Space News Update

— May 18, 2018 —

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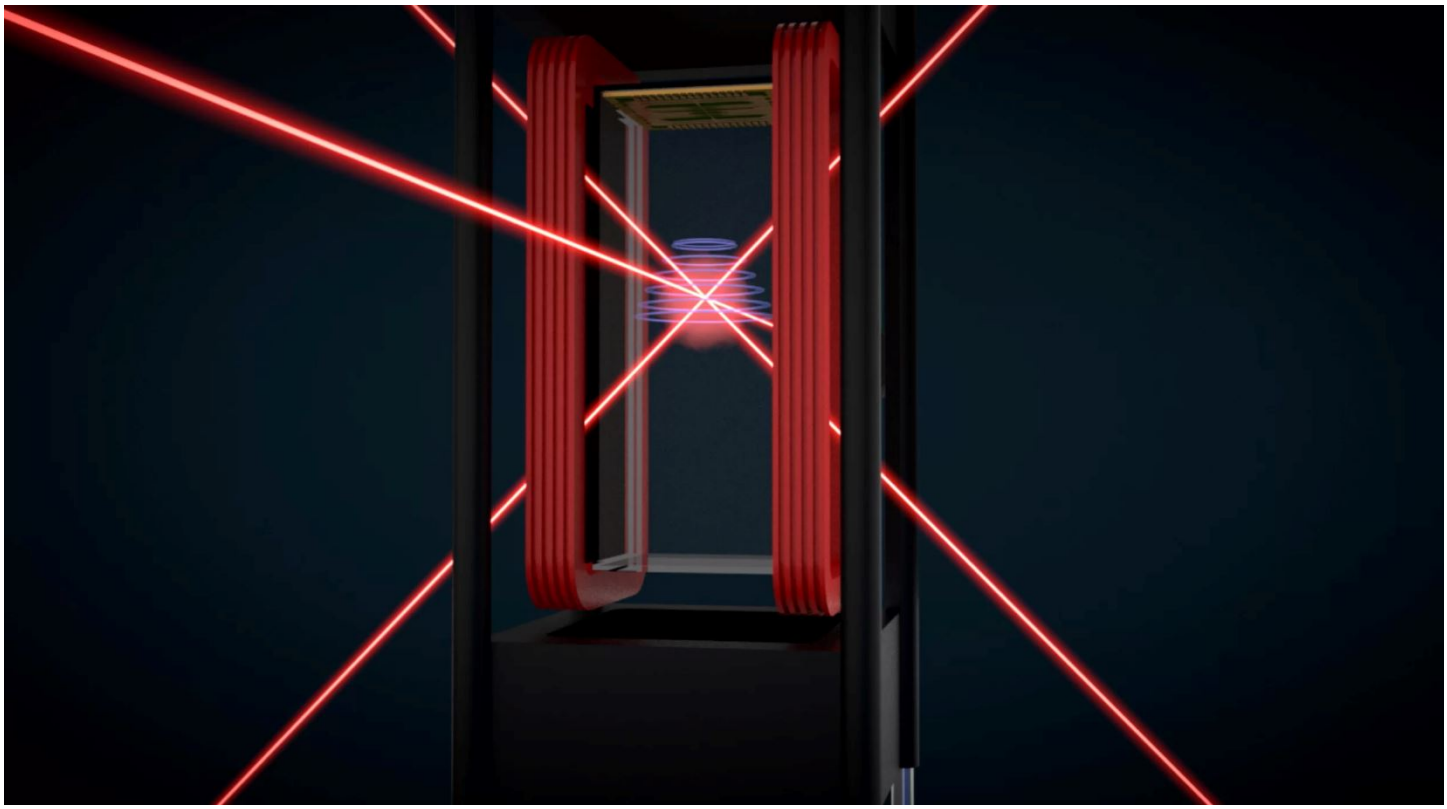
1. Here's the Weird Science Launching to the Space Station This Weekend



Update: The launch of Orbital ATK's Cygnus cargo mission has been postponed to no earlier than Monday (May 21) at 4:39 a.m. EDT (0839 GMT) "to support further pre-launch inspections and more favorable weather conditions," according to a statement from NASA.

This weekend, a cargo delivery to the International Space Station will carry old-fashioned sextants, E. colibacteria and lasers that will create a temperature 10 billion times colder than the vacuum of space.

These unusual science experiments are scheduled to launch Sunday morning (May 20) at 5:04 a.m. EDT (9:04 a.m. GMT) from NASA's Wallops Flight Facility in Wallops Island, Virginia. They will launch on the commercial spaceflight company Orbital ATK's Antares rocket, packed in the company's Cygnus spacecraft as part of 7,385 lbs. (3,350 kilograms) of scientific equipment, food, clothing and other supplies for the Expedition 55 space station crew.

This mission, known as OA-9, will be the spacecraft's ninth contracted cargo-resupply mission to the space station. The spacecraft is named the S.S. J.R. Thompson after J.R. Thompson, a late aerospace executive and NASA director who worked with the Cygnus spacecraft and helped to advance human spaceflight. [Orbital ATK's Antares Rocket & Cygnus Explained (Infographic)]

The early morning launch will be visible along the U.S. East Coast, and you can watch it live online here at Space.com, courtesy of NASA TV.

Aboard the craft will be an experiment from the Cold Atom Laboratory (CAL), a physics research facility in which scientists will explore the lowest temperatures that we can reach in a lab and how those temperatures affect atomic interactions. These temperatures are "like one-tenth of a billion of a degree above absolute zero," Robert Shotwell, CAL project manager and an engineer at NASA's Jet Propulsion Laboratory in California, said in a press conference May 10.

CAL is sending the space station an experimental physics package that holds an "ice chest"-like compartment filled with lasers and electronics; the interior will be able to reach a temperature10 billion times colder than the vacuum of space, according to a NASA statement. Within this instrument, the researchers will use laser cooling techniques and magnets to slow down atoms until they are almost entirely motionless.

By studying these ultra-cold atom clouds in the microgravity environment aboard the space station and observing how these atoms interact, CAL could help scientists answer some of their most puzzling quantum questions, NASA officials said.

This cargo mission will also carry "ICE Cubes," but not the chilly variety you may be picturing. These cubes, sent as part of the International Commercial Experiment, or ICE Cubes Service, are small, modular containers about the size of microwave ovens. Neatly slotted into a laboratory rack as part of a "plug-and-play" model, these cubes are connected to electricity and monitoring systems and will each contain a different experiment.

This service is a partnership between the European Space Agency (ESA) and Space Application Services (SpaceAps). ICE Cubes vary in size and are easy to build, install and remove. "The idea is to provide fast, direct and affordable access to space for research, technology and education for any organization or customer," Hilde Stenuit of SpaceAps, said in the statement.

ICE Cubes sent in this mission will include an experiment that will study how different seeds germinate and grow under a variety of unique space conditions, an experiment that looks at how bacteria can be used to create methane in microgravity, and more.

An unusually low-tech item will also be aboard the spacecraft: a handheld sextant. This instrument, which measures the angular distance between two visible objects, is a time-honored staple of navigation. The traditional, metal tool has historically been used for nautical navigation by sailors out at sea or to measure distances in the night sky.

The Sextant Navigation investigation will test the use of handheld sextants for emergency navigation on future deep-space missions, according to the NASA statement. As crewed missions travel farther and farther from Earth, the risks will increase. If a crew found itself without communications or sufficient computing capabilities, it could theoretically use a sextant to find its way using the angles among the moon, planets and stars.

Because the instrument requires no power or external support to operate, it could be a simple but life-saving tool, NASA officials said.

Also coming aboard the spacecraft will be Biomolecule Extraction and Sequencing Technology (BEST), which will use DNA and RNA sequencing to study microbes aboard the space station and better understand how spaceflight could contribute to mutations in these species.

With a swab-to-sequencer process, astronauts can sequence the genome of microbes found on board without having to culture the organisms first. This is a huge step forward, as previously, "NASA's microbiology has relied on culturing the organisms," Sarah Wallace, a NASA microbiologist and principal investigator for BEST, said during the press conference.

With human spaceflight advancing every day, this work will allow scientists to better understand how microscopic organisms, like bacteria, react to the microgravity aboard the space station, Wallace said. BEST will also advance sequencing in space by performing direct RNA sequencing.

Escherichia coli (E. coli), the bacterium best-known for its ability to cause food poisoning in humans, is also heading up to the space station. Aside from causing gastrointestinal distress, a genetically engineered strain of E. coli can also produce isobutane. This E. Coli strain, while harmless to humans, can produce this molecule,

which we use to make everything from latex to medical devices and fuel additives. In fact, isobutane is a significant part of manufacturing today, researchers said in the news conference.

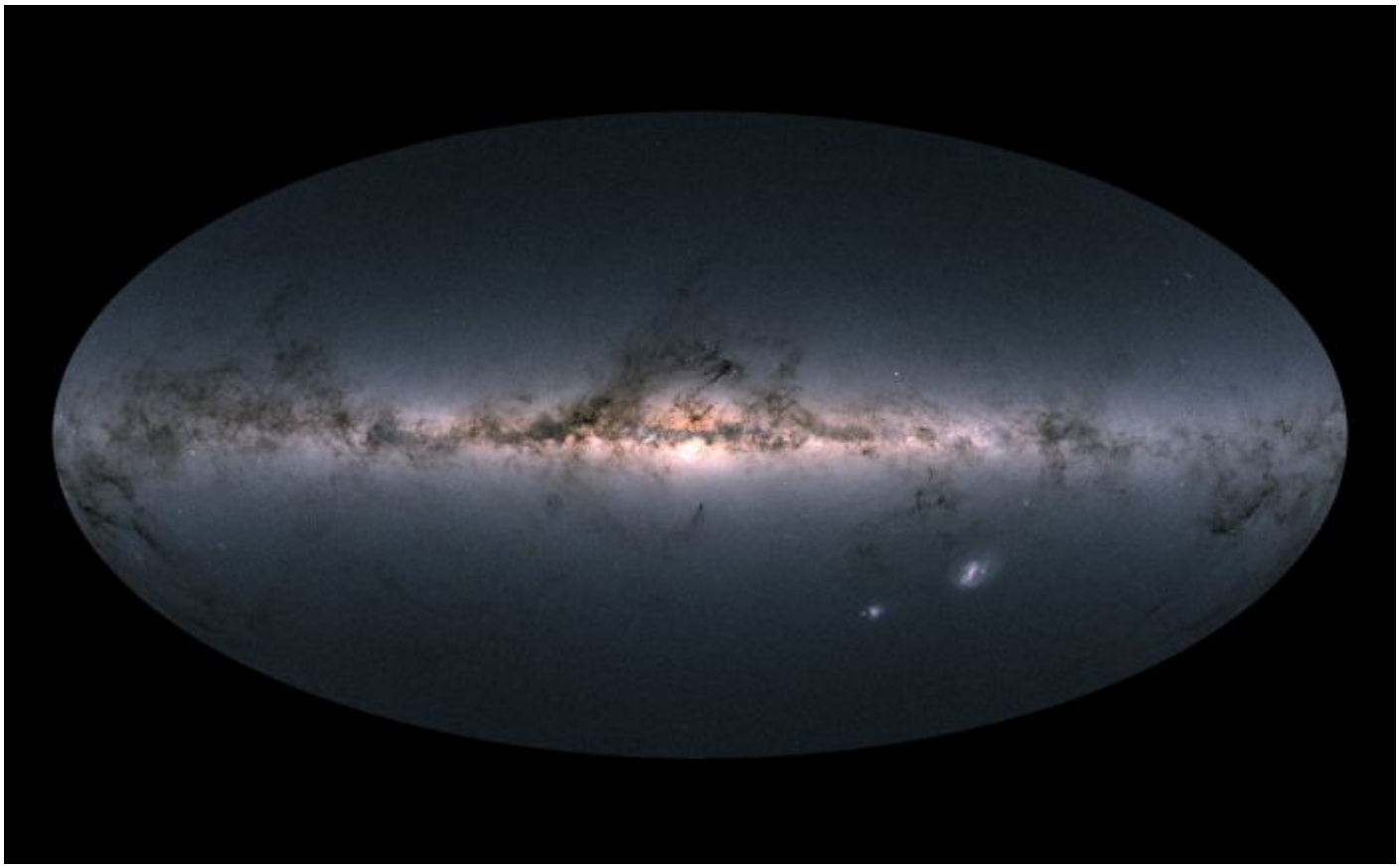
Unfortunately, the material is primarily produced, for manufacturing purposes, from fossil fuels and nonrenewable sources. The process of producing isobutane is energy-intensive and polluting, as Brandon Briggs, an assistant professor at the University of Alaska Anchorage, discussed in the conference. By genetically engineering E. coli to produce isobutane and sending some of these into space, researchers can investigate what environments are ideal for isobutane production in these microbes.

Additionally, the spacecraft will carry NASA's Continuous Liquid-Liquid Separation in Microgravity investigation which will use theliquid-liquid separation system from company Zaiput Flow Technologies. While liquid separation here on Earth typically relies on gravity, this separator uses surface forces independent of gravity, such as surface tension. The system will be put to the test in the space station's microgravity environment, where the variable of gravity can be removed and they can see whether or not surface tension alone can be used as a liquid separator.

This will allow researchers to improve the performance of the system, according to Andrea Adamo, founder and CEO of Zaiput Flow Technologies, in the press conference. Adamo also noted in the news conference that this system might one day be used to enable chemical synthesis in space.

Source: Space.com Return to Contents

2. Gaia Turns Up 13,928 White Dwarfs Nearby the Sun



In 2013, the European Space Agency (ESA) deployed the *Gaia* mission, a space observatory designed to measure the positions of movements of celestial bodies. For the past four years, *Gaia* has been studying distant stars, planets, comets, asteroids, quasars and other astronomical objects, and the data it has acquired will be used to construct the largest and most precise 3D space catalog ever made, totaling 1 billion objects.

The second release of *Gaia* data, which took place on April 25th, 2018, has already resulted in a number of impressive discoveries. The latest was made by an international team of scientists who identified 13,928 white dwarfs within 100 parsecs (326 light-years) of the Sun, many of which were formed through mergers. This is the first time that white dwarf stars have been directly detected within the Solar neighborhood.

The study which describes their findings, "Gaia Reveals Evidence for Merged White Dwarfs", recently appeared online and is being considered for publication in the *Monthly Notices of the Royal Astronomical Society.* The study was led by Dr. Mukremin Kilic, an associate professor at the University of Oklahoma, and included members from the Institute for Astronomy at the University of Edinburghand the University of Montreal.

Basically, white dwarfs are what become of the majority of stars (with masses less than 8 Solar masses) once they exit the main sequence phase of their lives. This consists of a star exhausting its hydrogen fuel and expanding to several times its size (entering its Red Giant Branch Phase). These stars then blow off their external layers (a supernova) and leaving behind a white dwarf remnant.

By studying them, astronomers can learn far more about the life cycle of stars and how they evolve. As Dr. Kilic explained to Universe Today via email:

"[W]e're basically doing Galactic archaeology when we study nearby white dwarfs. They tell us about the ages and star formation histories of the Galactic disk and halo. More importantly, white dwarfs explode as a Type Ia supernova when they reach 1.4 times the mass of the Sun. We use these supernovae to study the shape of the Universe and conclude that the expansion of the universe is accelerating. However, we have not yet found the progenitor systems of these supernovae. One of the channels to form Type Ia supernovae is through mergers of white dwarfs. Hence, the direct detection of merged white dwarfs is important for understanding the frequency of these white dwarf mergers."

However, until recently only a few hundred white stars have been found within the local galactic neighborhood (500 within a 40 parsec radius). In addition, astronomers were only able to obtain accurate parallax (distance) measurements for about half of these. But thanks to the *Gaia* data, the number of white dwarfs systems that astronomers are able to study has increased exponentially.

"Gaia provided distance measurements," said Kilic. "We can now create complete samples of white dwarfs within a given volume. For example, prior to *Gaia*, we only knew about 100 white dwarfs within 20 parsecs of the Sun. With Gaia Data Release 2, we identified more than 13,000 white dwarfs within 100 parsecs of the Sun. The difference in numbers is amazing!"

The *Gaia* data was also helpful in determining the nature of these white dwarf systems and how they formed. As they indicate in their study, previous research has shown that the majority of white dwarf stars in our local galaxy (roughly 56%) are the product of single-star evolution, whereas 7 to 23% were the product of mergers between binaries. The remainder were white dwarf binaries, or binaries with one white dwarf and a main sequence star.

Using the *Gaia* data – which included the color and distribution data of thousands of white dwarf stars within ~326 light-years of the Sun – the team was able to determine how massive these stars are. This, in turn, provided vital clues as to how they formed, which indicated that mergers were far more common than previous studies suggested. As Kilic explained:

"Massive white dwarfs tend to be smaller, which means that they are also fainter (since they have a smaller surface area). Since Gaia gave us a complete sample of white dwarfs within 100 parsecs of the Sun, for the first time, we were able to derive the magnitude distribution (hence the mass distribution) of thousands of white dwarfs and find a large fraction of massive white dwarfs. We see that the number of massive white dwarfs is significantly higher than expected from single star evolution. Therefore, we concluded that many of these massive white dwarfs actually formed through mergers in previously binary systems."

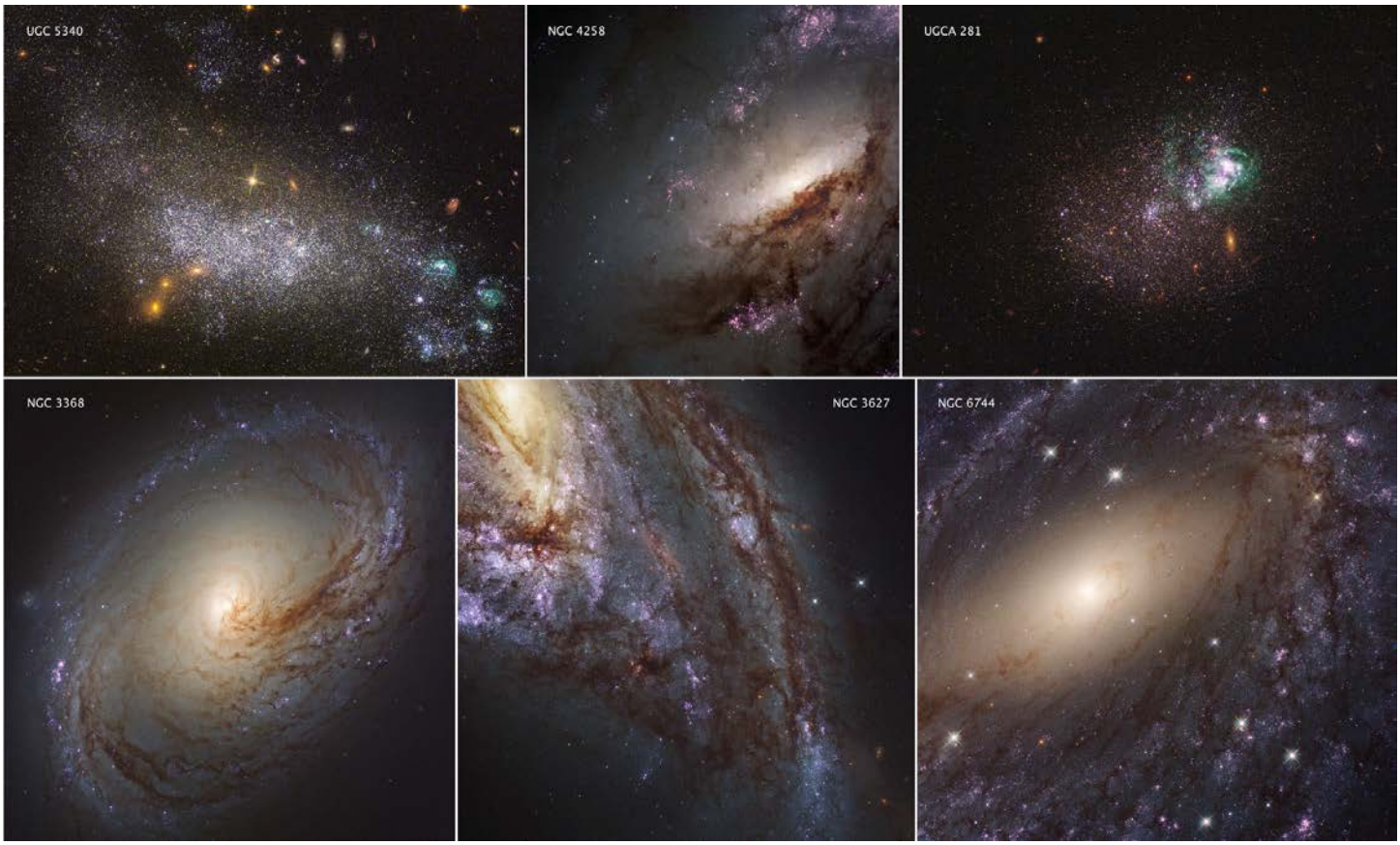
From this, the team was able to assemble the first reliable Hertzsprung-Russell Diagram for nearby field white dwarf stars, as well as estimates on how often white dwarf binaries merge. As Kilic indicated, this could have significant implications for other areas of astronomical study.

"Based on the frequency of these single white dwarfs that formed through mergers, we can estimate how many white dwarf mergers occur on average and with what mass distribution," he said. "We can then infer the rate of Type Ia supernovae from these mergers and see if it's enough to explain part or all of the Ia supernova explosions. This is an ongoing area of research and I'm sure we will some results on these very soon."

These findings are yet another gem to come from the second *Gaia* data release, which has proven to be a treasure trove for astronomers. The third release of *Gaia* data is scheduled to take place in late 2020, with the final catalog being published in the 2020s. Meanwhile, an extension has already been approved for the *Gaia* mission, which will now remain in operation until the end of 2020 (to be confirmed at the end of this year).

Source: Universe Today Return to Contents

3. Astronomers release most complete ultraviolet-light survey of nearby galaxies



Capitalizing on the unparalleled sharpness and spectral range of NASA's Hubble Space Telescope, an international team of astronomers is releasing the most comprehensive, high-resolution ultraviolet-light survey of nearby star-forming galaxies.

The researchers combined new Hubble observations with archival Hubble images for 50 star-forming spiral and dwarf galaxies in the local universe, offering a large and extensive resource for understanding the complexities of star formation and galaxy evolution. The project, called the Legacy ExtraGalactic UV Survey (LEGUS), has amassed star catalogs for each of the LEGUS galaxies and cluster catalogs for 30 of the galaxies, as well as images of the galaxies themselves. The data provide detailed information on young, massive stars and star clusters, and how their environment affects their development.

"There has never before been a star cluster and a stellar catalog that included observations in ultraviolet light," explained survey leader Daniela Calzetti of the University of Massachusetts, Amherst. "Ultraviolet light is a major tracer of the youngest and hottest star populations, which astronomers need to derive the ages of stars and get a complete stellar history. The synergy of the two catalogs combined offers an unprecedented potential for understanding star formation."

How stars form is still a vexing question in astronomy. "Much of the light we get from the universe comes from stars, and yet we still don't understand many aspects of how stars form," said team member Elena Sabbi of the Space Telescope Science Institute in Baltimore, Maryland. "This is even key to our existence—we know life wouldn't be here if we didn't have a star around."

The research team carefully selected the LEGUS targets from among 500 galaxies, compiled in ground-based surveys, located between 11 million and 58 million light-years from Earth. Team members chose the galaxies based on their mass, star-formation rate, and abundances of elements that are heavier than hydrogen and

helium. The catalog of ultraviolet objects collected by NASA's Galaxy Evolution Explorer (GALEX) spacecraft also helped lay the path for the Hubble study.

The team used Hubble's Wide Field Camera 3 and the Advanced Camera for Surveys over a one-year period to snap visible- and ultraviolet-light images of the galaxies and their most massive young stars and star clusters. The researchers also added archival visible-light images to provide a complete picture.

The star cluster catalogs contain about 8,000 young clusters whose ages range from 1 million to roughly 500 million years old. These stellar groupings are as much as 10 times more massive than the largest clusters seen in our Milky Way galaxy.

The star catalogs comprise about 39 million stars that are at least five times more massive than our Sun. Stars in the visible-light images are between 1 million and several billion years old; the youngest stars, those between 1 million and 100 million years old, shine prominently in ultraviolet light.

The Hubble data provide all of the information to analyze these galaxies, the researchers explained. "We also are offering computer models to help astronomers interpret the data in the star and cluster catalogs," Sabbi said. "Researchers, for example, can investigate how star formation occurred in one specific galaxy or a set of galaxies. They can correlate the properties of the galaxies with their star formation. They can derive the star-formation history of the galaxies. The ultraviolet-light images may also help astronomers identify the progenitor stars of supernovas found in the data."

One of the key questions the survey may help astronomers answer is the connection between star formation and the major structures, such as spiral arms, that make up a galaxy.

"When we look at a spiral galaxy, we usually don't just see a random distribution of stars," Calzetti said. "It's a very orderly structure, whether it's spiral arms or rings, and that's particularly true with the youngest stellar populations. On the other hand, there are multiple competing theories to connect the individual stars in individual star clusters to these ordered structures.

"By seeing galaxies in very fine detail—the star clusters—while also showing the connection to the larger structures, we are trying to identify the physical parameters underlying this ordering of stellar populations within galaxies. Getting the final link between gas and star formation is key for understanding galaxy evolution."

Team member Linda Smith of the European Space Agency (ESA) and the Space Telescope Science Institute, added: "We're looking at the effects of the environment, particularly with star clusters, and how their survival is linked to the environment around them."

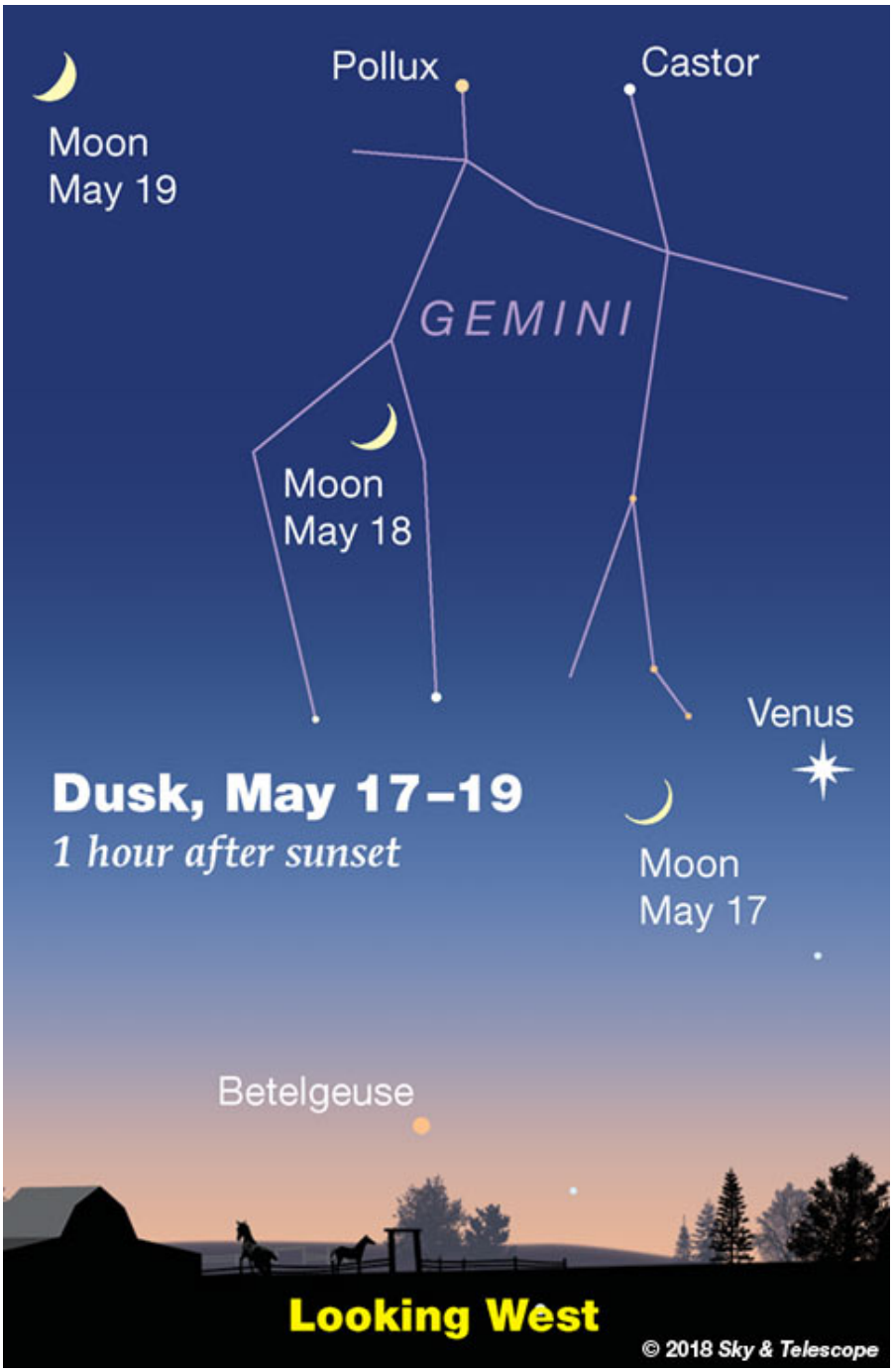
The LEGUS survey will also help astronomers interpret views of galaxies in the distant universe, where the ultraviolet glow from young stars is stretched to infrared wavelengths due to the expansion of space. "The data in the star and cluster catalogs of these nearby galaxies will help pave the way for what we see with NASA's upcoming infrared observatory, the James Webb Space Telescope, developed in partnership with ESA and the Canadian Space Agency (CSA)," Sabbi said.

Webb observations would be complementary to the LEGUS views. The space observatory will penetrate dusty stellar cocoons to reveal the infrared glow of infant stars, which cannot be seen in visible- and ultraviolet-light images. "Webb will be able to see how star formation propagates over a galaxy," Sabbi continued. "If you have information on the gas properties, you can really connect the points and see where, when, and how star formation happens."

Source: Phys.org Return to Contents

The Night Sky

Friday, May 18
• The Arch of Spring spans the western sky in late twilight, adorned this evening and tomorrow by the waxing crescent Moon. Pollux and Castor form the top of the Arch: they're lined up roughly horizontally in the west-northwest as shown here, about three finger-widths at arm's length apart. Look far to their lower left for Procyon (just outside the view here), and farther to their lower right for Menkalinan and then bright Capella. Venus blazes below the Arch, off center to the right.



• And then just as darkness becomes complete, an observing challenge: Get Venus in binoculars or a low-power, wide-field scope. Look upper left of it by about 1.6°. Can you make out the dim glow of the star cluster M35? Have you *ever* seen an M object this close to the horizon? It'll slide closer past Venus on Saturday and Sunday nights.

Saturday, May 19
• The Moon hangs in dim Cancer, left of Castor and Pollux almost in line with them as shown above. After nightfall is complete, use binoculars to look for the Beehive Star Cluster, M44, about 6° above the Moon (as seen from North America). That's roughly the width of the field of view in typical 8x binoculars.

Sunday, May 20
• Jupiter's Great Red Spot should cross the planet's central meridian around 9:17 p.m. Eastern Daylight Time. Farther west, Jupiter is too low and the sky too bright.

• But then Jupiter's largest moon, Ganymede, crosses the planet's face from 9:07 to 10:26 p.m. *Pacific* Daylight Time, followed by its tiny black shadow from 10:05 to 11:50 p.m. PDT. Convert these to other time zones, but check whether Jupiter will be in good view for you then.

Monday, May 21
• First-quarter Moon (exact at 11:49 p.m. Eastern Daylight Time). The Moon shines very near Regulus during evening for the Americas.

• This evening the asteroid 201 Penelope should occult a 9.9-magnitude star in Virgo for telescope users along a narrow path from the Oregon coast through Arizona and into Mexico. Map, details, finder charts.

Tuesday, May 22

• Now and for months to come, Jupiter stays within less than 2° or 3° of 3rd-magnitude Alpha Librae (Zubenelgenubi): a fine, wide double star for binoculars. Its two components, magnitudes 2.8 and 5.1, are a generous 231 arcseconds apart. Nevertheless they form a real, gravitationally bound pair; they're both measured to be 77 light-years away.

• Shining in the east-northeast after dark is Vega, the brightest and currently highest star of the Summer Triangle. But with summer still a month away (astronomically speaking), the Triangle's final star doesn't rise above the eastern horizon until about 10 or 11 p.m. That's Altair, the Triangle's lower right corner. The third star is Deneb, sparkling less far to Vega's lower left.

Source: Sky & Telescope Return to Contents

ISS Sighting Opportunities

For Denver:

Date	Visible	Max Height	Appears	Disappears
Fri May 18, 1:31 AM	< 1 min	12°	12° above N	12° above N
Fri May 18, 3:08 AM	< 1 min	11°	10° above N	11° above N
Fri May 18, 4:43 AM	3 min	29°	10° above NW	29° above NNE
Sat May 19, 00:40 AM	< 1 min	11°	11° above NNE	10° above NNE
Sat May 19, 2:15 AM	< 1 min	10°	10° above N	10° above N
Sat May 19, 3:51 AM	2 min	20°	11° above NNW	20° above NNE
Sat May 19, 10:06 PM	< 1 min	13°	10° above SW	13° above SW
Sat May 19, 11:48 PM	< 1 min	13°	13° above NNE	11° above NNE
Sun May 20, 2:59 AM	1 min	14°	11° above NNW	14° above N
Sun May 20, 4:35 AM	6 min	65°	10° above NW	10° above ESE
Sun May 20, 9:15 PM	5 min	29°	11° above SSW	10° above ENE
Sun May 20, 10:51 PM	5 min	30°	11° above W	11° above NNE
Mon May 21, 00:30 AM	< 1 min	10°	10° above NNW	10° above NNW
Mon May 21, 2:07 AM	< 1 min	11°	10° above N	11° above N
Mon May 21, 3:43 AM	6 min	35°	10° above NW	10° above E
Mon May 21, 9:58 PM	6 min	52°	10° above WSW	10° above NE
Mon May 21, 11:37 PM	3 min	13°	10° above NW	10° above NNE
Tue May 22, 2:51 AM	5 min	23°	11° above NNW	10° above E
Tue May 22, 4:27 AM	6 min	46°	10° above WNW	11° above SSE
Tue May 22, 9:06 PM	6 min	79°	10° above SW	10° above NE
Tue May 22, 10:44 PM	5 min	18°	10° above WNW	10° above NNE

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

NASA-TV Highlights

(all times Eastern Daylight Time)

May 18, Friday

10:10 a.m. – Space Station astronauts Drew Feustel and Ricky Arnold talk with the Edwardsville Community Unity School District in Edwardsville, Illinois (All Channels)

12 p.m. –Facebook Live on upcoming GRACE Follow-On mission to track water movement on Earth. (All Channels)

1 p.m., 5 p.m. - Replay of the First Agency Town Hall with NASA Administrator Jim Bridenstine (All Channels)

2:30 p.m., 6:30 p.m., 9:30 p.m. - Replay of SpaceCast Weekly (All Channels)

8 p.m., 10 p.m. - NASA TV Premiere – *AMS: The Fight for Flight* - A NASA documentary about the Alpha Magnetic Spectrometer and Nobel laureate Samuel Ting (All Channels)

May 19, Saturday

1 p.m. Orbital-ATK CRS-9 "What's On Board" Broadcast (All channels)

May 20, Sunday

11 a.m. - Orbital-ATK CRS-9 Space Station Resupply Mission Pre-launch News Conference with Mission Managers (All channels)

May 21, Monday
4 a.m. - Coverage of the Launch of the Orbital/ATK Cygnus CRS-9 Mission (Launch scheduled at 4:39 a.m. EDT) (All Channels)
5:45 a.m. - Coverage of the Deployment of the Solar Arrays on the Orbital/ATK Cygnus Cargo Craft (All Channels)
7 a.m. - Orbital/ATK Cygnus Post-Launch News Conference (All Channels)1:30 p.m. – GRACE Follow-On Pre-Launch News Conference (All Channels)
1:30 p.m. - GRACE Follow-On Pre-Launch News Conference - Vandenberg Air Force Base
4 p.m. - Next Space Station crew departs from the Gagarin Cosmonaut Training Center in Star City, Russia for the Baikonur Cosmodrome in Kazakhstan (Recorded on Saturday, May 19) (Media Channel)

May 22, Tuesday
11 a.m. - Space Station astronauts Ricky Arnold and Scott Tingle talk to students at the Vaughn Next Century Learning Center in San Fernando, California (All Channels)
3:15 p.m. - Coverage of the launch of GRACE Follow-On Mission (Launch scheduled at 3:47 pm EDT) from Vandenberg Air Force Base, California (All Channels)

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

Space Calendar

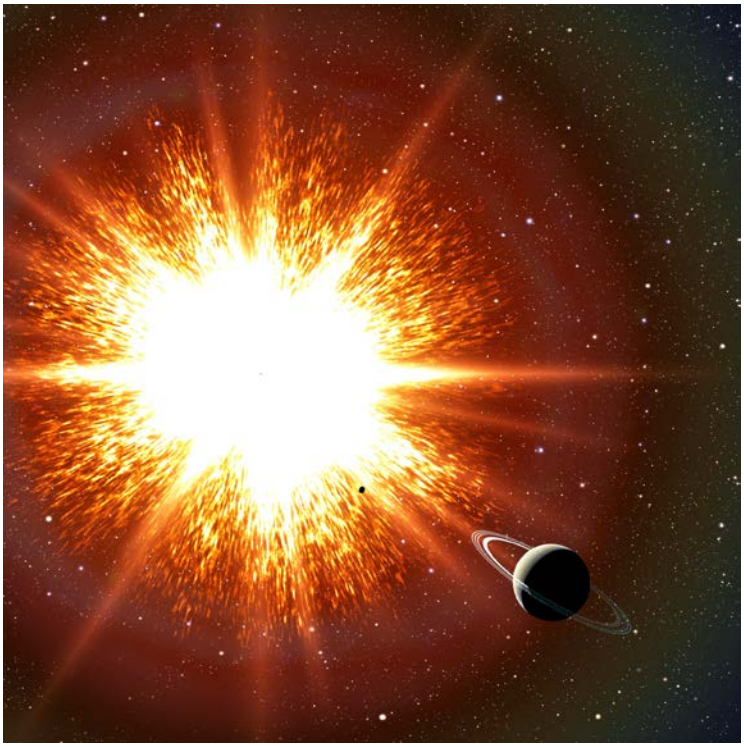
- Apr 18 - Transiting Expoplanet Survyey Satellite (TESS) Falcon 9 Launch, Successful
- Apr 18 - Comet 62P/Tsuchinshan At Opposition (1.130 AU)
- Apr 18 - Comet 186P/Garradd Closest Approach To Earth (3.632 AU)
- Apr 18 - Aten Asteroid 2018 HU Near-Earth Flyby (0.020 AU)
- Apr 18 - Apollo Asteroid 2015 XE352 Near-Earth Flyby (0.070 AU)
- Apr 18 - Apollo Asteroid 2018 GW3 Near-Earth Flyby (0.081 AU)
- Apr 19 - Blagovest-12L Proton-M/Briz-M Launch, Successful
- Apr 19 - Moon Occults Aldebaran
- Apr 19 - Comet 160P/LINEAR At Opposition (3.427 AU)
- Apr 19 - Comet P/2015 Q1 (Scotti) At Opposition (3.995 AU)
- Apr 19 - Apollo Asteroid 2018 HC1 Near-Earth Flyby (0.003 AU)
- Apr 19 - Apollo Asteroid 2018 HO1 Near-Earth Flyby (0.029 AU)
- Apr 19 - Apollo Asteroid 2014 JG15 Near-Earth Flyby (0.050 AU)
- Apr 19 - Aten Asteroid 2018 GU3 Near-Earth Flyby (0.058 AU)
- Apr 19 - Apollo Asteroid 2015 HD10 Near-Earth Flyby (0.098 AU)
- Apr 19 - Asteroid 6312 Robheinlein Closest Approach To Earth (1.272 AU)
- Apr 19 - Asteroid 42776 Casablanca Closest Approach To Earth (2.039 AU)
- Apr 19 - Asteroid 193 Ambrosia Closest Approach To Earth (2.129 AU)
- Apr 19 - 5th Anniversary (2013), Wolcott Meteorite Fall (Hit House in Connecticut)
- Apr 19-20 - Meeting: Exoplanet Science Strategy, Irvine, California
- Apr 20 - Comet P/2000 R2 (LINEAR) At Opposition (2.634 AU)
- Apr 20 - Comet 162P/Siding Spring At Opposition (3.884 AU)
- Apr 20 - Apollo Asteroid 2018 HE2 Near-Earth Flyby (0.004 AU)
- Apr 20 - Apollo Asteroid 2018 HS Near-Earth Flyby (0.013 AU)
- Apr 20 - Apollo Asteroid 2018 GS3 Near-Earth Flyby (0.022 AU)
- Apr 20 - Aten Asteroid 2016 JP Near-Earth Flyby (0.031 AU)
- Apr 20 - Apollo Asteroid 2010 JO33 Near-Earth Flyby (0.060 AU)
- Apr 20 - Atira Asteroid 164294 (2004 XZ130) Closest Approach To Earth (0.667 AU)
- Apr 20 - Asteroid 25399 Vonnegut Closest Approach To Earth (1.454 AU)
- Apr 20 - Asteroid 234750 Amymainzer Closest Approach To Earth (2.437 AU)
- Apr 20 - Asteroid 2906 Caltech Closest Approach To Earth (2.645 AU)
- Apr 20 - Kai Seigbahn's 100th Birthday (1918)
- Apr 21 - Comet 24P/Schaumasse Closest Approach To Earth (1.333 AU)
- Apr 21 - Comet P/2008 QP20 (LINEAR-Hill) At Opposition (4.245 AU)
- Apr 21 - Apollo Asteroid 2018 HW1 Near-Earth Flyby (0.002 AU)
- Apr 21 - Apollo Asteroid 2018 HL1 Near-Earth Flyby (0.012 AU)
- Apr 21 - Apollo Asteroid 2018 HT Near-Earth Flyby (0.018 AU)
- Apr 21 - Apollo Asteroid 2018 HN Near-Earth Flyby (0.021 AU)
- Apr 21 - Apollo Asteroid 2018 GR1 Near-Earth Flyby (0.047 AU)
- Apr 21 - Apollo Asteroid 2018 GS2 Near-Earth Flyby (0.061 AU)
- Apr 21 - Asteroid 4457 van Gogh Closest Approach To Earth (1.416 AU)
- Apr 21 - Asteroid 39415 Janeausten Closest Approach To Earth (2.676 AU)
- Apr 22 - Earth Day
- Apr 22 - Lyrids Meteor Shower Peak
- Apr 22 - Tesla Roadster At Opposition (0.166 AU)
- Apr 22 - Apollo Asteroid 2018 HV Near-Earth Flyby (0.001 AU)
- Apr 22 - Apollo Asteroid 2018 HX1 Near-Earth Flyby (0.007 AU)
- Apr 22 - Apollo Asteroid 2018 GL4 Near-Earth Flyby (0.081 AU)
- Apr 22 - Apollo Asteroid 2018 CY Near-Earth Flyby (0.097 AU)
- Apr 22 - Asteroid 11246 Orvillewright Closest Approach To Earth (1.882 AU)

- Apr 22 - Asteroid 2097 Galle Closest Approach To Earth (2.675 AU)
- Apr 22 - Miguel Hurtado's 40th Birthday (1978)

Source: JPL Space Calendar Return to Contents

Food for Thought

Could recent supernovae be responsible for mass extinctions?



Two nearby supernovae that exploded about 2.5 and eight million years ago could have resulted in a staggered depletion of Earth's ozone layer, leading to a variety of repercussions for life on Earth.

In particular, two-and-a-half million years ago the Earth was changing dramatically. The Pliocene, which was a hot and balmy epoch, was ending and the Pleistocene, an era of repeated glaciation known as the Ice Age, was beginning. Natural variations in Earth's orbit and wobble likely accounted for the change in climate, but the simultaneous event of a supernova could provide insight on the diversification of life during this epoch.

This supernova is thought to have occurred between 163 and 326 light years away (50–100 parsecs) from Earth. For perspective, our closest stellar neighbor, Proxima Centauri, is 4.2 light years away.

Consequences for Earth

Supernovae can sterilize any nearby inhabited planets that happen to be in the path of their harmful ionizing radiation. Could nearby supernovae wreak havoc on the existing biology of our planet? One researcher wanted to find out. Dr. Brian Thomas, an astrophysicist at Washburn University in Kansas, USA, modeled the biological impacts at the Earth's surface, based on geologic evidence of nearby supernovae 2.5 million and 8 million years ago. In his latest paper, Thomas investigated cosmic rays from the supernovae as they propagated through our atmosphere to the surface, to understand their effect on living organisms.

Looking at the fossil record during the Pliocene–Pleistocene boundary (2.5 million years ago), we see a dramatic change in the fossil record and in land cover globally. Thomas tells Astrobiology Magazinethat "there were changes, especially in Africa, which went from being more forested to more grassland." During this time the geologic record shows an elevated global concentration of iron-60 (60Fe), which is a radioactive isotope produced during a supernova.

"We are interested in how exploding stars affect life on Earth, and it turns out a few million years ago there were changesin the things that were living at the time," says Thomas. "It might have been connected to this supernova."

For example, there was a change in the abundance of species during the Pliocene–Pleistocene boundary. Although no major mass extinctions happened, there was a higher rate of extinction in general, more speciation and a change in vegetation.

Not quite so deadly

How would a nearby supernova affect life on Earth? Thomas laments that supernovae often are exemplified as "supernova goes off and everything dies", but that is not quite the case. The answer lies in the atmosphere.

Beyond sunscreen, the ozone layer protects all biology from harmful, genetically altering ultraviolet (UV) radiation. Thomas used global climate models, recent atmospheric chemistry models and radiative transfer (the propagation of radiation through the layers of the atmosphere) to better understand how the flux of cosmic rays from supernovae would alter Earth's atmosphere, specifically the ozone layer.

One thing to note is that cosmic rays from supernovae would not blast everything in their paths all at once. The intergalactic medium acts as a kind of sieve, slowing down the arrival of cosmic rays and "radioactive iron rain" (60Fe) over hundreds of thousands of years, Thomastells Astrobiology Magazine. Higher energetic particles will reach Earth first and interact with our atmosphere differently than lower energy particles arriving later. Thomas's study modeled the depletion in ozone 100, 300, and 1,000 years after the initial particles from a supernovabegan penetrating our atmosphere. Interestingly, depletion peaked (at roughly 26 percent) for the 300-year case, beating out the 100-year case.

The high-energy cosmic rays in the 100-year case would zip right through the stratosphere and deposit their energy below the ozone layer, depleting it less, while the less energetic cosmic rays arriving during the 300-year interval would deposit more energy in the stratosphere, depleting ozone significantly.

A decrease in ozone could be a concern for life on the surface. "This work is an important step towards understanding the impact of nearby supernovae on our biosphere," says Dr. Dimitra Atri, a computational physicist at the Blue Marble Space Institute of Science in Seattle, USA.

Mixed effects

Thomas examined several possible biologically-damaging effects (erythema, skin cancer, cataracts, marine phytoplankton photosynthesis inhibition and plant damage) at different latitudes as a result of increased UV radiation resulting from a depleted ozone layer. They showed heightened damage across the board, generally increasing with latitude, which makes sense given the changes we see in the fossil record. However, the effects aren't equally detrimental to all organisms. Plankton, the primary producers of oxygen, seemed to be minimally affected. The results also suggested a small increase in the risk of sunburn and skin cancer among humans.

So, do nearby supernovae result in mass extinctions? It depends, says Thomas. "There is a subtler shift; instead of a 'wipe-out everything', some [organisms] are better off and some are worse off." For example some plants showed increase yield, like soybean and wheat, while other plants showed reduced productivity. "It fits," Thomas states, referring to the change in species in the fossil record.

In the future, Thomas hopes to expand on this work and examine possible linkages between human evolution and supernovae.

Source: Phys.org Return to Contents

Space Image of the Week

Attack of the Laser Guide Stars
Image Credit & License: European Southern Observatory / Gerhard Hudepohl (atacamaphoto.com)

Explanation: Dodging powerful laser beams, a drone captured this stunning aerial view. The confrontation took place above the 8.2 meter diameter Very Large Telescopes of the Paranal Observatory on planet Earth. Firing during a test of the observatory's 4 Laser Guide Star Facility, the lasers are ultimately battling against the blurring effect of atmospheric turbulence by creating artificial guide stars. The guide stars are actually emission from laser excited sodium atoms at high altitudes within the telescopic field of view. Guide star image fluctuations are used in real-time to correct for atmospheric blurring by controlling a deformable mirror in the telescope's optical path. Known as adaptive optics, the technique can produce images at the diffraction limit of the telescope. That's the same sharpness you would get if the telescope were in space.

Source: APOD

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