



National Aeronautics and
Space Administration

2024 NASA SCIENCE





Science inspires us. Science connects us. Science empowers us.

NASA's latest marvels and scientific achievements have captured the public's imagination and continue to inspire the next generation of scientists and explorers. Celebrating its first anniversary, the James Webb Space Telescope continues to wow us with its incredible images of the complex cosmos, while the Artemis campaign promises yet another exciting chapter of human exploration of other worlds once again.

In 2024, NASA will embark on an exciting year of scientific exploration and discovery. I invite you to explore with us, as we are all scientists and explorers at heart. You don't have to have a degree to be a scientist; you just have to like asking questions. We ask questions of ourselves and the world around us, and, as we explore our environment, science is the key to satisfying our curiosity. At NASA, we are fortunate that our science and exploration endeavors are inextricably linked and help us discover and innovate for the benefit of humanity. Together, we explore to advance scientific understanding. Ultimately, exploration enables science, and science enables exploration.

Nicola Fox

Associate Administrator
NASA Science Mission Directorate

On April 8, 2024, millions of people will gather from Texas to Maine to witness one of the most rare and incredible phenomena of our lifetimes: a *total solar eclipse*. As the Moon passes in front of the Sun, this cosmic alignment will touch humans, animals, and even our atmosphere, and it is sure to be a memory of a lifetime. Our nation's next solar eclipse is more than 20 years away, so I truly hope you get to witness this spectacle in 2024!

This year, we will also explore worlds near and far like never before. Two exciting Earth science missions—the joint NASA–Indian Space Research Organisation (ISRO) Synthetic Aperture Radar (NISAR) and the Plankton, Aerosols, Cloud, ocean Ecosystem (PACE)—will give us insight into different layers of our environment. Later in the year, we will launch the Europa Clipper to help determine whether Jupiter's water- and ice-covered moon has the conditions to support life. Finally, our Commercial Lunar Payload Services (CLPS) missions will begin to study the Moon in novel ways, providing scientific opportunities that are complementary to those of Artemis and critical to understanding the origins of our solar system.

From fire to water to ice and beyond, NASA Science is exploring the universe. We are excited to journey with you, sharing the creation of knowledge and the magic of discovery for the benefit of all humanity.





January 2024



Rho Ophiuchi. The first anniversary image from NASA's James Webb Space Telescope displays star birth like it's never been seen before, full of detailed, impressionistic texture. The subject is the Rho Ophiuchi cloud complex, the closest star-forming region to Earth. It is considered to be a relatively small, quiet stellar nursery, but you'd never know it from Webb's chaotic close-up. Jets bursting from young stars crisscross the image, impacting the surrounding interstellar gas and lighting up molecular hydrogen, shown in red. Some stars display the telltale shadow

of a circumstellar disk, the makings of future planetary systems. **Image and text credit:** NASA, European Space Agency (ESA), Canadian Space Agency (CSA), Space Telescope Science Institute (STScI), and Klaus Pontoppidan (STScI)

<https://go.nasa.gov/441bXcZ>

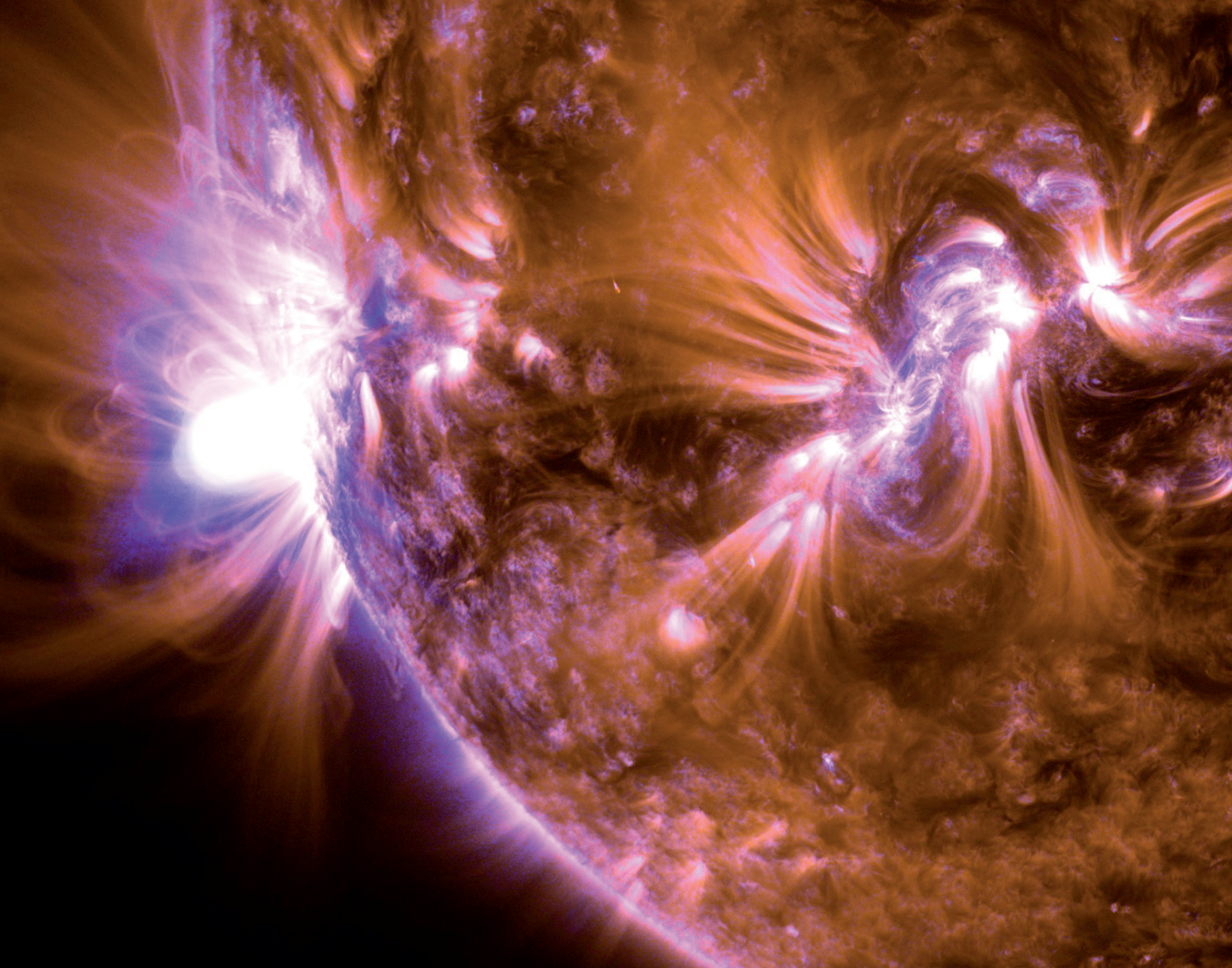


James Webb Space Telescope Team. The extraordinary work of thousands of scientists, engineers, and technicians contributing to the spectacular success of the James Webb Space Telescope has been recognized by several prestigious group achievement and individual awards by NASA and private organizations in the United States and Europe. This picture showing some members of Webb's international development team with the full-scale observatory model represents only a small fraction of the outstanding Webb team. Photo credit: NASA

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1 New Year's Day	2	3	4 Last Quarter	5	6
7	8	9	10	11 New Moon	12	13
14	15 Birthday of Martin Luther King, Jr.	16	17	18 First Quarter	19	20
21	22	23	24	25 Full Moon	26	27
28	29	30	31			

December 2023						
S	M	T	W	T	F	S
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10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

February 2024						
S	M	T	W	T	F	S
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18	19	20	21	22	23	24
25	26	27	28	29		





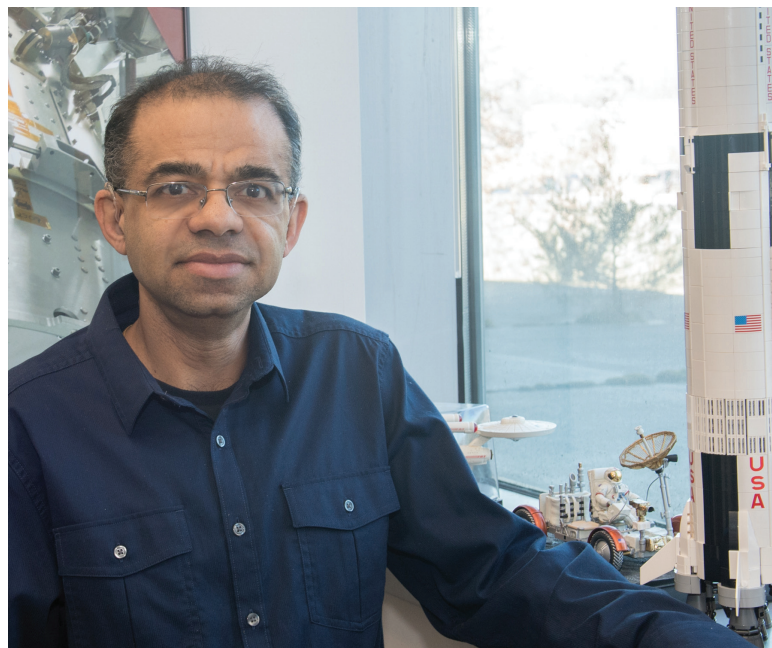
February 2024



Sun Emits X1.2 Flare. An X1.2-class solar flare flashes on the left edge of this image of the Sun, captured by NASA's Solar Dynamics Observatory on January 5, 2023. The image shows a blend of light from the 171- and 131-angstrom wavelengths, which highlight the Sun's corona and flaring regions. Solar flares are powerful bursts of energy. Flares and solar eruptions can pose risks to

spacecraft, astronauts, high-frequency radio communications, electric power grids, and navigation signals. **Image and text credit:** NASA/Goddard Space Flight Center/Solar Dynamics Observatory

<https://go.nasa.gov/47v3cuy>



Apurva Varia has worked for NASA for more than 20 years. He is currently serving as Mission Operations Director for three NASA missions: Parker Solar Probe, Lunar Reconnaissance Orbiter (LRO), and Interstellar Boundary Explorer (IBEX). Apurva was also one of 12 ambassadors for the first crew of the privately funded AstroAccess project. Each ambassador has a disability and participated in a zero-gravity airplane flight on October 17, 2021, to help determine how to adapt spacecraft for disabled astronauts and develop and test the technologies to remove barriers to spaceflight. Photo credit: Bill Hrybyk

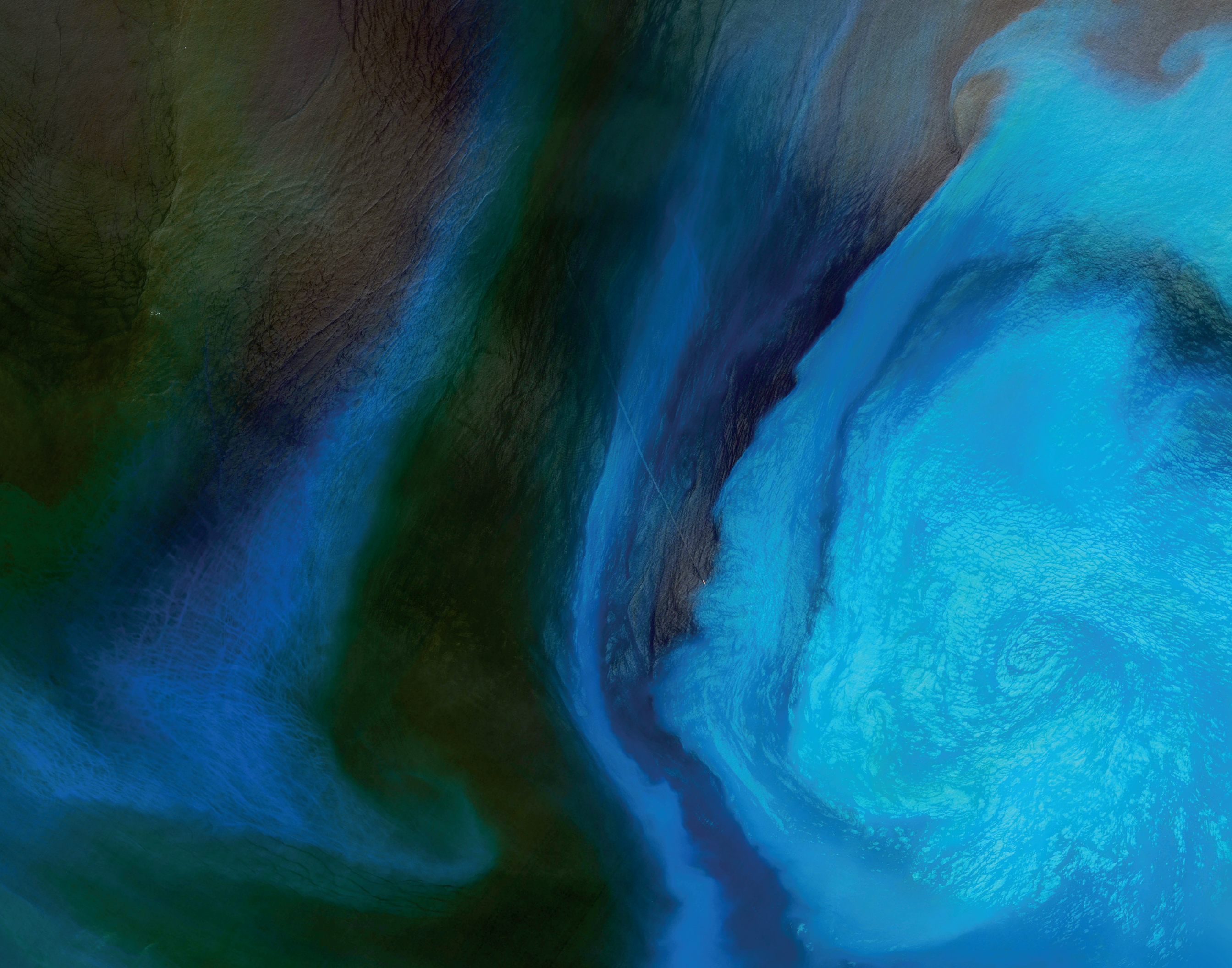
January 2024						
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March 2024						
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17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2	3
					Last Quarter	
4	5	6	7	8	9	10
					New Moon	
11	12	13	14	15	16	17
					First Quarter	
18	19	20	21	22	23	24
						Full Moon
25	26	27	28	29		

Washington's Birthday
(observed date)

Valentine's Day





March 2024



Bloomin' Atlantic. Vibrant swirls of green and turquoise appeared in the North Atlantic for several weeks in April 2023. Some of the color is due to an abundance of *phytoplankton*, floating plant-like organisms. Although they are microscopic, large groups of phytoplankton are visible from space, as revealed in this image captured by the NASA–U.S. Geological Survey (USGS) Landsat 9 Operational Land Imager-2 (OLI-2) instrument. Phytoplankton are responsible for nearly half of Earth’s primary production of organic matter—food for the rest of the marine ecosystem. They turn carbon dioxide, sunlight, and nutrients into the food that feeds almost all other life in the sea, from zooplankton to

finfish to whales. NASA’s Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission, scheduled to launch in 2024, will advance the assessment of ocean health by measuring the distribution of phytoplankton that sustain the marine food web. **Image and text credit:** NASA Earth Observatory image by Lauren Dauphin, using Landsat data from USGS

<https://go.nasa.gov/3OArDzp>

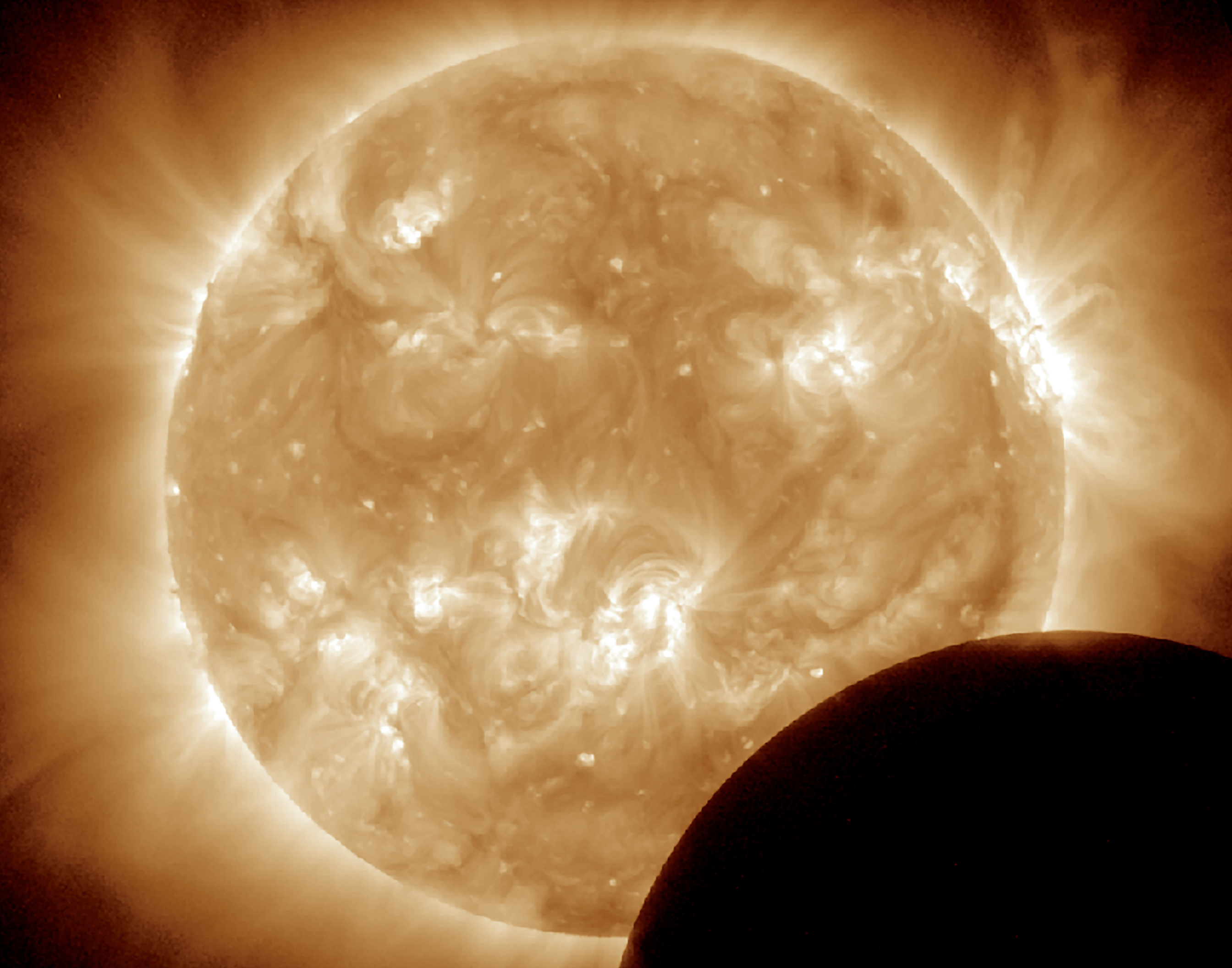


Dr. Jackson Tan is a scientist with the University of Maryland, Baltimore County, working at NASA’s Goddard Space Flight Center. His research focuses on the development of the gridded global precipitation product from the Global Precipitation Measurement (GPM) mission, using observations from the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument to classify cloud regimes, and the relationship between clouds and precipitation. Tan received the 2022 NASA Early Career Achievement Medal for outstanding achievement in precipitation science by unveiling the rainfall properties of cloud regimes and providing multi-satellite algorithm innovations. Photo credit: Jackson Tan

February 2024						
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18	19	20	21	22	23	24
25	26	27	28	29		

April 2024						
S	M	T	W	T	F	S
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7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4	5	6	7	8	9
 Last Quarter	10	11	12	13	14	15
 New Moon						
Daylight Saving Time Begins						
17	18	19	20	21	22	23
 First Quarter						
24	25	26	27	28	29	30
31	 Full Moon					





April 2024







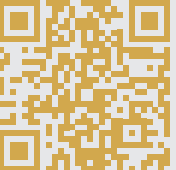
SUVI Captures a Partial Solar Eclipse. The National Oceanic and Atmospheric Administration's (NOAA) Geostationary Operational Environmental Satellite-16 (GOES-16, or GOES East) Solar Ultraviolet Imager (SUVI) instrument captured the Moon passing across the disk of the Sun during a partial solar eclipse on April 30, 2022. SUVI observes the Sun with six extreme ultraviolet channels to estimate coronal plasma temperatures and measure solar emissions. SUVI characterizes complex active regions of the Sun, solar flares, and the eruptions of solar filaments that may give

rise to coronal mass ejections. SUVI data help NOAA's Space Weather Prediction Center provide early warning of possible space weather impacts to electric power companies, telecommunications providers, and satellite operators. **Image and text credit:** NOAA

<https://www.nesdis.noaa.gov/news/the-top-satellite-images-2022>

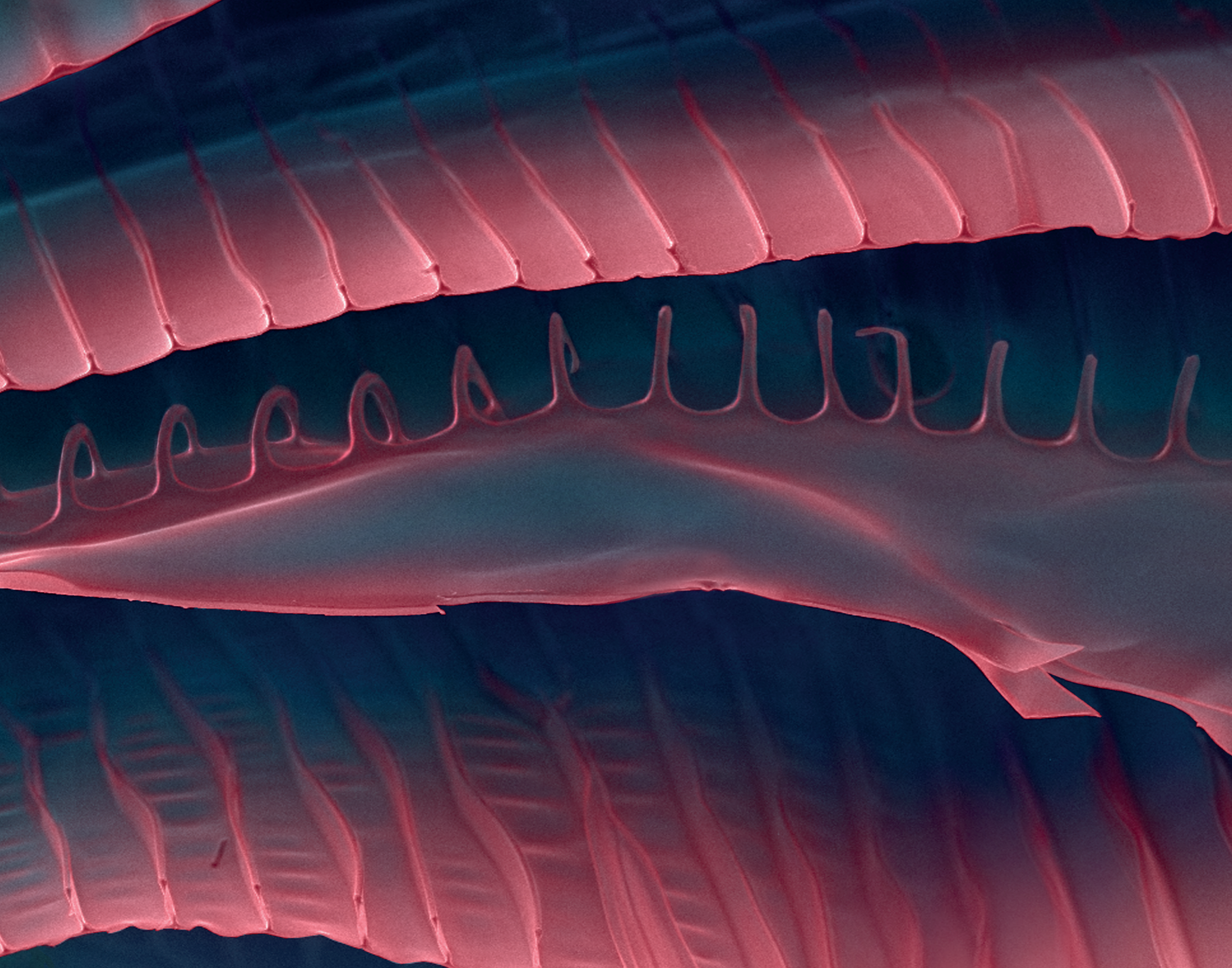


Rear Admiral Evelyn Fields is the first woman and first African American to lead the NOAA Commissioned Officer Corps, which is one of the nation's eight uniformed services. Fields began her career at NOAA as a cartographer in 1972, only two years after the agency formed. Less than a year later, the NOAA Corps began accepting women into its commissioned officer ranks, and she became the first African American woman to join. Fields became a rear admiral and director of both NOAA Corps and the Office of Marine and Aviation Operations in 1999. She is the first woman to become a NOAA Corps rear admiral. Fields retired in late 2003. Photo credit: NOAA/Military Officer Association of America

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2  Last Quarter	3	4	5	6
7	8  New Moon	9	10	11	12	13
14	15  First Quarter	16	17	18	19	20
21	22	23  Full Moon	24	25	26	27
28	29	30	<p>Did you know that April is Citizen Science Month? NASA's citizen science projects are collaborations between scientists and interested members of the public. Through these collaborations, volunteers (known as citizen scientists) have helped make thousands of important scientific discoveries. Want to work on real NASA science? NASA citizen science projects are open to everyone around the world, not limited to U.S. citizens or residents. Many projects can be done by anyone, anywhere, with just a cellphone or laptop. Visit https://science.nasa.gov/citizenscience or scan the QR code to get started.</p> 			

March 2024						
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24	25	26	27	28	29	30
31						

May 2024						
S	M	T	W	T	F	S
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12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	





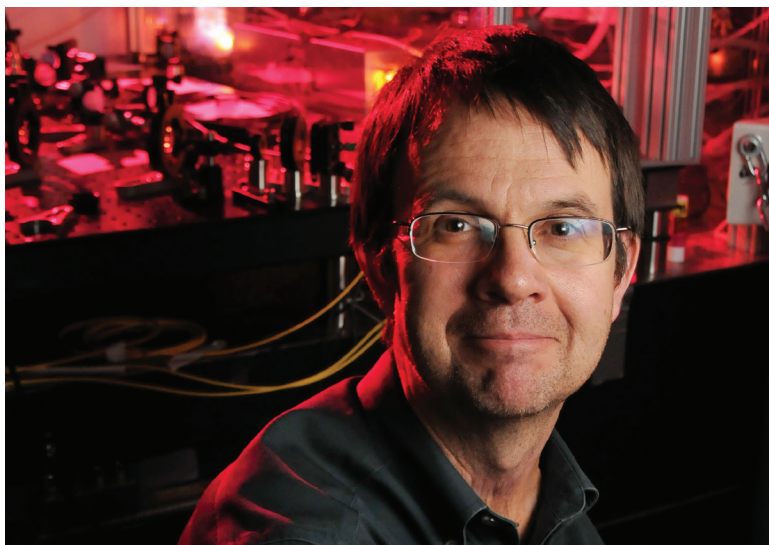
May 2024




Freeze-Cast Biopolymer Scaffolds. Biopolymer scaffolds play an important role when injuries need to be repaired. When a peripheral nerve has been severed, for example, tubular implants with a honeycomb-shaped porosity can be used to bridge the gap. These scaffolds provide cells with structural support and guide their directional growth to help nerve ends reconnect. This magnified image is looking down into such a scaffold made from a process called freeze casting, in which the cell wall surfaces are decorated with features including regularly spaced ridges and tentacle-like loops. During freeze casting, the biopolymer solution becomes increasingly concentrated and viscous between the growing ice crystals, and finally turns into a polymer glass. When the entire

sample is frozen, the ice crystals are removed by sublimation in a process called freeze drying, and the final architecture shown in this image is revealed. Exactly how the regularly spaced ridges, tentacle-like loops, and wrinkled cell walls form remained a mystery until a combined experimental effort revealed the underlying mechanisms. Funded by NASA, this ground-based research was performed in preparation of experiments to be performed aboard the International Space Station (ISS). **Image and text credit:** Kaiyang Yin, Louise Littles, Ulrike G. K. Wegst, and Andy Troy

<https://www.pnas.org/doi/10.1073/pnas.2210242120>



Dr. Eric Cornell is a co-principal investigator on NASA's Cold Atom Lab and a fellow at JILA, a joint institute between the National Institute of Standards and Technology (NIST) and the University of Colorado Boulder. His research focuses on ultracold atoms and on precision metrology (the scientific study of measurement) in the service of fundamental physics. Along with Dr. Carl Wieman and Dr. Wolfgang Ketterle, he was awarded the 2001 Nobel Prize for the first experimental realization of a Bose-Einstein condensate—a fifth state of matter first predicted in 1917. Today, the techniques that Cornell helped develop for cooling atoms to ultracold temperatures are used in laboratories around the world and on the International Space Station by the Cold Atom Lab. Photo credit: University of Colorado Boulder

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1  Last Quarter	2	3	4
5	6	7	8  New Moon	9	10	11
12 Mother's Day	13	14	15  First Quarter	16	17	18
19	20	21	22	23  Full Moon	24	25
26	27 Memorial Day	28	29  Last Quarter	30	31	

April 2024						
S	M	T	W	T	F	S
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June 2024						
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23	24	25	26	27	28	29
30						





June 2024



Malapert Massif. NASA's Lunar Reconnaissance Orbiter (LRO) captured this view of the Moon's surface on March 3, 2023, when the spacecraft was about 105 miles (170 kilometers) beyond Shackleton Crater, an impact crater that lies at the lunar South Pole. The low Sun angle near the pole makes for a dramatic scene of light and shadow. At lower left (foreground) is Malapert Massif, a lunar mountain thought to be a remnant of the South Pole–Aitken basin rim, which formed more than 4 billion years ago. More recently, this area was selected by NASA as a candidate Artemis III landing region. The candidate landing region is partially visible in the image, appearing

as a relatively flat area, extending away from the summit (lower left) toward the top of the frame. The mountain's highest point rises more than 16,400 feet (5,000 meters) above its base. In the distance (upper right portion of the image) is a sunlit cliff rising 11,480 feet (3,500 meters) from the lunar surface. **Image and text credit:** NASA/Goddard Space Flight Center and Arizona State University

<https://www.lroc.asu.edu/posts/1294>



Dr. Adam P. Showman (1968–2020), an expert on the dynamics of hot gas giant atmospheres, was a professor in the University of Arizona's Lunar and Planetary Lab (LPL), where he developed eight different courses in planetary science and served as an advisor and mentor to many students. Showman's early research on the atmospheric dynamics of exoplanets remains the standard for atmospheric circulation models of hot gas giants. His later research focused on exploring the atmospheric structure and dynamics of brown dwarfs. Additionally, he collaborated with others to interpret their observations of exoplanet atmospheres and to advance modeling techniques. Raised in Cupertino, California, Showman earned his undergraduate degree from Stanford University and a Ph.D. from the California Institute of Technology. Prior to joining LPL, he worked at the University of Louisville and NASA's Ames Research Center. Showman was named a Galileo Circle Fellow by the University of Arizona and a Fellow of the American Geophysical Union. Photo credit: Lunar and Planetary Laboratory/University of Arizona

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1
2	3	4	5	6 New Moon	7	8
9	10	11	12	13	14 First Quarter Flag Day	15
16	17	18	19	20	21	22 Full Moon
Father's Day			Juneteenth National Independence Day			
23	24	25	26	27	28	29
30					31 Last Quarter	

May 2024						
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July 2024						
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21	22	23	24	25	26	27
28	29	30	31			



2024 YEAR AT A GLANCE

January

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14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

February

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24						29

March

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31						

April

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28	29	30				

May

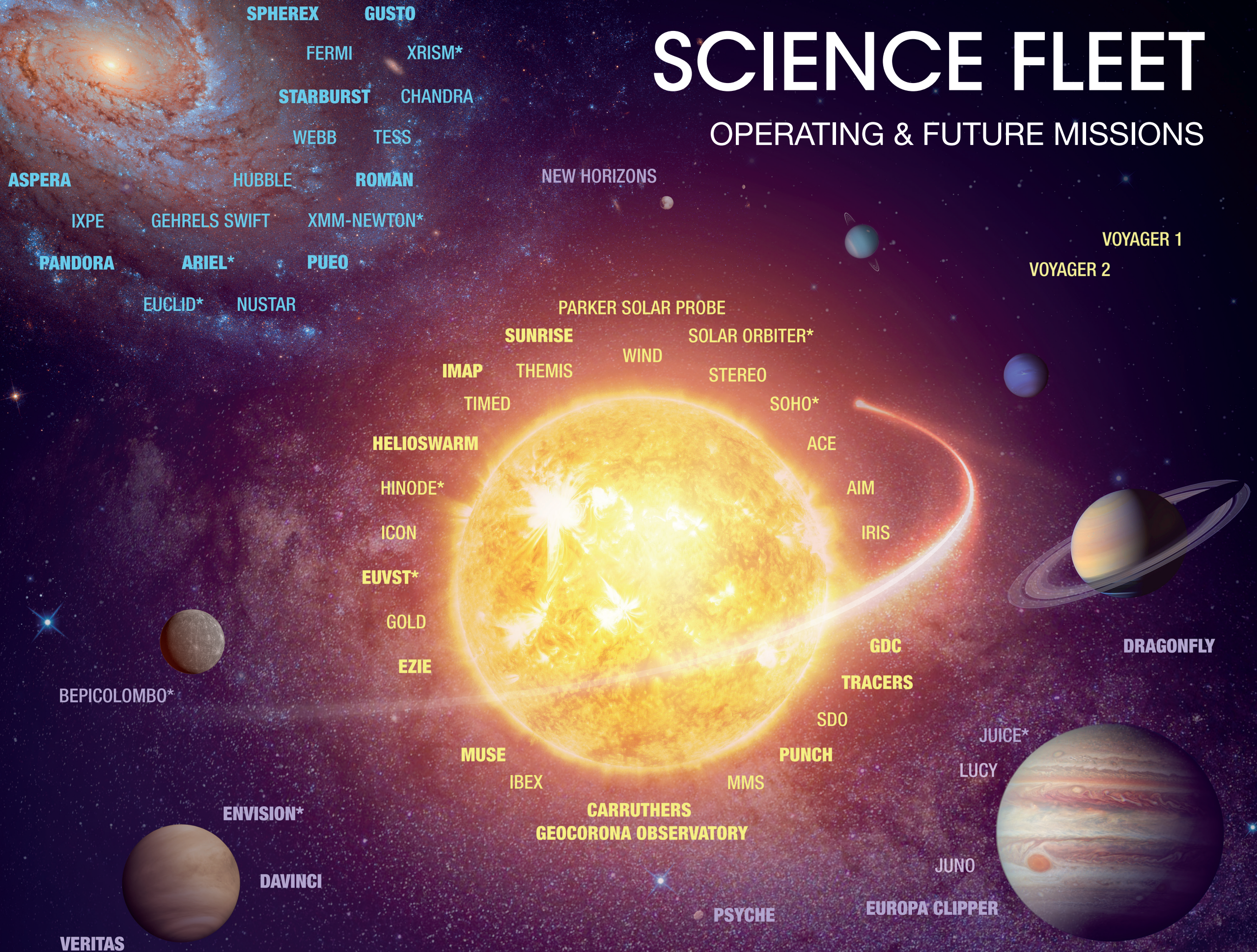
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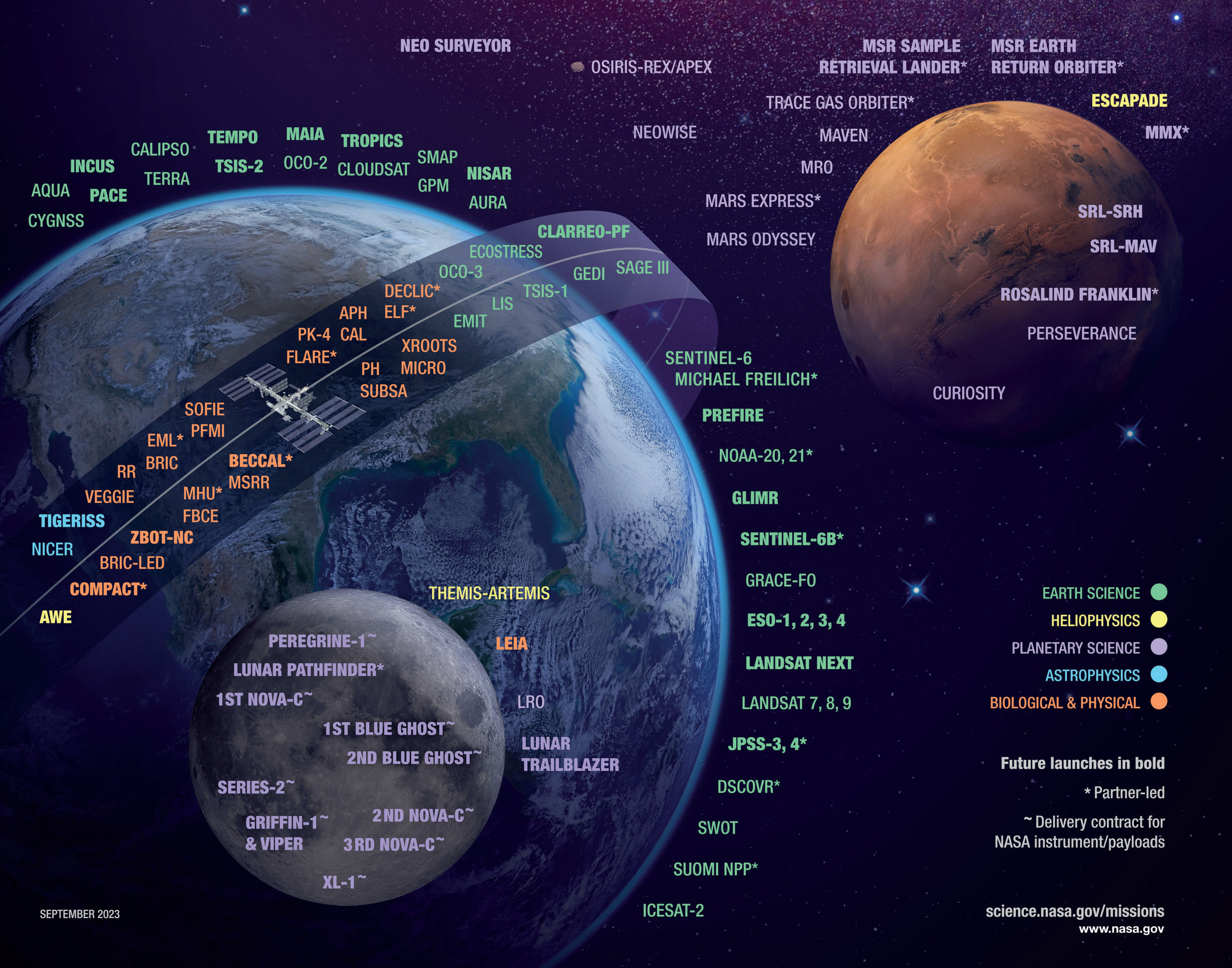
June

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23	24	25	26	27	28	29
30						

SCIENCE FLEET

OPERATING & FUTURE MISSIONS





NEO SURVEYOR

OSIRIS-REX/APEX

MSR SAMPLE RETRIEVAL LANDER*

MSR EARTH RETURN ORBITER*

TRACE GAS ORBITER*

ESCAPADE

NEOWISE

MAVEN

MMX*

TEMPO

MAIA

TROPICS

SMAP

NISAR

INCUS

CALIPSO

TSIS-2

OCO-2

CLOUDSAT

GPM

AURA

PACE

TERRA

AQUA

CYGNSS

MRO

MARS EXPRESS*

MARS ODYSSEY

SRL-SRH

SRL-MAV

CLARREO-PF

ECOSTRESS

GEDI SAGE III

OCO-3

TSIS-1

DECLIC*

LIS

EMIT

APH

ELF*

PK-4 CAL

XROOTS

PH

MICRO

SUBSA

SENTINEL-6

MICHAEL FREILICH*

ROSALIND FRANKLIN*

PERSEVERANCE

CURIOSITY

PREFIRE

NOAA-20, 21*

GLIMR

SENTINEL-6B*

GRACE-FO

ESO-1, 2, 3, 4

LANDSAT NEXT

LANDSAT 7, 8, 9

JPSS-3, 4*

DSCOVR*

SWOT

SUOMI NPP*

ICESAT-2

EARTH SCIENCE ●

HELIOPHYSICS ●

PLANETARY SCIENCE ●

ASTROPHYSICS ●

BIOLOGICAL & PHYSICAL ●

Future launches in bold

* Partner-led

~ Delivery contract for NASA instrument/payloads

PEREGRINE-1~

LUNAR PATHFINDER*

1ST NOVA-C~

1ST BLUE GHOST~

2ND BLUE GHOST~

SERIES-2~

**GRIFFIN-1~
& VIPER**

2ND NOVA-C~

3RD NOVA-C~

XL-1~

THEMIS-ARTEMIS

LEIA

LRO

**LUNAR
TRAILBLAZER**

October						
S	M	T	W	T	F	S
27	28	29	30	31		
20	21	22	23	24	25	26
13	14	15	16	17	18	19
6	7	8	9	10	11	12
		1	2	3	4	5

November						
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24	25	26	27	28	29	30
17	18	19	20	21	22	23
10	11	12	13	14	15	16
3	4	5	6	7	8	9
				1	2	

December						
S	M	T	W	T	F	S
29	30	31				
22	23	24	25	26	27	28
15	16	17	18	19	20	21
8	9	10	11	12	13	14
1	2	3	4	5	6	7

July						
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28	29	30	31			
21	22	23	24	25	26	27
14	15	16	17	18	19	20
7	8	9	10	11	12	13
	1	2	3	4	5	6

August						
S	M	T	W	T	F	S
25	26	27	28	29	30	31
18	19	20	21	22	23	24
11	12	13	14	15	16	17
4	5	6	7	8	9	10
				1	2	3

September						
S	M	T	W	T	F	S
29	30					
22	23	24	25	26	27	28
15	16	17	18	19	20	21
8	9	10	11	12	13	14
1	2	3	4	5	6	7



July 2024



M16 (Eagle Nebula). This composite image from NASA's Chandra X-ray Observatory and James Webb Space Telescope shows Messier 16—also known as the Eagle Nebula—a famous region of the sky often referred to as the "Pillars of Creation." Infrared data from Webb (red, green, blue) reveal the dark columns of gas and dust shrouding the few remaining fledgling stars just being formed, while X-rays from Chandra (red, blue) identify the positions of stars appearing as point-like sources. These data show that the hot outer atmospheres of these young stars in this region give

off copious amounts of X-rays. **Image and text credit:** Chandra: NASA/Chandra X-ray Center/ Smithsonian Astrophysical Observatory; JWST: NASA/European Space Agency (ESA), Canadian Space Agency (CSA), Space Telescope Science Institute (STScI)

<https://go.nasa.gov/45sTLKb>



Dame Jocelyn Bell Burnell is a British astrophysicist who discovered the first radio pulsars in 1967. She is the Chancellor of the University of Dundee. She has served as the president of the Royal Astronomical Society and president of the Institute of Physics (UK). She is a recipient of several professional honors, including the Special Breakthrough Prize in Fundamental Physics. She was the second female recipient of the Copley Medal. She was appointed Dame Commander of the Order of the British Empire for her services to astronomy. Photo credit: Courtesy of Jocelyn Bell Burnell

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4 Independence Day	5 New Moon	6
7	8	9	10	11	12	13 First Quarter
14	15	16	17	18	19	20
21 Full Moon	22	23	24	25	26	27
28 Last Quarter	29	30	31			

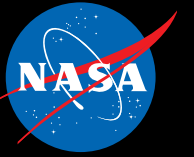
June 2024						
S	M	T	W	T	F	S
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9	10	11	12	13	14	15
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30						

August 2024						
S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31





August 2024



A Dazzling Aurora Borealis. In February 2023, NASA astronaut Josh Cassada captured this incredible photo of the aurora borealis from his perspective on the International Space Station, showing how expansive the aurora can be. When the solar wind—the constant stream of material flowing off the Sun—reaches Earth, it sends charged particles down Earth’s magnetic field lines,

where they interact with gases in our atmosphere, creating this dazzling display of lights. **Image and text credit:** NASA astronaut Josh Cassada

<https://go.nasa.gov/3QC6nuf>



Dr. Bea Gallardo-Lacourt first joined NASA as a NASA Postdoctoral Program fellow affiliated with the Universities Space Research Association (USRA). She is a member of the Heliophysics Division working in the Ionospheric-Thermospheric-Mesospheric (ITM) Laboratory. Her research focuses on magnetosphere-ionosphere coupling with an emphasis on ground-based instruments, as well as the dynamics of auroral and subauroral structures. In 2018, she was part of the team receiving a NASA Group Achievement Award for work on the subauroral phenomenon known as STEVE, which stands for Strong Thermal Emission Velocity Enhancement. Photo credit: Marina Stepanova, courtesy of Bea Gallardo-Lacourt

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2	3
4	5	6	7	8	9	10
 New Moon						
11	12	13	14	15	16	17
	 First Quarter					
18	19	20	21	22	23	24
	 Full Moon					
25	26	27	28	29	30	31
		 Last Quarter				

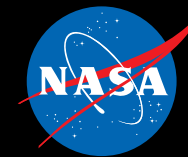
July 2024						
S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

September 2024						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					





September 2024



Webb's Jupiter Images Showcase Auroras and Hazes. In this view of Jupiter, which is a composite of several images from NASA's James Webb Space Telescope, auroras extend to high altitudes above both the northern and southern poles of Jupiter. The Great Red Spot, a famous storm so big it would cover Earth, appears white in these views, as do other clouds, because they are reflecting a considerable amount of sunlight. Webb's Jupiter observations complement

data from Juno and other missions and will reveal even more clues about Jupiter's inner functions. **Image and text credit:** NASA, European Space Agency (ESA), Canadian Space Agency (CSA), Jupiter Early Release Science Team; image processing by Judy Schmidt

<https://go.nasa.gov/3OWXZEB>



On September 26, 2022, the **Double Asteroid Redirection Test (DART)** team achieved what NASA Administrator Bill Nelson has called "a watershed moment in planetary defense" when it purposefully crashed a spacecraft into an asteroid, significantly changing the orbit of that celestial body with kinetic impact. Accolades for the DART team of NASA and the Johns Hopkins University Applied Physics Laboratory (APL) include the American Institute of Aeronautics and Astronautics Award for Aerospace Excellence, the National Space Club and Foundation's Nelson P. Jackson Aerospace Award, and the Space Foundation's 2023 Space Achievement Award. DART was cited by *Fast Company* as one of the NASA innovations that led the magazine to rank the Agency first in the science category for the World's 50 Most Innovative Companies for 2023. In addition, DART Mission Project Manager Ed Reynolds of APL was selected by *Time* magazine as one of its 100 Most Influential People for 2023. Photo credit: NASA/Johns Hopkins University APL/Ed Whitman

August 2024						
S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

October 2024						
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2 Labor Day	3 New Moon	4	5	6	7
8	9	10	11 First Quarter	12	13	14
15	16	17 Constitution Day	18 Full Moon	19	20	21
22	23	24 Last Quarter	25	26	27	28
29	30					





October 2024



The Wetlands of Adair Bay. The wetlands of Adair Bay (also known as Bahia Adair) mark the transition between the Great Altar Desert in northwestern Mexico and the Gulf of California. A single highway, paralleled by a railroad, cuts across dry salt flats and sand on the northern reaches of the estuary. This photo—taken August 1, 2022, with a Nikon D5 digital camera by an astronaut on the International Space Station—highlights the sediment-rich waterways that allow mixing of fresh and salt water vital to the function of the estuary. The green areas in the estuary system are salt-tolerant halophytic vegetation, composed mostly of mangrove trees and shrubs. Salty mudflats, indicated by the blend of gray and white hues, separate the estuary from the adjacent desert sand.

Coastal salt marshes like the wetlands of Adair Bay are sustained by tides. During low tides, water evaporates from exposed soils, creating salt flats; during high tides, nutrients are washed into the estuary, supporting halophytic vegetation growth and the life cycle of aquatic organisms. The wetlands provide protected nesting grounds for migratory birds and breeding grounds for endangered fish. **Image and text credit:** NASA/Expedition 67 crew; original caption by Sara Schmidt, GeoControl Systems, JETS Contract at NASA/Johnson Space Center

<https://go.nasa.gov/3rKyvkx>

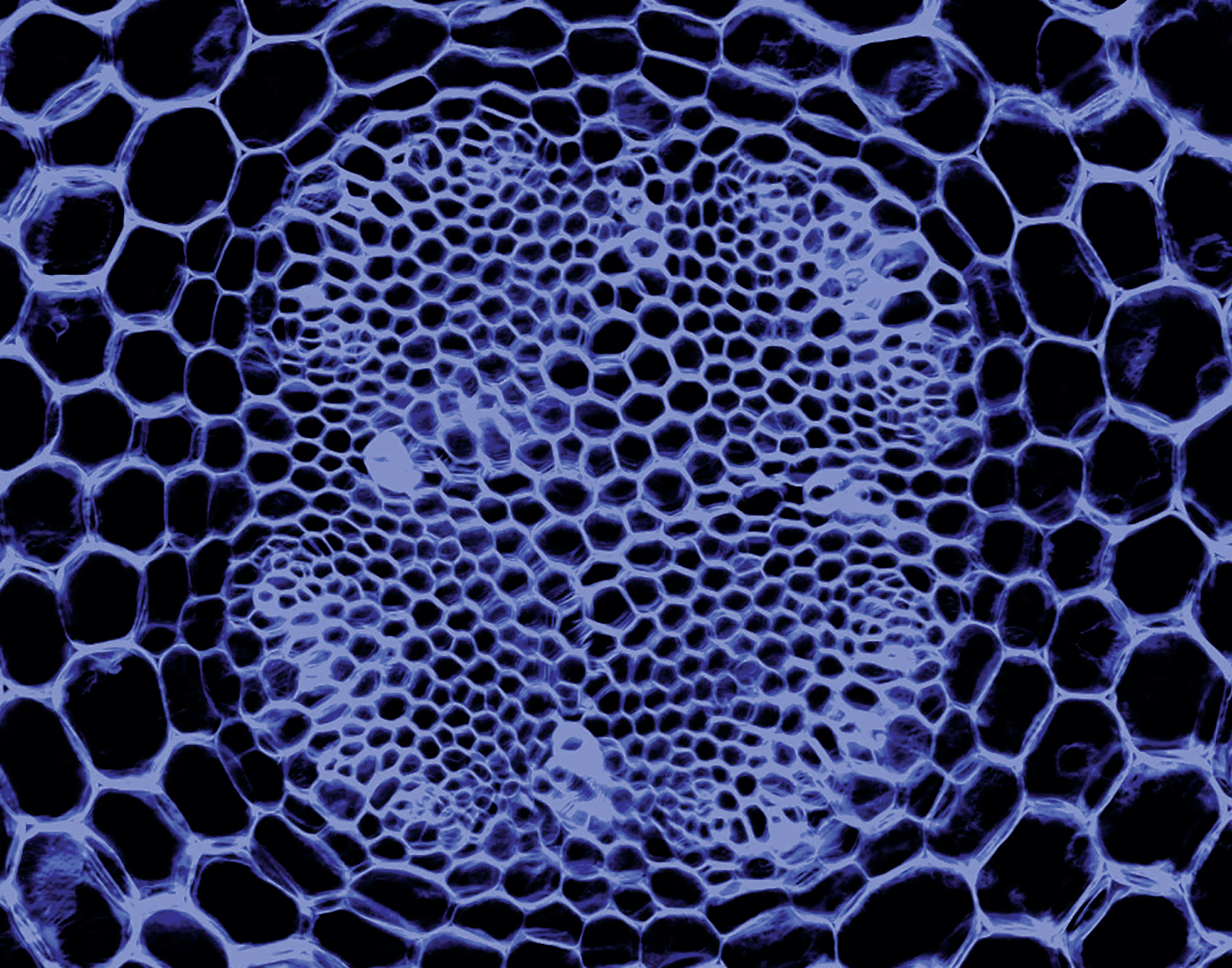


Dr. Christian Braneon is a climate scientist and civil engineer whose research focuses on climate impacts on communities. He advises city planners on using satellite and climate data to inform decision making and is a leader in integrating climate science with environmental justice. In 2021, he was a winner of the AXA Research Fund's Climate Science Award for his contributions to advancing climate equity and understanding climate change impacts on urban, agricultural, and natural environments. He was in the Climate Impacts Group at NASA's Goddard Institute for Space Studies until late 2022 and currently is the Head of Climate Justice at Carbon Direct. Photo credit: NASA

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4	5
			New Moon			
6	7	8	9	10	11	12
				First Quarter		
13	14	15	16	17	18	19
	Columbus Day			Full Moon		
20	21	22	23	24	25	26
				Last Quarter		
27	28	29	30	31		
					Halloween	

September 2024						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

November 2024						
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30





November 2024



Medicago Truncatula. One of NASA's space biology objectives is to understand how the spaceflight environment affects how plants grow and thrive. This photo presents a root cross-section of the model plant *Medicago truncatula* taken as part of a NASA Kennedy Space Center-managed research project. Model plants are utilized by researchers because of their wide applicability in investigating basic biological processes and relevance to agricultural industries. Plant cells are enclosed within a carbohydrate-rich wall that structurally supports the body of the plant as it grows while also playing essential roles in defense, water transport, and responses to environmental stresses. The cell wall provides the raw materials for many useful plant-based products, such as paper, textiles, and wood. The round shapes in this image are individual cells

from a thinly cut section of a plant root. The root section was stained with a chemical that binds to a component of the cell wall called cellulose and imaged with a confocal microscope. The chemical used to stain the root produces blue light (false-colored in purple) when exposed to the ultraviolet (UV) laser line of the confocal microscope. Methods to label and observe plant cell walls show that their development, composition, and structural integrity are modified by microgravity, which could have implications for growing plants in space. **Image and text credit:** NASA Kennedy Space Center

<https://go.nasa.gov/3K44Aca>

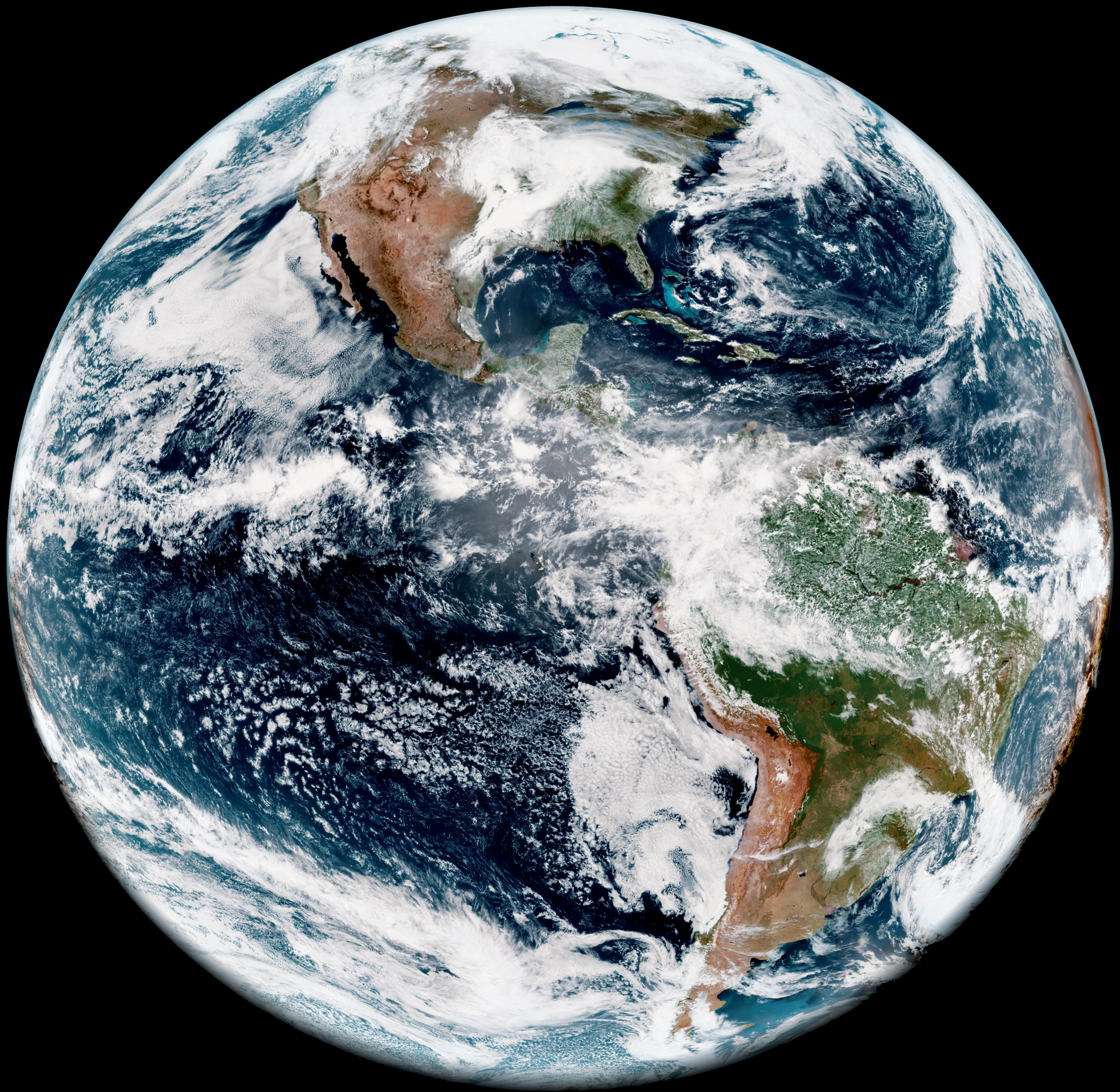


Growing Plants in Lunar Regolith. Future space missions may use the Moon as a hub for growing plants. Could the soil already on the Moon be used to grow plants for food and oxygen? To answer that question, Dr. Anna-Lisa Paul (*left*) and Dr. Rob Ferl (*right*) used 12 grams (a few teaspoons) of lunar regolith collected between 1969 and 1972 during the Apollo 11, 12, and 17 missions to successfully grow *Arabidopsis* plants. The next steps are for researchers to investigate how growing plants in lunar soil changes the soil itself, possibly conditioning it to be a better environment for plant growth. Photo credit: University of Florida's Institute of Food and Agricultural Sciences (UF/IFAS)

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1 New Moon	2
3 Daylight Saving Time Ends	4	5 Election Day	6	7	8	9 First Quarter
10	11 Veterans Day	12	13	14	15 Full Moon	16
17	18	19	20	21	22	23 Last Quarter
24	25	26	27	28 Thanksgiving Day	29	30

October 2024						
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

December 2024						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				





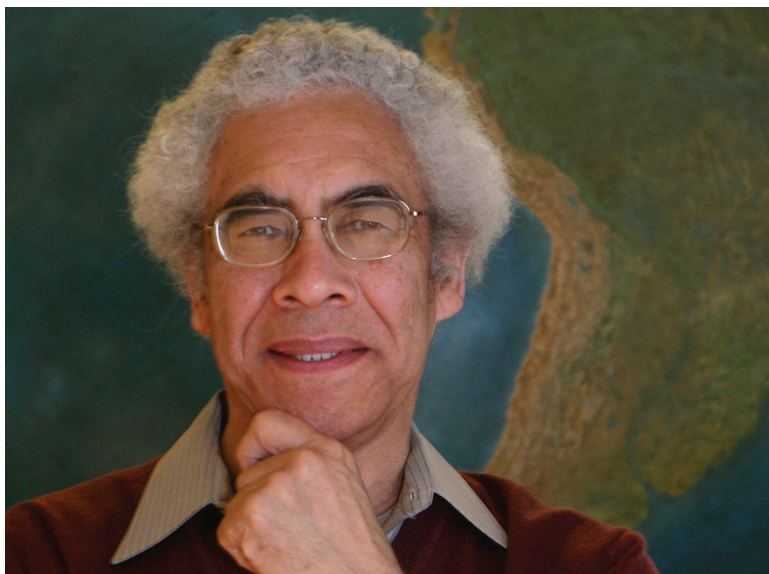
December 2024



50 Years After Blue Marble. On May 11, 2022, the National Oceanic and Atmospheric Administration (NOAA) shared this first image of the Western Hemisphere from the Geostationary Operational Environmental Satellite-18 (GOES-18, formerly GOES-T). GOES-18, NOAA's newest geostationary satellite, launched on March 1, 2022. Its primary instrument, the Advanced Baseline Imager (ABI), views Earth with 16 different channels, each measuring energy at different wavelengths along the electromagnetic spectrum to obtain information about Earth's atmosphere, land, and ocean. ABI data are used for a wide range of applications related to severe weather,

hurricanes, heavy rainfall and flooding, wildfires, smoke, dust, fog, volcanic eruptions, and other natural hazards. GOES-18 entered operational service as NOAA's GOES West on January 4, 2023, keeping watch over the western contiguous United States, Alaska, Hawaii, Mexico, Central America, and the Pacific Ocean as far south as New Zealand. **Image and text credit:** NASA/NOAA

<https://www.nesdis.noaa.gov/news/earth-orbit-noaa-debuts-first-imagery-goes-18>



Dr. George Philander is a climate scientist known for his work on ocean-atmosphere interactions that sustain the Southern Oscillation between El Niño and La Niña. He is the Knox Taylor Professor Emeritus of Geosciences at Princeton University, exploring ways to persuade everyone that all of us should be responsible stewards of planet Earth, not only because of fear of imminent disasters, but because we love this planet. Philander grew up in South Africa under the system of apartheid but was allowed to take classes at the University of Cape Town, where he received a bachelor of science in applied mathematics and physics. He earned his Ph.D. at Harvard University in 1970 and did postdoctoral work at the Massachusetts Institute of Technology. He joined the NOAA Geophysical Fluid Dynamics Laboratory in 1970 and moved to Princeton's Department of Geosciences in 1990. His work on paleoclimatology has helped develop models for the prediction of future impacts of global warming and global climate change. Photo credit: Courtesy of S. George Philander

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 New Moon	2	3	4	5	6	7
8 First Quarter	9	10	11	12	13	14
15 Full Moon	16	17	18	19	20	21
22 Last Quarter	23	24	25	26	27	28
29	30 New Moon	31	Christmas Day			

November 2024						
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

January 2025						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	





January 2025



NASA's Chandra and Webb Combine for Arresting Views (M74). Messier 74 is a spiral galaxy—like our Milky Way—that we see face-on from our vantage point on Earth. It is about 32 million light-years away. Messier 74 is nicknamed the Phantom Galaxy because it is relatively dim, making it harder to spot with small telescopes than other galaxies in Charles Messier's famous catalog from the 18th century. Data from Webb outline gas and dust in the infrared (green, yellow, red, magenta), while Chandra data spotlight high-energy activity from stars at X-ray wavelengths (purple). Hubble optical data (orange, cyan, blue) showcase additional stars and dust along the

dust lanes. **Image and text credit:** Chandra: NASA/Chandra X-Ray Center/Smithsonian Astrophysical Observatory; XMM: European Space Agency's XMM-Newton; JWST: NASA/European Space Agency (ESA), Canadian Space Agency (CSA), Space Telescope Science Institute (STScI); Spitzer: NASA/Jet Propulsion Laboratory/Caltech; Hubble: NASA/ESA/STScI, ESO; image processing by L. Frattare, J. Major, and K. Arcand

<https://go.nasa.gov/3OzQdyY>

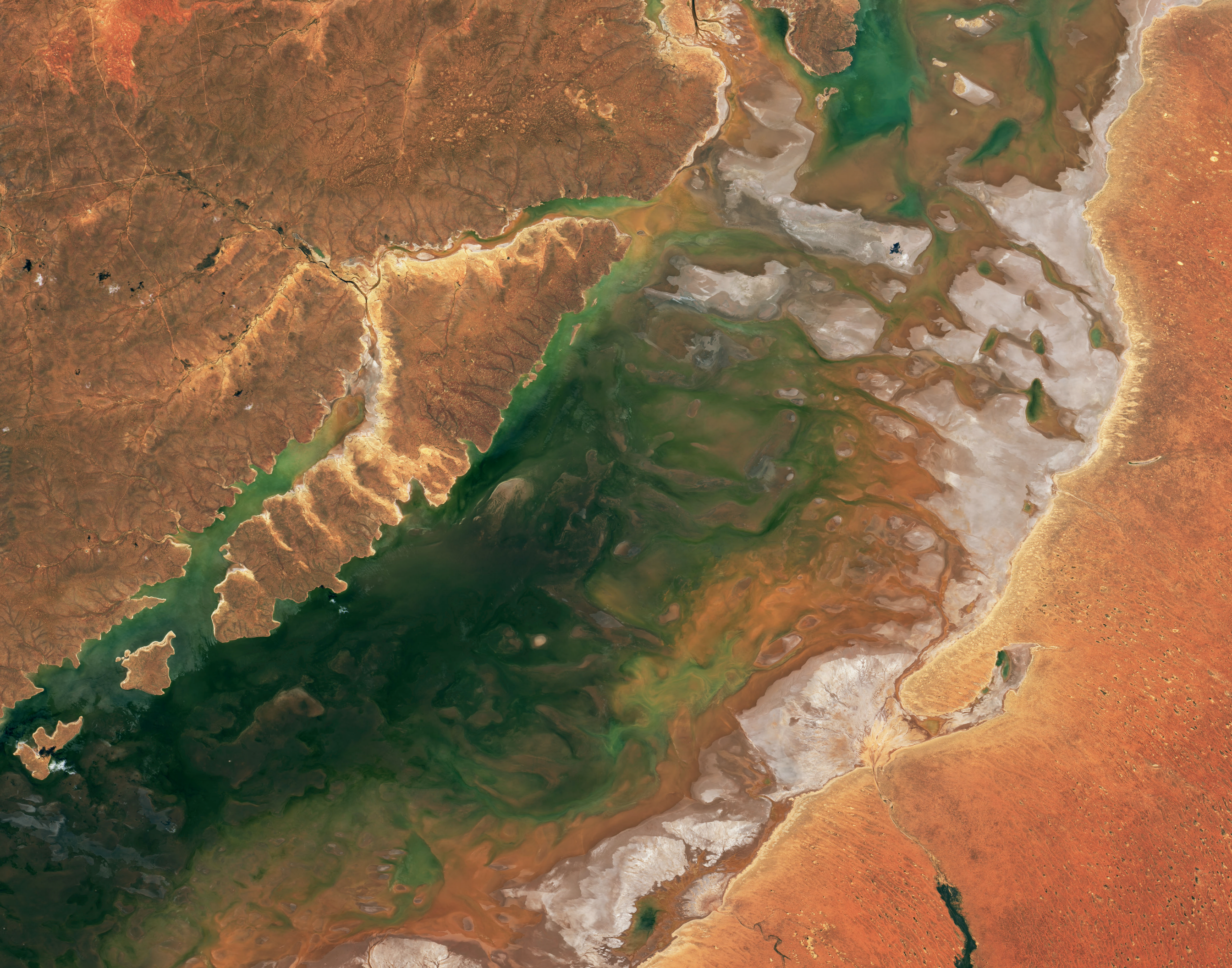


Dr. France A. Córdoba is an American astrophysicist and administrator who has made significant contributions to space research, instrumentation, and X-ray and gamma-ray astronomy, with over 150 scientific papers published. Córdoba has served in five presidential administrations and held national scientific leadership roles. She served as director of the National Science Foundation, was the first woman to be NASA chief scientist, and was the first and so far only woman to serve as president of Purdue University. She has advised a number of space missions and entities; she currently serves on the Jet Propulsion Laboratory Advisory Board. Córdoba presently serves as president of the Science Philanthropy Alliance, which promotes scientific discovery through visionary philanthropy. She has received numerous prestigious professional awards, including the NASA Distinguished Service Medal and the Women in Space Science Award from the Adler Planetarium, and she was a Kilby Laureate. She is a member of the National Academy of Sciences and the American Academy of Arts and Sciences. Córdoba earned her bachelor of arts from Stanford University and her Ph.D. in physics from the California Institute of Technology. Photo credit: NSF/Stephen Voss

December 2024						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

February 2025						
S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2	3	4
			New Year's Day			
5	6	7	8	9	10	11
						
12	13	14	15	16	17	18
						
19	20	21	22	23	24	25
	Birthday of Martin Luther King, Jr. (observed date) Inauguration Day					
						
26	27	28	29	30	31	
						





February 2025



Lake Torrens Is a Lake Again. On most days, South Australia's Lake Torrens shows up in satellite images as a relatively dry salt and mud flat. This region is generally very dry, and water's presence in the lake depends primarily on rainfall. In October 2022, a substantial amount of water returned to this ephemeral lake. This image of Lake Torrens, acquired on October 28, 2022, by the NASA-U.S. Geological Survey (USGS) Landsat 9's Operational Land Imager-2 (OLI-2), shows

water spanning much of the lakebed. Wet areas are green-brown, salty surfaces are white, and land is red-brown. **Image and text credit:** NASA Earth Observatory image by Lauren Dauphin, using Landsat data from USGS

<https://go.nasa.gov/3qhlYEK>



EXPORTS. The team behind NASA'S EXport Processes in the Ocean from RemoTe Sensing (EXPORTS) oceanographic field campaign received the 2022 Robert H. Goddard Award for continued efforts to understand the twilight zone, the dark area right below the ocean's surface. The 2021 deployment of the EXPORTS field campaign consisted of 150 scientists and crew from more than 30 governmental, university, and private non-governmental institutions. The photo depicts the deployment of the Wire Walker, an instrument that samples ocean parameters up and down the water column while drifting with the currents and generating its power from waves. Photo credit: Deborah Steinberg

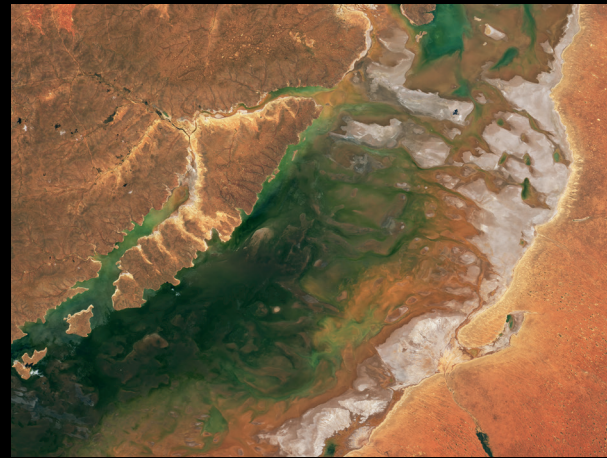
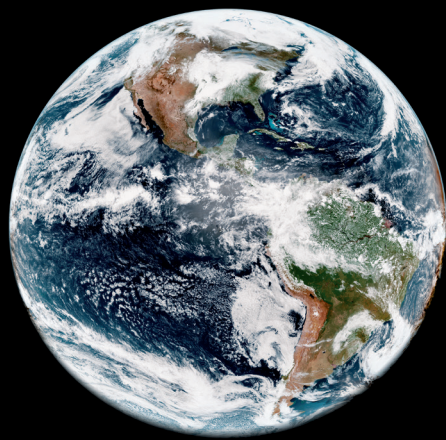
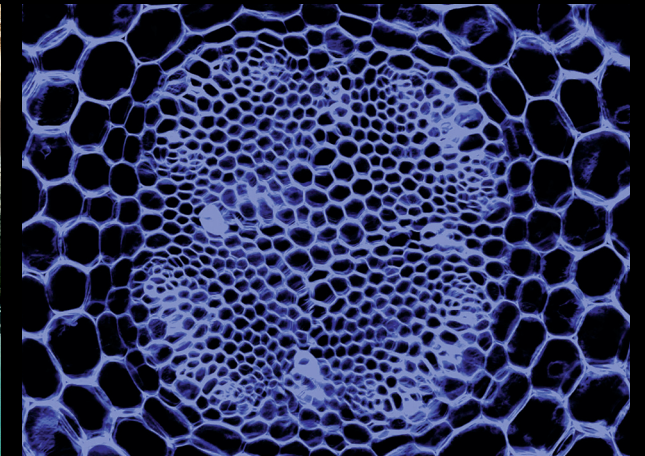
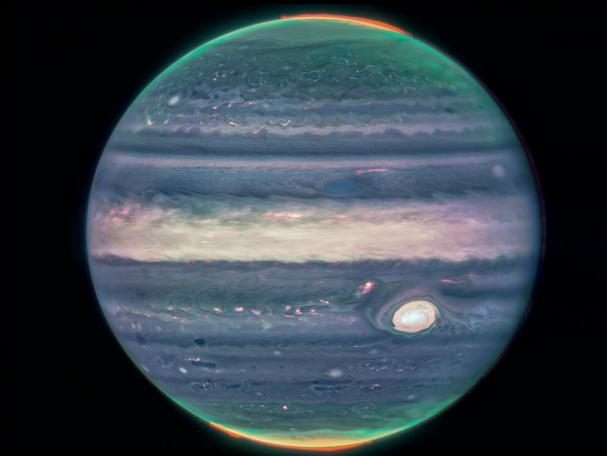
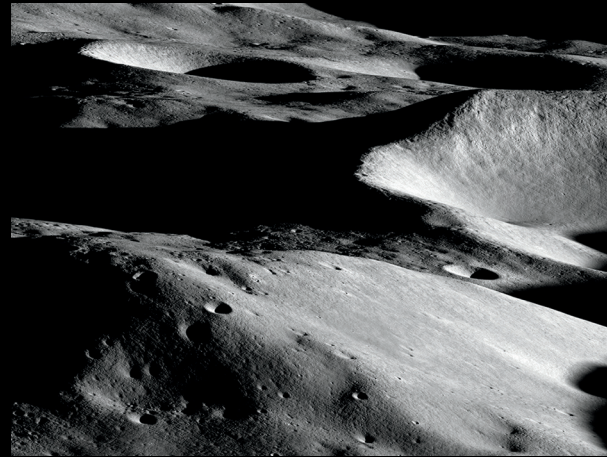
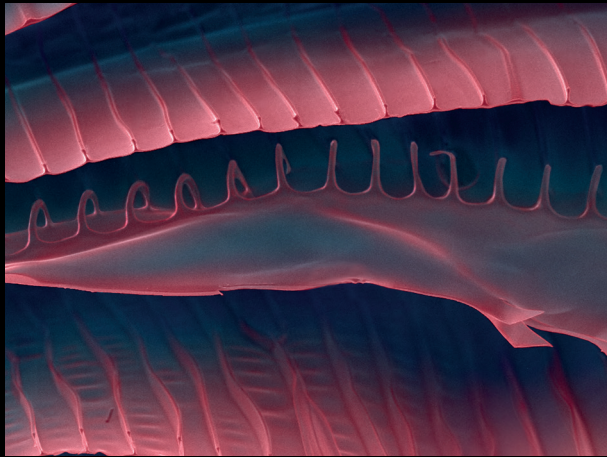
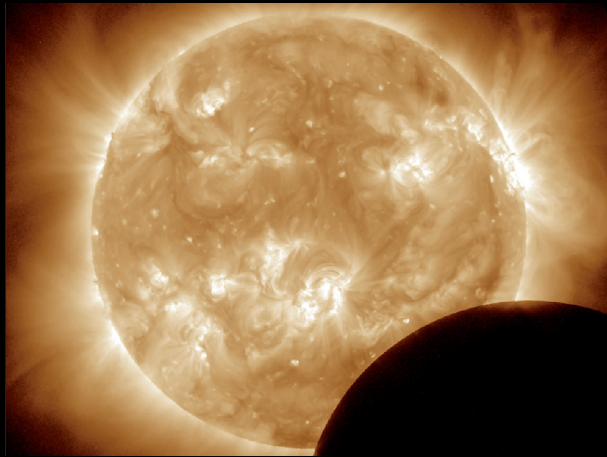
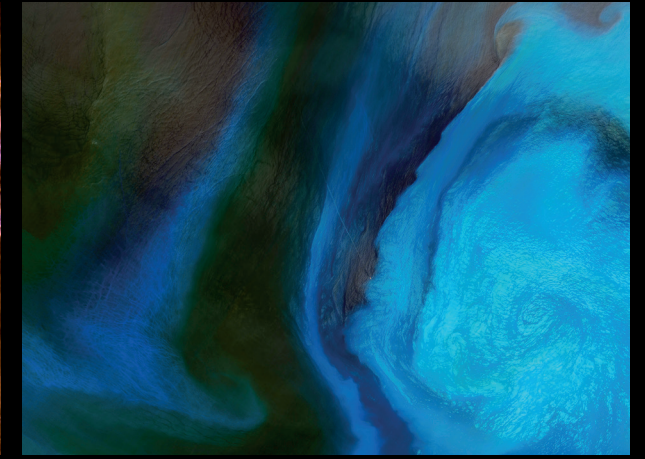
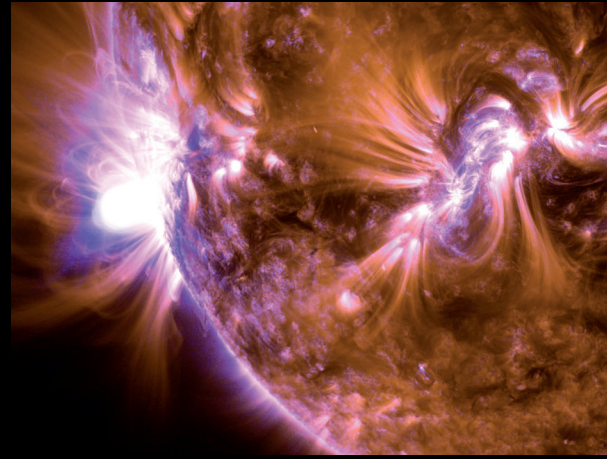
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1
2	3	4	5  First Quarter	6	7	8
9	10	11	12  Full Moon	13	14 Valentine's Day	15
16	17	18	19	20	21	22
				23	24 Washington's Birthday (observed date)	25
				26	27  Last Quarter	28
						29  New Moon
						30
						31

January 2025						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

March 2025						
S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					



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