events, electronic systems on the planets surface are sometimes affected as well.

The event was witnessed by a team from a consortium of Universities, which included the University of Sheffield and Queen's University Belfast. With the support of the Science and Technology Facilities Council, they conducted their observations using the Institute for Solar Physics' (ISP) 1-meter Swedish Solar Telescope, which is located at the Roque de los Muchachos Observatory – operated by the Instituto de Astrofisica de Canarias.

As Professor Mihalis Mathioudakis, who led the project at Queen's University Belfast, indicated in a recent University of Sheffield press statement:

"Solar flares are the most energetic events in our solar system and can have a major impact on earth. The dedication and perseverance of our early career scientists who planned and executed these observations led to the capture of this unique event and have helped to advance our knowledge in this area."

The team was able to capture the opening moments of a solar flare's life. This was extremely fortunate, since one of the biggest challenges of observing solar flares from ground-based telescopes is the short time-scales over which they erupt and evolve. In the case of X-class flares, they are capable of forming and reaching peak intensity in just about five minutes.

In other words, observers – who only see a small part of the sun at any one moment – must act very quickly to ensure they catch the crucial opening moments of a flare's evolution. As Dr Chris Nelson, from the Solar Physics and Space Plasma Research Centre (SP2RC) – who was one of the observers at the telescope – explained:

"It's very unusual to observe the opening minutes of a flare's life. We can only observe about 1/250th of the solar surface at any one time using the Swedish Solar Telescope, so to be in the right place at the right time requires a lot of luck. To observe the rise phases of three X-classes over two days is just unheard of."

Another interesting thing about this flare, and the two that preceded it, was the timing. At present, astronomers expected that we were in a period of diminished solar activity. But as Dr Aaron Reid, a research fellow at at Queen's University Belfast's Astrophysics Research Center and a co-author on the paper, explained:

"The Sun is currently in what we call solar minimum. The number of Active Regions, where flares occur, is low, so to have X-class flares so close together is very usual. These observations can tell us how and why these flares formed so we can better predict them in the future."

Professor Robertus von Fáy-Siebenbürgen, who leads the SP2RC, was also very enthused about the research team's accomplishment. "We at SP2RC are very proud to have such talented scientists who can make true discoveries," he said. "These observations are very difficult and will require hard work to fully understand what exactly has happened on the Sun."

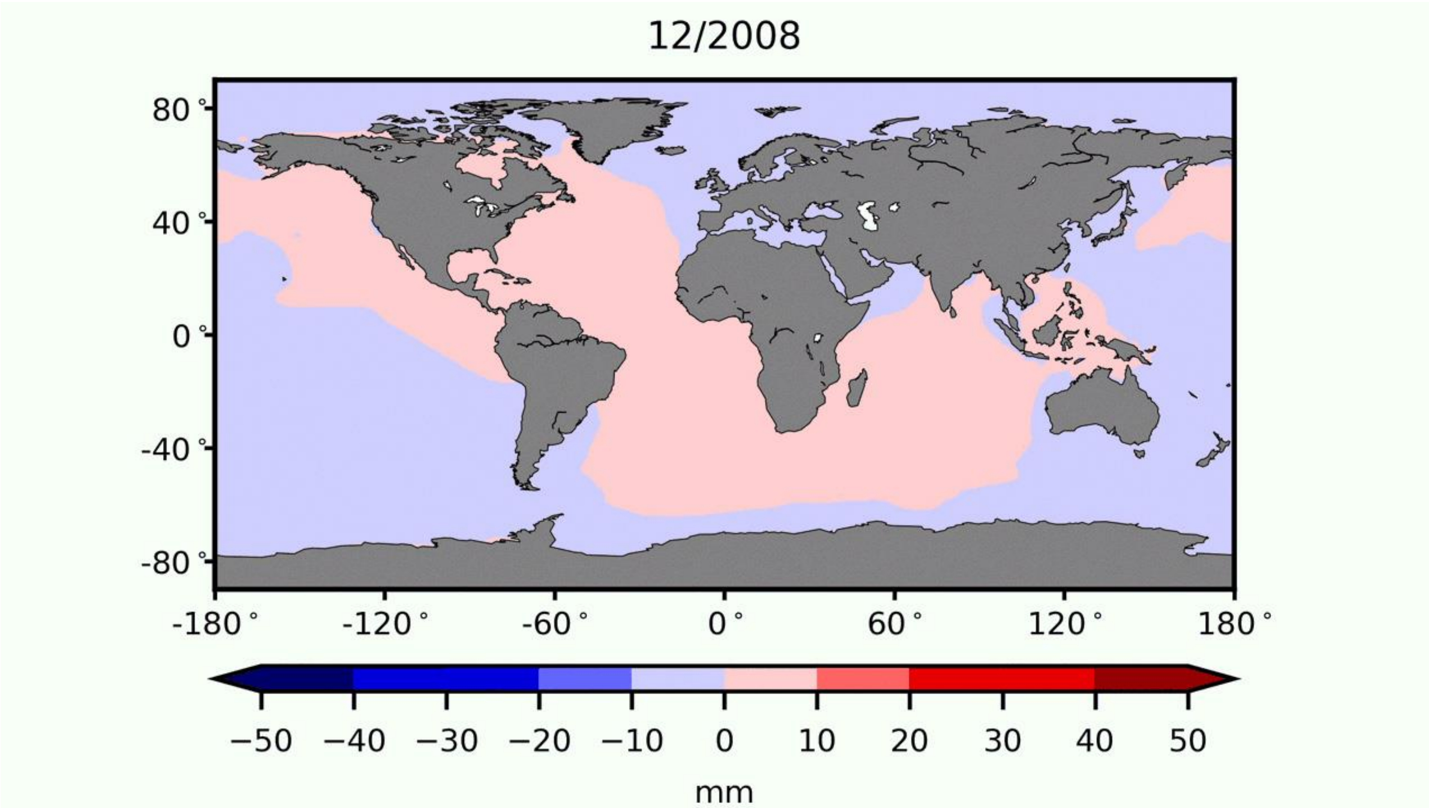
Predicting when and how solar flares will occur will also aid in the development of early warning and preventative measures. The is part of growing industry that seeks to protect satellites and orbital missions from harmful electromagnetic disruption. And with humanity's presence in LEO expended to grow considerably in the coming decades, this industry is expected to become worth several billion dollars.

Yes, with everything from small satellites, space planes, commercial habitats and more space stations being deployed to space, Low Earth Orbit is expected to get pretty crowded in the coming decades. The last thing we need is for vast swaths of this machinery or – heaven forbid! – crewed spacecraft, stations and habitats to become inoperative thanks to solar flare activity.

If human beings are to truly become a space-faring race, we need to know how to predict space weather the same we do the weather here on Earth. And just like the wind, the rain, and other meteorological phenomena, we need to know when to batten down the hatches and adjust the sails.

Source: Universe Today Return to Contents

3. NASA/UCI Find Evidence of Sea Level 'Fingerprints'



Researchers from NASA's Jet Propulsion Laboratory in Pasadena, California, and the University of California, Irvine, have reported the first detection of sea level "fingerprints" in ocean observations: detectable patterns of sea level variability around the world resulting from changes in water storage on Earth's continents and in the mass of ice sheets. The results will give scientists confidence they can use these data to determine how much the sea level will rise at any point on the global ocean as a result of glacier ice melt.

As ice sheets and glaciers undergo climate-related melting, they alter Earth's gravity field, resulting in sea level changes that aren't uniform around the globe. For example, when a glacier loses ice mass, its gravitational attraction is reduced. Ocean waters nearby move away, causing sea level to rise faster far away from the glacier. The resulting pattern of sea level change is known as a sea level fingerprint. Certain regions, particularly in Earth's middle and low latitudes, are hit harder, and Greenland and Antarctica contribute differently to the process. For instance, sea level rise in California and Florida generated by the melting of the Antarctic ice sheet is up to 52 percent greater than its average effect on the rest of the world.

To calculate sea level fingerprints associated with the loss of ice from glaciers and ice sheets and from changes in land water storage, the team used gravity data collected by the twin satellites of the U.S./German Gravity Recovery and Climate Experiment (GRACE) between April 2002 and October 2014. During that time, the loss of mass from land ice and from changes in land water storage increased global average sea level by about 0.07 inch (1.8 millimeters) per year, with 43 percent of the increased water mass coming from Greenland, 16 percent from Antarctica and 30 percent from mountain glaciers. The scientists then verified their calculations of sea level fingerprints using readings of ocean-bottom pressure from stations in the tropics.

"Scientists have a solid understanding of the physics of sea level fingerprints, but we've never had a direct detection of the phenomenon until now," said co-author Isabella Velicogna, UCI professor of Earth system science and JPL research scientist.

"It was very exciting to observe the sea level fingerprints in the tropics, far from the glaciers and ice sheets," said lead author Chia-Wei Hsu, a graduate student researcher at UCI.

The findings are published today in the journal Geophysical Research Letters. The research project was supported by UCI and NASA's Earth Science Division.

GRACE is a joint NASA mission with the German Aerospace Center (DLR) and the German Research Center for Geosciences (GFZ), in partnership with the University of Texas at Austin. For more information on NASA's GRACE mission, visit: https://grace.jpl.nasa.gov/

Source: JPL Return to Contents

The Night Sky

Tuesday, September 12

• The Great Square of Pegasus is high in the east after dark, balancing on one corner. From the Square's left corner extends a big line of three 2nd-magnitude stars running to the lower left. They mark the head, backbone and leg of the constellation Andromeda. (The line of three includes the Square's corner.) Upper left from the end of this line, you'll find W-shaped Cassiopeia tilting up.

Wednesday, September 13

• Vega now passes the zenith an hour after sunset, in late twilight, for those of us at mid-northern latitudes. Vega is bigger, hotter, and more luminous than our Sun, but at 25 light-years it's 1,600,000 times farther away.

Thursday, September 14

• Saturn is at eastern quadrature: 90° east of the Sun in the evening sky. So this month, telescope users see the shadow of Saturn's globe falling farthest eastward onto the rings behind it, enhancing Saturn's overall 3-D appearance.

Friday, September 15

• This evening Saturn's biggest and brightest moon, Titan, stands about four ring-lengths to Saturn's east. A 4-inch telescope will begin to show the orange color of its smoggy atmosphere.

• Before sunrise on Sunday morning the 16th, Mercury is only about 0.3° from dimmer Mars. Bring optical aid to scan very low in the east, lower left of Venus, as shown here.

Source: Sky & Telescope Return to Contents

ISS Sighting Opportunities

For Denver:

Date	Visible	Max Height	Appears	Disappears
Tue Sep 12, 4:28 AM	1 min	11°	11° above N	10° above NNE
Tue Sep 12, 6:03 AM	3 min	12°	10° above NNW	11° above NNE
Wed Sep 13, 5:12 AM	2 min	11°	10° above N	10° above NNE
Thu Sep 14, 4:20 AM	< 1 min	10°	10° above N	10° above NNE
Thu Sep 14, 5:55 AM	3 min	17°	10° above NNW	16° above NE
Fri Sep 15, 5:03 AM	3 min	13°	10° above NNW	12° above NE

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

NASA-TV Highlights

(all times Eastern Daylight Time)

- **2 p.m., Tuesday, September 12 -** Replay of The Smithsonian's National Air & Space Museum's "What's New in Aerospace?" Astronaut Presentation -- Featuring NASA Astronaut Shane Kimbrough (NTV-1 (Public))
- **4 p.m., Tuesday, September 12 -** ISS Expedition 53-54/Soyuz MS-06 Launch Coverage (Misurkin, Vande Hei, Acaba; includes video B-roll of the crew's launch day pre-launch activities at 4:30 p.m. ET; launch scheduled at 5:17 p.m. ET) (Starts at 4:15 p.m.) (all channels)
- **7 p.m., Tuesday, September 12 -** Video File of ISS Expedition 53-54/Soyuz MS-06 (Misurkin, Vande Hei, Acaba) Pre-Launch and Launch Video and Post-Launch Interviews (all channels)
- **10 p.m., Tuesday, September 12 -** ISS Expedition 53-54/Soyuz MS-06 Docking to the ISS Coverage (Misurkin, Vande Hei, Acaba; docking scheduled at 10:57 p.m. ET) (Starts at 10:15 p.m.) (all channels)
- **Midnight, Wednesday, September 13 -** ISS Expedition 53-54/Soyuz MS-06 Hatch Opening and Welcoming Ceremony (Misurkin, Vande Hei, Acaba; hatch opening scheduled at appx. 12:30 a.m. ET) (all channels)
- **2:30 a.m., Wednesday, September 13 -** Video File of ISS Expedition 53-54/Soyuz MS-06 Docking, Hatch Opening and Other Activities (all channels)
- **9 a.m., 3 p.m., Wednesday, September 13 -** Von Karman Lecture Series - Cassini: Epic Journey at Saturn (Replay) (NTV-1 (Public))
- **10:30 a.m., 4:30 p.m., Wednesday, September 13 -** Von Karman Lecture Series - Going out in a Blaze of Glory: Cassini Science Highlights and Grand Finale (Replay) (NTV-1 (Public))

- **1 p.m., 2 p.m., 6 p.m., Wednesday, September 13 -** Cassini Pre –End of Mission News Conference (all channels)
- **7 a.m., 11 a.m., Thursday, September 14 -** Replay of Cassini Pre-End of Mission News Conference (all channels)
- **8 a.m., Thursday, September 14 -** Von Karman Lecture Series - Cassini: Epic Journey at Saturn (Replay) (NTV-1 (Public))
- **9 a.m., Thursday, September 14 -** Von Karman Lecture Series - Going out in a Blaze of Glory: Cassini Science Highlights and Grand Finale (Replay) (starts at 9:20 a.m.) (NTV-1 (Public))
- **4 p.m., Thursday, September 14 -** Cassini NASA Social (all channels)
- **7 a.m., Friday, September 15 -** Cassini End of Mission Commentary (NTV-1 (Public))
- **7 a.m., Friday, September 15 -** Cassini End of Mission - Clean Feed (NTV-3 (Media))
- **9:30 a.m., Friday, September 15 -** Cassini Post-End of Mission News Conference (all channels)

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

Space Calendar

- Sep 12 - [Sep 05] Soyuz MS-6 Soyuz-FG Launch (International Space Station 52S)
- Sep 12 - [Sep 05] 25th Anniversary (1992), 1st African-American Woman in Space (Mae Jemison)
- Sep 12 - Mercury At Its Greatest Western Elongation (18 Degrees)
- Sep 12 - Moon Occults Aldebaran
- Sep 12 - Comet 73P-P/Schwassmann-Wachmann Closest Approach To Earth (1.198 AU)
- Sep 12 - Comet 14P/Wolf Closest Approach To Earth (1.862 AU)
- Sep 12 - Comet 240P/NEAT At Opposition (1.923 AU)
- Sep 12 - Comet 49P/Arend-Rigaux Closest Approach To Earth (2.216 AU)
- Sep 12 - Comet 59P/Kearns-Kwee At Opposition (2.505 AU)
- Sep 12 - 25th Anniversary (1992), STS-47 Launch (Space Shuttle Endeavour, Spacelab-J)
- Sep 12 - 55th Anniversary (1962), John F. Kennedy's Moon Speech
- Sep 12 - Robert Farquhar's 85th Birthday (1932)
- Sep 13 - Comet P/2008 T4 (Hill) Closest Approach To Earth (2.101 AU)
- Sep 13 - Comet 239P/LINEAR At Opposition (3.321 AU)
- Sep 13 - Asteroid 39566 Carllewis Closest Approach To Earth (0.827 AU)
- Sep 13 - Asteroid 11020 Orwell Closest Approach To Earth (1.848AU)
- Sep 13 - 10th Anniversary (2007), Kaguya (Selene 1) Launch (Japan Moon Orbiter)
- Sep 13 - Horace Babcock's 105th Birthday (1912)
- Sep 14 - NROL-42/ Trumpet Atlas 5 Launch
- Sep 14 - Apollo Asteroid 310560 (2001 QL142) Near-Earth Flyby (0.058 AU)
- Sep 14 - Asteroid 6032 Nobel Closest Approach To Earth (0.869 AU)
- Sep 14 - Asteroid 14764 Kilauea Closest Approach To Earth (1.101 AU)
- Sep 14 - Asteroid 28078 Mauricehilleman Closest Approach To Earth (1.134 AU)
- Sep 15 - Xiaoxiang 2-5/Mini Hubble CZ-11 Launch
- Sep 15 - Cassini, Distant Flyby of Janus, Pan, Pandora & Epimetheus
- Sep 15 - [Sep 08] Cassini, Saturn Impact
- Sep 15 - Comet 73P-AC/Schwassmann-Wachmann Closest Approach To Earth (1.251 AU)
- Sep 15 - Comet P/2016 J1-A (PANSTARRS) At Opposition (2.192 AU)
- Sep 15 - Comet P/2016 J1-B (PANSTARRS) At Opposition (2.192 AU)
- Sep 15 - Comet 100P/Hartley At Opposition (2.874 AU)
- Sep 15 - Asteroid 6030 Zolensky Closest Approach To Earth (1.966 AU)
- Sep 15 - Asteroid 16522 Tell Closest Approach To Earth (2.088 AU)
- Sep 15 - 10th Anniversary (2007), Carancas Meteorite Fall in Peru (Created Crater)

Source: JPL Space Calendar

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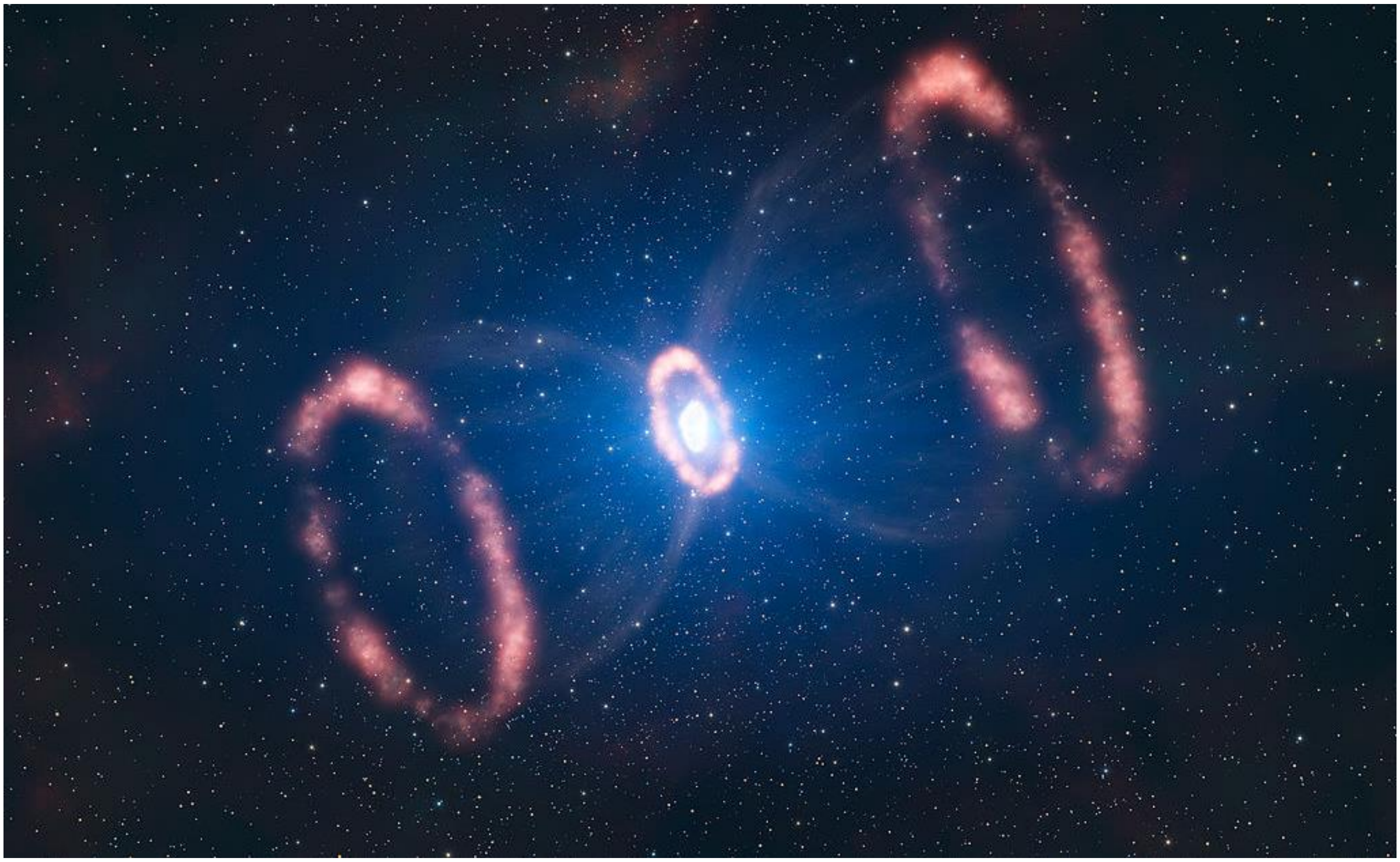
Food for Thought

Gravitational waves will let us see inside stars as supernovae happen



On February 11th, 2016, scientists at the Laser Interferometer Gravitational-wave Observatory (LIGO) announced the first detection of gravitational waves. This development, which confirmed a prediction made by Einstein's Theory of General Relativity a century ago, has opened up new avenues of research for cosmologists and astrophysicists. Since that time, more detections have been made, all of which were said to be the result of black holes merging.

However, according to a team of astronomers from Glasgow and Arizona, astronomers need not limit themselves to detecting waves caused by massive gravitational mergers. According to a study they recently produced, the Advanced LIGO, GEO 600, and Virgo gravitational-wave detector network could also detect the gravitational waves created by supernova. In so doing, astronomers will able to see inside the hearts of collapsing stars for the first time.

The study, titled "Inferring the Core-Collapse Supernova Explosion Mechanism with Three-Dimensional Gravitational-Wave Simulations," recently appeared online. Led by Jade Powell, who recently finished her Ph.D. at the Institute for Gravitational Research at the University of Glasgow, the team argue that current gravitational wave experiments should be able to detect the waves created by core collapse supernovae (CSNe).

Otherwise known as Type II supernovae, CCSNe are what happens when a massive star reaches the end of its lifespan and experiences rapid collapse. This triggers a massive explosion that blows off the outer layers of the star, leaving behind a remnant neutron star that may eventually become a black hole. In order for a star to undergo such collapse, it must be at least 8 times (but no more than 40 to 50 times) the mass of the Sun.

When these types of supernovae take place, it is believed that neutrinos produced in the core transfer gravitational energy released by core collapse to the cooler outer regions of the star. Dr. Powell and her colleagues believe that this gravitational energy could be detected using current and future instruments. As they explain in their study:

"Although no CCSNe have currently been detected by gravitational-wave detectors, previous studies indicate that an advanced detector network may be sensitive to these sources out to the Large Magellanic Cloud (LMC). A CCSN would be an ideal multi-messenger source for aLIGO and AdV, as neutrino and electromagnetic counterparts to the signal would be expected. The gravitational waves are emitted from deep inside the core of CCSNe, which may allow astrophysical parameters, such as the equation of state (EOS), to be measured from the reconstruction of the gravitational-wave signal."

Dr. Powell and her also outline a procedure in their study that could be implemented using the Supernova model Evidence Extractor (SMEE). The team then conducted simulations using the latest three-dimensional models of gravitational-wave core collapse supernovae to determine if background noise could be eliminated and proper detection of CCSNe signals made.

As Dr. Powell explained to Universe Today via email:

"The Supernova Model Evidence Extractor (SMEE) is an algorithm that we use to determine how supernovae get the huge amount of energy they need to explode. It uses Bayesian statistics to distinguish between different possible explosion models. The first model we consider in the paper is that the explosion energy comes from the neutrinos emitted by the star. In the second model the explosion energy comes from rapid rotation and extremely strong magnetic fields."

From this, the team concluded that in a three-detector network researchers could correctly determine the explosion mechanics for rapidly-rotating supernovae, depending on their distance. At a distance of 10 kiloparsecs (32,615 light-years) they would be able to detect signals of CCSNe with 100% accuracy, and signals at 2 kiloparsecs (6,523 light-years) with 95% accuracy.

In other words, if and when a supernova takes place in the local galaxy, the global network formed by the Advanced LIGO, Virgo and GEO 600 gravitational wave detectors would have an excellent chance of picking up on it. The detection of these signals would also allow for some groundbreaking science, enabling scientists to "see" inside of exploding stars for the first time. As Dr. Powell explained:

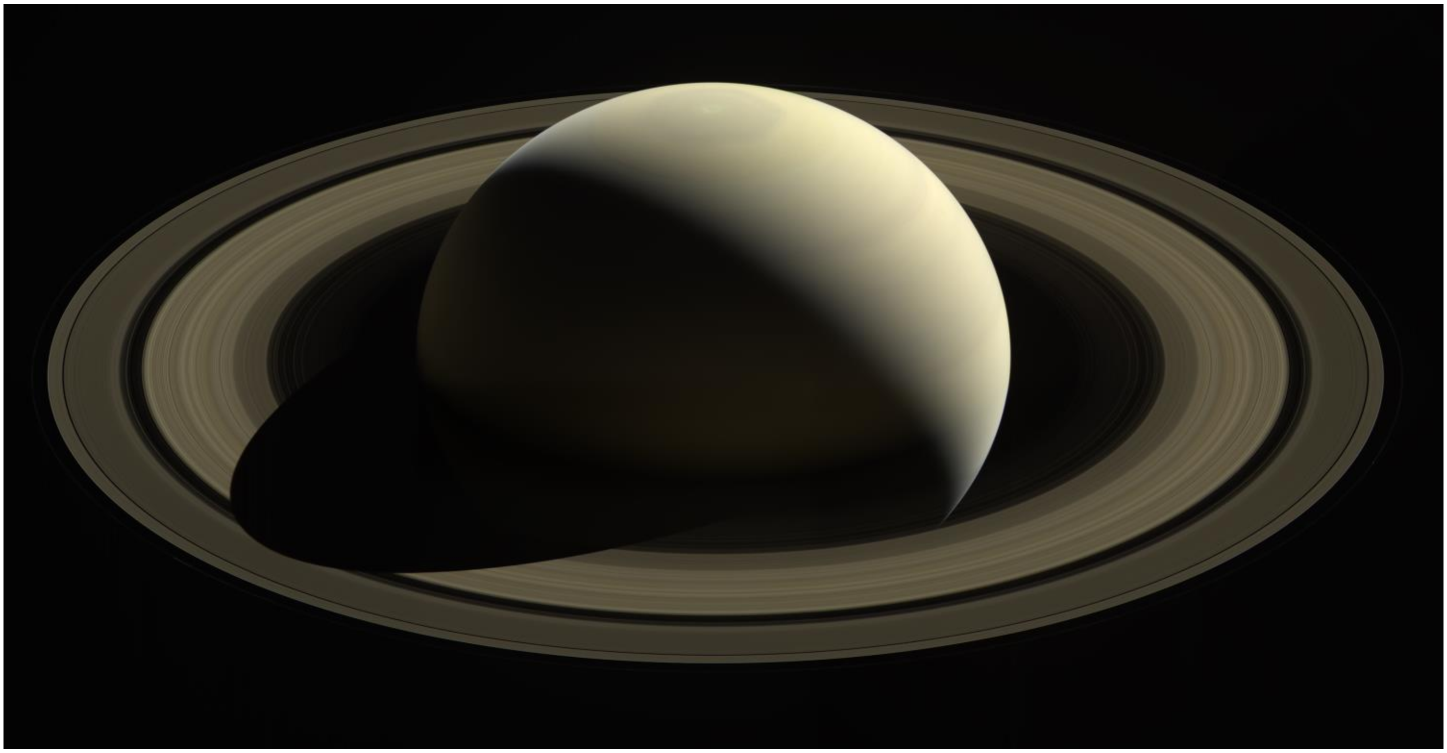
"The gravitational waves are emitted from deep inside the core of the star where no electromagnetic radiation can escape. This allows a gravitational wave detection to tell us information about the explosion mechanism that can not be determined with other methods. We may also be able to determine other parameters such as how rapidly the star is rotating."

Dr. Powell, having recently completed work on her PhD will also be taking up a postdoc position with the RC Centre of Excellence for Gravitational Wave Discovery (OzGrav), the gravitational wave program hosted by the University of Swinburne in Australia. In the meantime, she and her colleagues will be conducting targeted searchers for supernovae that occurred during the first and seconds advanced detector observing runs.

While there are no guarantees at this point that they will find the sought-after signals that would demonstrate that supernovae are detectable, the team has high hopes. And given the possibilities that this research holds for astrophysics and astronomy, they are hardly alone!

Source: Phys.org Return to Contents

Space Image of the Week



So Far from Home

With this view, Cassini captured one of its last looks at Saturn and its main rings from a distance. The Saturn system has been Cassini's home for 13 years, but that journey is nearing its end.

Cassini has been orbiting Saturn for nearly a half of a Saturnian year but that journey is nearing its end. This extended stay has permitted observations of the long-term variability of the planet, moons, rings, and magnetosphere, observations not possible from short, fly-by style missions.

When the spacecraft arrived at Saturn in 2004, the planet's northern hemisphere, seen here at top, was in darkness, just beginning to emerge from winter (see PIA06164). Now at journey's end, the entire north pole is bathed in the continuous sunlight of summer.

Images taken on Oct. 28, 2016 with the wide angle camera using red, green and blue spectral filters were combined to create this color view. This view looks toward the sunlit side of the rings from about 25 degrees above the ringplane.

The view was acquired at a distance of approximately 870,000 miles (1.4 million kilometers) from Saturn. Image scale is 50 miles (80 kilometers) per pixel.

Credit: NASA/JPL-Caltech/Space Science Institute

Source: NASA

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