Space News Update

— July 10, 2018 —

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1. Listen: Sound of Electromagnetic Energy Moving Between Saturn, Enceladus

Click image to view YouTube video.

New research from NASA's Cassini spacecraft's up-close Grand Finale orbits shows a surprisingly powerful and dynamic interaction of plasma waves moving from Saturn to its rings and its moon Enceladus. The observations show for the first time that the waves travel on magnetic field lines connecting Saturn directly to Enceladus. The field lines are like an electrical circuit between the two bodies, with energy flowing back and forth.

Researchers converted the recording of plasma waves into a "whooshing" audio file that we can hear -- in the same way a radio translates electromagnetic waves into music. In other words, Cassini detected electromagnetic waves in the audio frequency range -- and on the ground, we can amplify and play those signals through a speaker. The recording time was compressed from 16 minutes to 28.5 seconds.

Much like air or water, plasma (the fourth state of matter) generates waves to carry energy. The Radio Plasma Wave Science (RPWS) instrument on board NASA's Cassini spacecraft recorded intense plasma waves during one of its closest encounters to Saturn.

"Enceladus is this little generator going around Saturn, and we know it is a continuous source of energy," said Ali Sulaiman, planetary scientist at the University of Iowa, Iowa City, and a member of the RPWS team. "Now we find that Saturn responds by launching signals in the form of plasma waves, through the circuit of magnetic field lines connecting it to Enceladus hundreds of thousands of miles away."

Sulaiman is lead author of a pair of papers describing the findings, published recently in Geophysical Research Letters.

The interaction of Saturn and Enceladus is different from the relationship of Earth and its Moon. Enceladus is immersed in Saturn's magnetic field and is geologically active, emitting plumes of water vapor that become ionized and fill the environment around Saturn. Our own Moon does not interact in the same way with Earth. Similar interactions take place between Saturn and its rings, as they are also very dynamic.

The recording was captured Sept. 2, 2017, two weeks before Cassini was deliberately plunged into the atmosphere of Saturn. The recording was converted by the RPWS team at the University of Iowa, led by physicist and RPWS Principal Investigator Bill Kurth.

Source: JPL

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2. Crew Dragon completes thermal vacuum tests ahead of first test flight

The first SpaceX Crew Dragon spacecraft has completed a series of tests at a NASA center that may put the spacecraft one step closer to an uncrewed test flight later this year.

In a speech at the American Institute of Aeronautics and Astronautics' Propulsion and Energy Forum here July 9, Janet Kavandi, director of NASA's Glenn Research Center, said the spacecraft recently left the center's Plum Brook Station after a series of thermal vacuum and acoustics tests.

"They just left yesterday or today," she said in her remarks at the conference. "They've been out there twice, at least, at Plum Brook Station." She didn't disclose the outcome of the tests, and SpaceX did not respond to an email requesting comment on the status of the test.

The company previously indicated that the testing at Plum Brook was the last milestone before the spacecraft was shipped to Florida for final testing and integration with its Falcon 9 rocket. "Once complete, Crew Dragon will travel to Kennedy Space Center in Florida ahead of its first flight," the company said in a June 20 Instagram post about the tests that were ongoing at Plum Brook.

Jessica Jensen, director of Dragon mission management at SpaceX, also said the Plum Brook tests were the last before the spacecraft is shipped to Florida for launch. "Once it leaves Plum Brook, it's going to come down to Cape Canaveral for final launch processing," she said at a June 28 briefing at the Kennedy Space Center about the launch of a Dragon cargo spacecraft to the International Space Station.

That launch will be the first of two test flights of the Crew Dragon vehicle, this one without a crew. NASA schedules released earlier this year, representing the most recent public updates for commercial crew test flights, said that the uncrewed Dragon test flight would take place in August, followed by a crewed test flight in December. SpaceX officials have stuck to that schedule in recent comments.

However, at that same KSC briefing last month, NASA acknowledged some changes in those schedules were likely because of development delays as well as finding slots in the overall visiting vehicle schedule for the ISS.

“We’re evaluating exactly when opportunities might be and when they’ll be ready, but we’re not ready to set an official date at this point in time,” Kirk Shireman, NASA ISS program manager, said at that June 28 briefing when asked about revised schedules for both Boeing and SpaceX commercial crew test flights. He added that updates would be coming “very soon.”

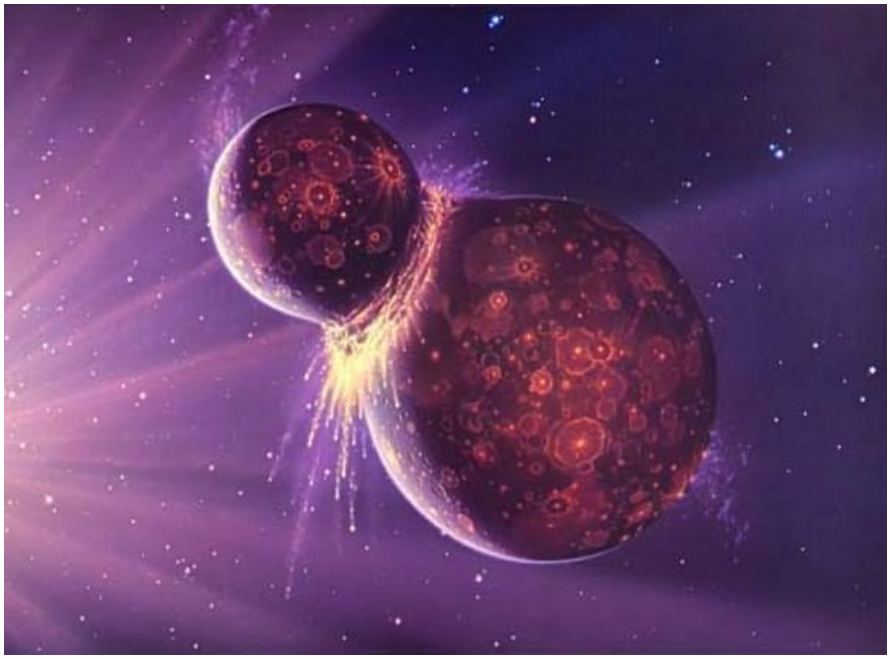
Source: SpaceNews Return to Contents

3. New Insights into What Might Have Smashed Uranus over Onto Its Side

The gas/ice giant Uranus has long been a source of mystery to astronomers. In addition to presenting some thermal anomalies and a magnetic field that is off-center, the planet is also unique in that it is the only one in the Solar System to rotate on its side. With an axial tilt of 98°, the planet experiences radical seasons and a day-night cycle at the poles where a single day and night last 42 years each.

Thanks to a new study led by researchers from Durham University, the reason for these mysteries may finally have been found. With the help of NASA researchers and multiple scientific organizations, the team conducted simulations that indicated how Uranus may have suffered a massive impact in its past. Not only would this account for the planet's extreme tilt and magnetic field, it would also explain why the planet's outer atmosphere is so cold.

The study, "Consequences of Giant Impacts on Early Uranus for Rotation, Internal Structure, Debris, and Atmospheric Erosion", recently appeared in *The Astrophysical Journal.* The study was led by Jacob Kegerreis, a PhD researcher from Durham University's Institute for Computational Cosmology, and included members from the Bay Area Environmental Research (BAER) Institute, NASA's Ames Research Center, the Los Alamos National Laboratory, Descartes Labs, the University of Washington and UC Santa Cruz.



Artist's impression of the huge impact that is believed have formed the Moon roughly 4.5 billion years ago. Credit: Joe Tucciarone

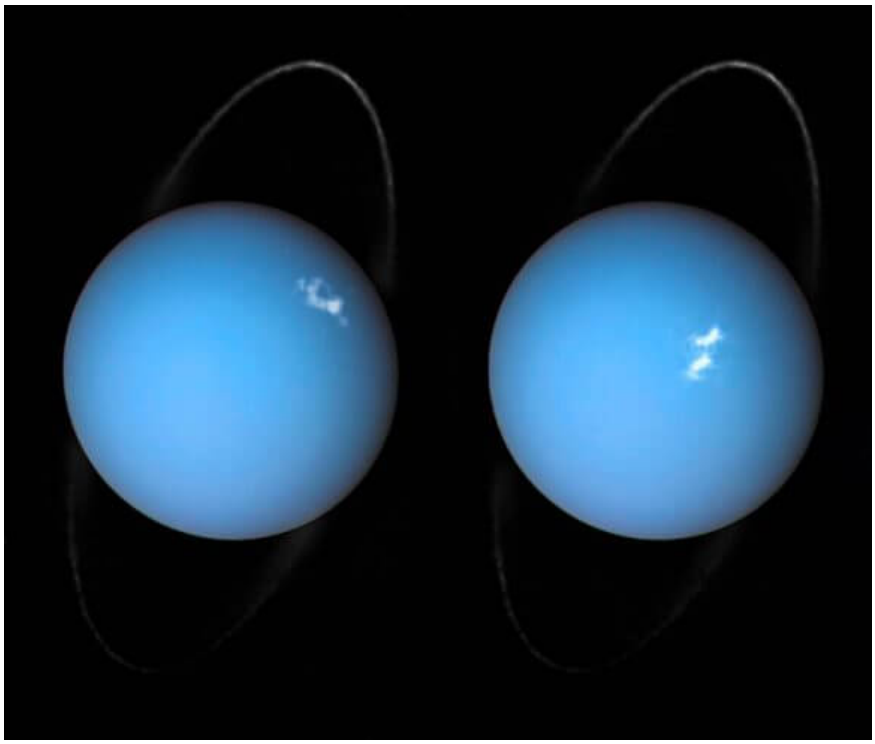
For the sake of their study, which was funded by the Science and Technology Facilities Council, The Royal Society, NASA and the Los Alamos National Laboratory, the team ran the first high-resolution computer simulations of how massive collisions with Uranus would affect the planet's evolution. As Kegerries explained in a recent Durham University press release:

"Uranus spins on its side, with its axis pointing almost at right angles to those of all the other planets in the solar system. This was almost certainly caused by a giant impact, but we know very little about how this actually happened and how else such a violent event affected the planet."

To determine how a giant impact would affect Uranus, the team conducted a suite of smoothed particle hydrodynamics (SPH) simulations, which were also used in the past to model the giant impact that led to the

formation of the Moon (aka. the Giant Impact Theory). All told, the team ran more than 50 different impact scenarios using a high-powered computer to see if it would recreate the conditions that shaped Uranus.

In the end, the simulations confirmed that Uranus' tilted position was caused by a collision with a massive object (between two and three Earth masses) that took place roughly 4 billion years ago – i.e. during the formation of the Solar System. This was consistent with a previous study that indicated that an impact with a young proto-planet made of rock and ice could have been responsible for Uranus' axial tilt.



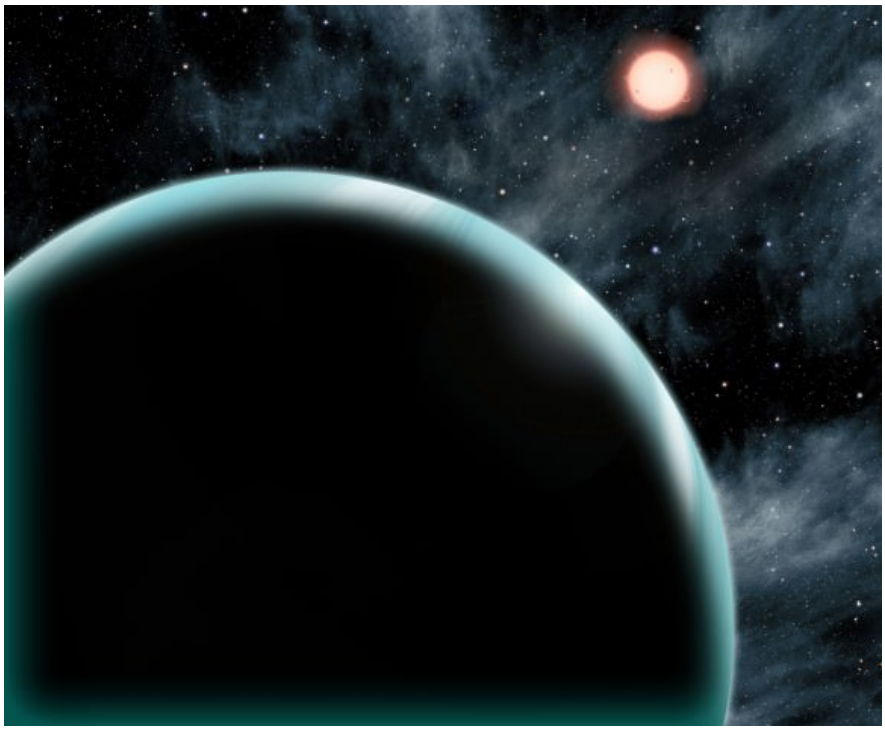
Composite image of Uranus by Voyager 2 and two different observations made by Hubble — one for the ring and one for the auroras. Credit: NASA/ESA

"Our findings confirm that the most likely outcome was that the young Uranus was involved in a cataclysmic collision with an object twice the mass of Earth, if not larger, knocking it on to its side and setting in process the events that helped create the planet we see today," said Kegerries.

In addition, the simulations answered a fundamental questions about Uranus that was raised in response to previous studies. Essentially, scientists have wondered how Uranus could retain its atmosphere after a violent collision, which would have theoretically blown off its out layers of hydrogen and helium gas. According to the team's simulations, this was most likely because the impact struck a grazing a blow on Uranus.

This would have been enough to alter Uranus' tilt, but was not strong enough to remove its outer atmosphere. In addition, their simulations indicated that the impact could have jettisoned rock and ice into orbit around the planet. This could then have coalesced to form the planet's inner satellites and altered the rotation of any pre-existing moons already in orbit around Uranus.

Last, but not least, the simulations offered a possible explanation for how Uranus got its off-center magnetic field and its thermal anomalies. In short, the impact could have created molten ice and lopsided lumps of rock inside the planet (thus accounting for its magnetic field). It could have also created a thin shell of debris near the edge of the planet's ice layer which would have trapped internal heat, which could explain why Uranus' outer atmosphere experiences extremely cold temperatures of -216 °C (-357 °F).



This artist's conception shows the Uranus-sized exoplanet Kepler-421b, which orbits an orange, type K star about 1,000 light-years from Earth. Credit: David A. Aguilar (CfA)

Beyond helping astronomers to understand Uranus, one of the least-understood planets in the Solar System, the study also has implications when it comes to the study of exoplanets. So far, most of the planets discovered in other star systems have been comparable in size and mass to Uranus. As such, the researchers hope their findings will shed light on these planet's chemical compositions and explain how they evolved.

As Dr. Luis Teodoro – of the BAER Institute and NASA Ames Research Center – and one of the co-authors on the paper, said, "All the evidence points to giant impacts being frequent during planet formation, and with this kind of research we are now gaining more insight into their effect on potentially habitable exoplanets."

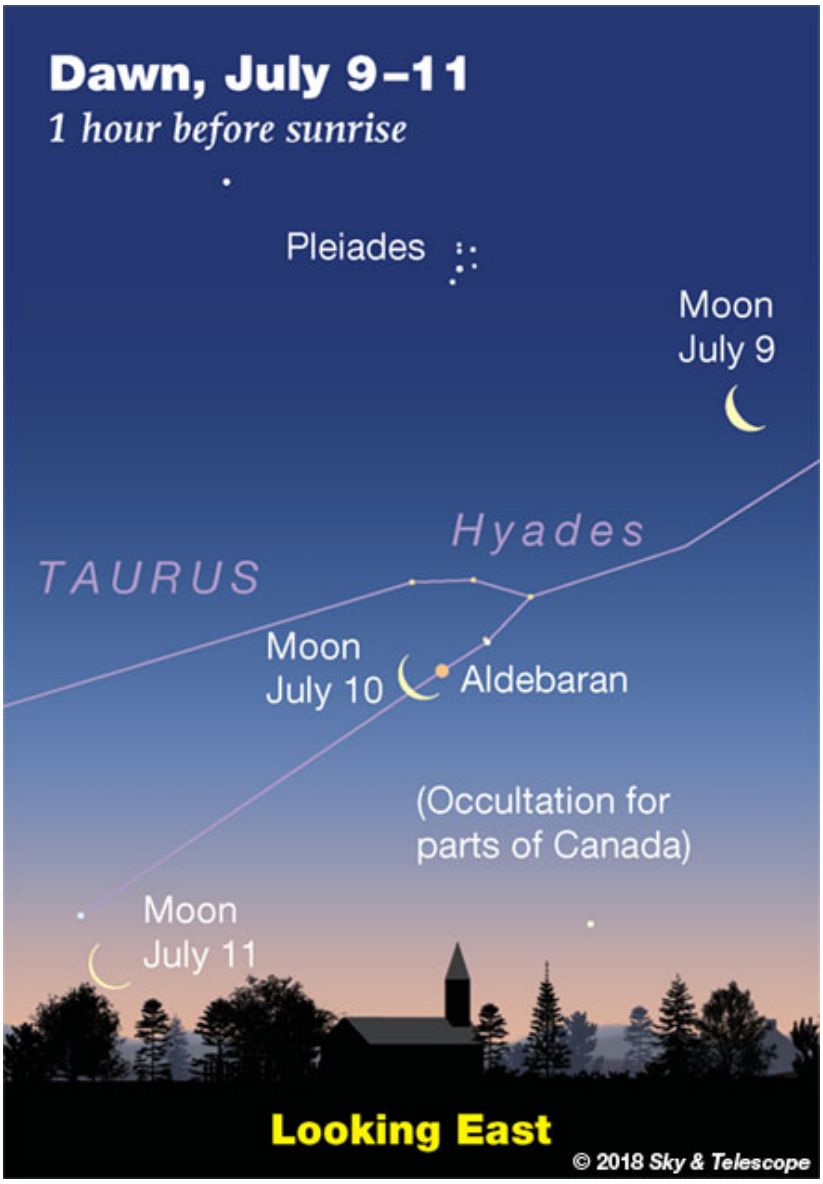
In the coming years, additional missions are planned to study the outer Solar System and the giant planets. These studies will not only help astronomers understand how our Solar System evolved, they could also tell us what role gas giants play when it comes to habitability.

Source: Universe Today Return to Contents

The Night Sky

Tuesday, July 10

• If you have a dark enough sky, the Milky Way now forms a magnificent arch high across the eastern heavens after nightfall is complete. It runs all the way from below Cassiopeia in the north-northeast, up and across Cygnus and the Summer Triangle in the east, and down to the south behind Saturn and the spout of the Sagittarius Teapot.



Wednesday, July 11

• The Cygnus Milky Way is high in the east after dark and passes overhead late at night. The Heart Star of Cygnus, and the center of the Northern Cross, is 2nd-magnitude Sadr (Gamma Cygni), smack in the Milky Way's midst. Binoculars will show the roughly heart-shaped ring of faint stars around and including it. Explore this area with Matt Wedel's Binocular Highlight column and chart in the July *Sky & Telescope*, page 43.

Thursday, July 12

• *Three doubles at the top of Scorpius.* The head of Scorpius — the nearly vertical row of three stars upper right of Antares — stands highest in the south right after dark, about two fists at arm's length to the left of bright Jupiter. The top star of the row is Beta (ß) Scorpii or Graffias, a fine double star for telescopes.

Just 1° below or lower left of it (a fingertip at arm's length) is the very wide naked-eye pair Omega^{1}and Omega^{2} Scorpii, not quite vertical. Binoculars show their slight color difference.

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

• New Moon (exact at 10:48 p.m. Eastern Daylight Time).

Friday, July 13

• Cassiopeia is now well past its annual bottoming out due north. Look for its W pattern climbing low in the north-northeast after dark. The farther north you live, the higher it will be.

Source: Sky & Telescope

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ISS Sighting Opportunities

For Denver:

Date	Visible	Max Height	Appears	Disappears
Tue Jul 10, 2:40 AM	< 1 min	32°	32° above N	23° above NNE
Tue Jul 10, 4:15 AM	2 min	12°	10° above NW	11° above N
Wed Jul 11, 1:49 AM	< 1 min	16°	16° above NE	10° above NE
Wed Jul 11, 3:22 AM	2 min	16°	12° above NW	15° above N
Wed Jul 11, 5:00 AM	1 min	10°	10° above N	10° above N
Thu Jul 12, 2:31 AM	1 min	22°	22° above NNW	18° above N
Thu Jul 12, 4:08 AM	1 min	10°	10° above NNW	10° above N
Fri Jul 13, 1:41 AM	1 min	17°	17° above NNE	10° above NE
Fri Jul 13, 3:15 AM	2 min	12°	10° above NNW	11° above N
Fri Jul 13, 4:53 AM	1 min	11°	10° above NNW	11° above N

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

NASA-TV Highlights

(all times Eastern Daylight Time)

July 10, Tuesday
10:30 a.m. – Station astronaut Serena Aunon-Chancellor talks with NASA's Glenn Research Center in Cleveland, Ohio (All Channels)
1 p.m. – The New Space Age: A Conversation with NASA Administrator Jim Bridenstine and Politico Live (All Channels)
2:10 p.m. – Station astronaut Alexander Gerst of the European Space Agency talks with NASA's Langley Research Center in Hampton, Virginia (All Channels)
6 p.m., 8 p.m. – p.m. – The New Space Age: A Conversation with NASA Administrator Jim Bridenstine and Politico Live (All Channels)

July 11, Wednesday
10:15 a.m. – Station astronaut Ricky Arnold talks with the Trena Ferrell/Goddard Spaceflight Center Summer Camps in Greenbelt, Maryland (All Channels)
11 a.m. – National Science Foundation Press Conference on astrophysics findings led by NSF's IceCube Neutrino Observatory

July 13, Friday
12 p.m. – Station astronaut Ricky Arnold talks with the Sea Education Association in Falmouth, Massachusetts (All Channels)

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

Space Calendar

- Jul 10 - Moon Occults Aldebaran
- Jul 10 - Apollo Asteroid 65803 Didymos Closest Approach To Earth (1.296 AU)
- Jul 10-13 - Meeting: Astrochemistry - Past, Present and Future, Pasadena, California
- Jul 10-14 - 2018 Colloquium on QTT Science and Technology, Urumqi, China
- Jul 11 - Asteroid 1388 Aphrodite Closest Approach To Earth (1.770 AU)
- Jul 11 - Asteroid 13586 Copenhagen Closest Approach To Earth (1.787 AU)
- Jul 11 - 150th Anniversary (1868), Ornans Meteorite Fall in Franc
- Jul 12 - Mercury At Its Greatest Eastern Elongation (26 Degrees)
- Jul 12 - Jupiter Trojan Asteroid 1143 Odysseus Closest Approach To Earth (4.693 AU)
- Jul 12 - 30th Anniversary (1988), Phobos 2 Launch (Soviet Mars Orbiter)
- Jul 12-13 - 8th Forum for New Leaders in Space Science, Pasadena, California
- Jul 12-16 - Conference: Pluto After New Horizons, Laurel, Maryland
- Jul 13 - 

[Jul 09] Partial Solar Eclipse
- Jul 13 - Asteroid 3768 Monroe Closest Approach To Earth (1.953 AU)
- Jul 13 - Dwarf Planet 134340 Pluto At Opposition (32.584 AU)

Illustration of the Phobos spacecraft

Source: JPL Space Calendar

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Food for Thought

Researchers find organic material in the Antennae Galaxies

A study led by the researcher of the Instituto de Astrofísica de Canarias (IAC) Ana Monreal Ibero proves the presence of probable organic molecules in galaxies beyond the Milky Way.

After carrying out a spectroscopic analysis with the MUSE instrument, on the VLT (Very Large Telescope), in the European Southern Observatory (Chile), a team led by astrophysicist Ana Monreal Ibero has proved the existence of diffuse interstellar bands (DIBs) in the Antennae Galaxies, 70 million light years from Earth. The study shown that there is probably organic material in other galaxies beyond our galactic neighbourhood.

The electromagnetic spectrum of a celestial object results from breaking down its emitted light into its constituent colours. The characteristics of this spectrum inform researchers about the properties of the object, such as its speed relative to Earth, and chemical composition. "In addition, and for the same price," explains Ana Monreal, "this analysis gives us information about the material that light passes through on its way to us and, in particular, about the interstellar medium." The DIBs are dark bands that appear in the spectra of astronomical objects associated with this medium and whose origin is still a mystery today. They cannot be explained by the presence of known simple molecules and are suspected to be caused by material which is probably organic.

Most studies related to the DIBs have been confined to objects in the Milky Way, as they are particularly weak spectral features. Outside our galaxy there are some detections of DIBs, mostly in the Magellanic Clouds, which are members of the Local Group of galaxies, but only very rarely have they been detected well beyond the confines of the Local Group. However, when we look well beyond the Milky Way it is of interest to see how they behave in highly energetic interstellar medium conditions, such as those found in a starburst galaxy, where stars are being formed at a much higher rate than in our galaxy.

These observations beyond the galaxies that surround us can give additional clues about the possible nature of the molecules that cause DIBs, but they can also provide tools for astronomers to characterize the interstellar medium to which they belong.

"In our work, we have explored the potential of using integral field spectrographs, such as HARMONI (an instrument designed for the future 39m telescope, the E-ELT), in whose construction the IAC participates," says Ana Monreal. "For this, we have used what constitutes, today, the crème de la crème in this type of instrumentation, MUSE on the VLT, to obtain data from the closest merging spiral galaxy system: The Antennae Galaxies."

MUSE obtains a huge number of spectra from a relatively large area on the sky from a single exposure. "Based on adding the signal of neighbouring spectra and carefully modelling and separating the emission due to the stars and the ionized gas in the system, we managed to detect the signal from two of the best-known DIBs and, in fact, the first two DIBs to be identified, along more than 200 and 100 independent lines of sight respectively," explains Monreal.

This study also compares the detections obtained by the group with other properties and components of the interstellar medium in this system, in particular: the attenuation (directly related to the amount of dust) and the distribution of atomic hydrogen, molecular gas and some bands in emission in the middle infrared that also appear to be associated with organic compounds.

Source: Phys.org Return to Contents

Space Image of the Week

Hubble Captures Cluster of Aging Stars

This rich and dense field of stars is a massive globular cluster, a gravitationally bound collection of stars that orbits the Milky Way.

Globular clusters are denser and more spherical than open star clusters like the famous Pleiades. They typically contain hundreds of thousands of stars that are thought to have formed at roughly the same time.

Studies have shown that this globular cluster, named NGC 6139, is home to an aging population of stars. Most globular clusters orbiting the Milky Way are estimated to be over 10 billion years old; as a result, they contain some of the oldest stars in our galaxy, formed very early in the galaxy's history. However, their role in galactic evolution is still a matter of study.

This cluster is seen roughly in the direction of the center of the Milky Way, in the constellation of Scorpius (the Scorpion). This constellation is a goldmine of fascinating astronomical objects. Hubble has set its sights on Scorpius many times over the years to observe objects such as the Butterfly Nebula, surprising binary star systems, and other dazzling globular clusters.

Source: SpaceRef.com Return to Contents