National Aeronautics and
Space Administration

NASA'S CHANDRA X-RAY OBSERVATORY 2024

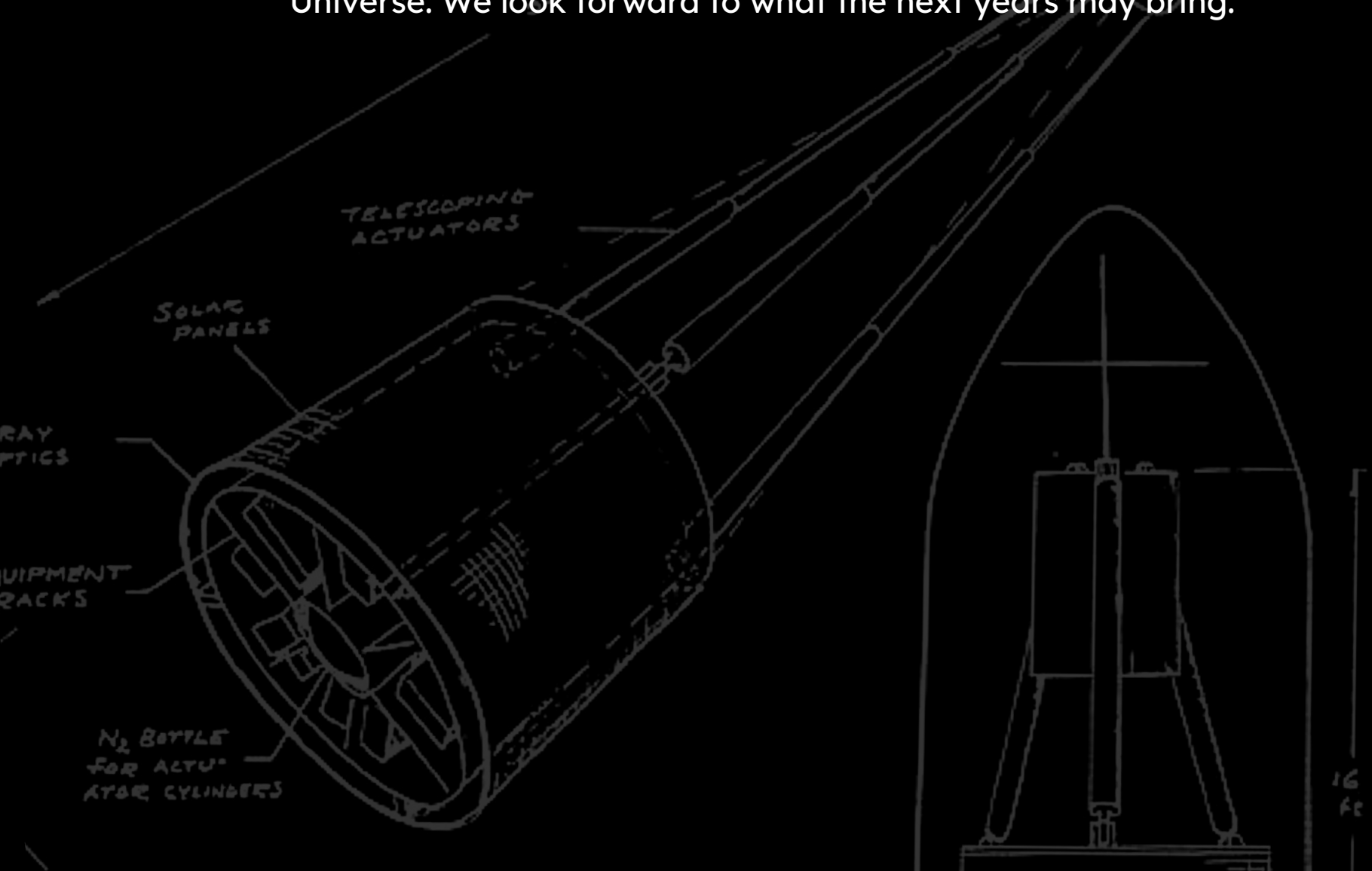
CHANDRA 25

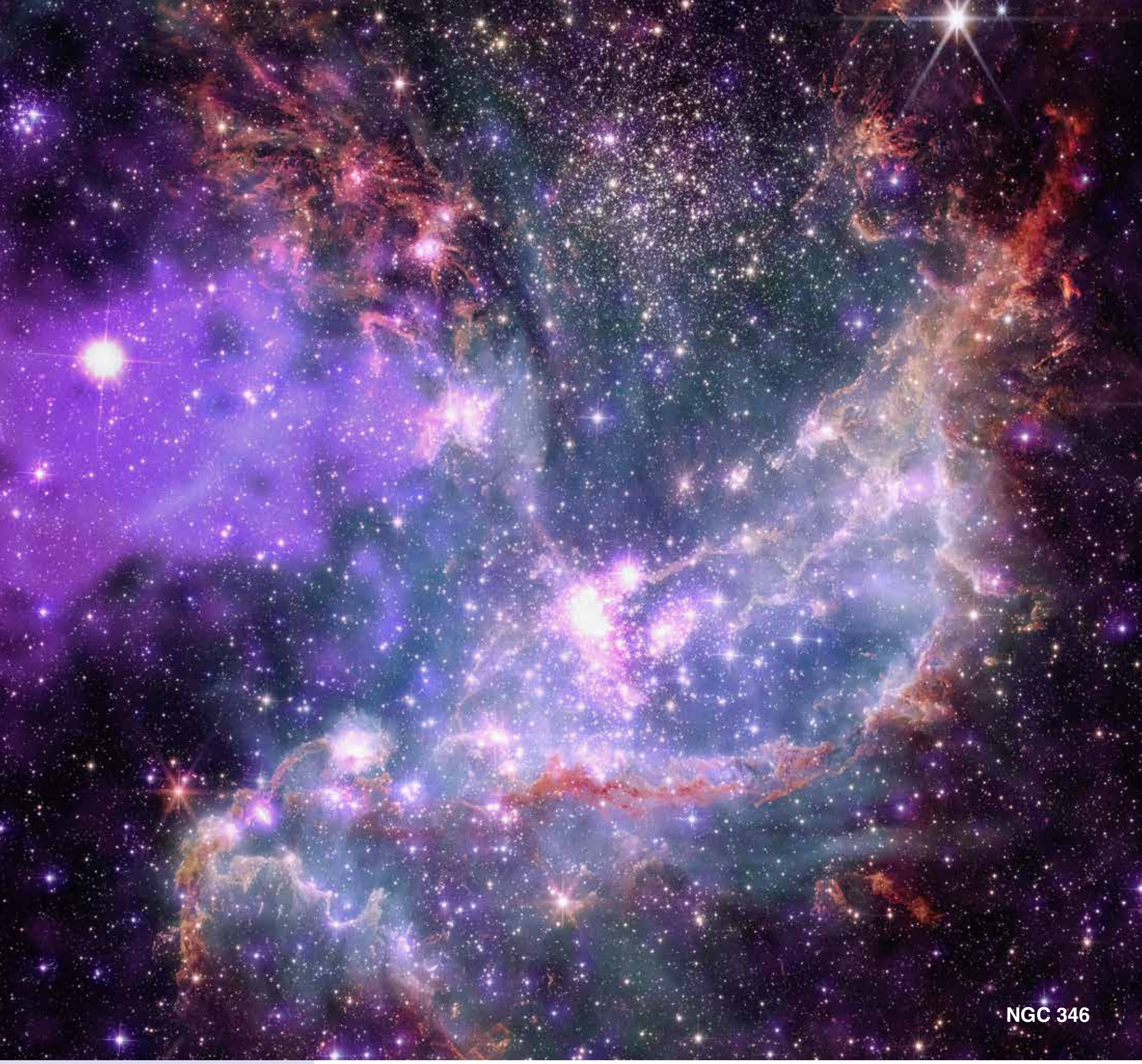
nasa.gov

IN THE PAST TWENTY-FIVE YEARS, CHANDRA HAS MADE PROFOUND DISCOVERIES AND CONTRIBUTED INVALUABLE INFORMATION ABOUT THE COSMOS AND THE WONDROUS OBJECTS WITHIN IT.

Since its launch on July 23, 1999, the Chandra X-ray Observatory has been NASA's flagship mission for X-ray astronomy, taking its place in the fleet of "Great Observatories." Chandra is part of a rich legacy of telescopes. Its X-ray lineage stretches back to the Space Age when scientists and engineers pioneered instruments that were sent above the Earth's atmosphere. This allowed astronomers to observe X-rays from cosmic objects for the first time.

Today, the quest to explore the Universe is both multiwavelength and multimessenger in nature, with many of the very significant and exciting discoveries requiring information from different types of light as well as gravitational waves and particle physics. In its 25 years of operation, Chandra and X-ray astronomy as a whole have played a pivotal role in uncovering and solving the mysteries of the Universe. We look forward to what the next years may bring.





JANUARY

NGC 346 is a star cluster in the Small Magellanic Cloud, about 200,000 light-years from Earth. NASA's James Webb Space Telescope shows plumes and arcs of gas and dust that stars and planets use as source material during their formation. The purple cloud on the left, seen with NASA's Chandra X-ray Observatory, is the remains of a supernova explosion from a massive star. Chandra data also reveals young massive stars. The image has data from NASA's Hubble Space Telescope and Spitzer Space Telescope, ESA's XMM-Newton, and ESO's New Technology Telescope.

Credit: X-ray: NASA/CXC/SAO; IR/Optical: NASA/ESA/CSA/STScI, NASA/ESA/STScI; IR/Optical/X-ray overlay: NASA/JPL/CalTech/Spitzer, ESO; ESA/XMM-Newton

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14	15 Birthday of Martin Luther King, Jr.	16	17	18	19	20
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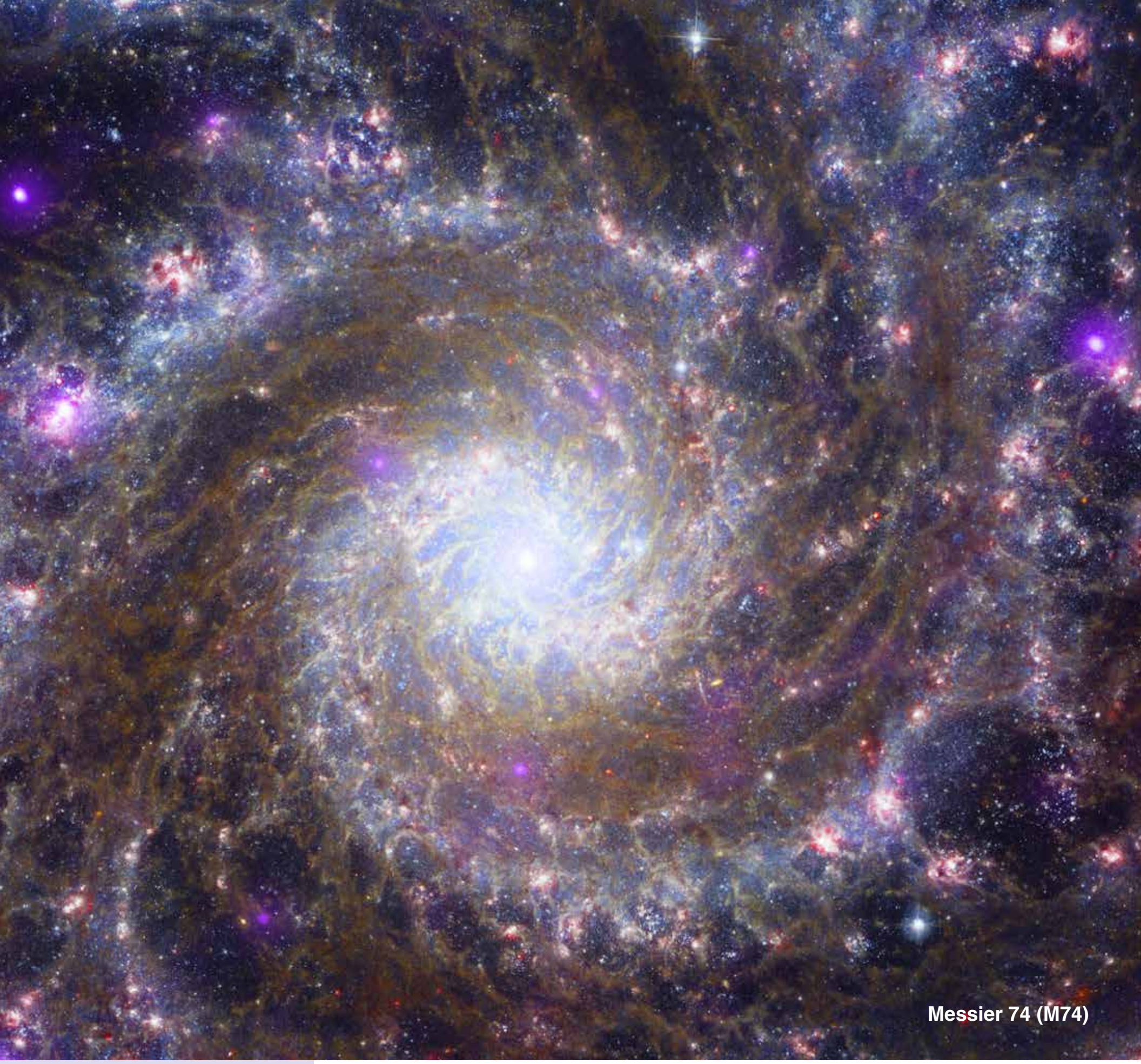

FEBRUARY

Messier 74 (M74) is a spiral galaxy — like our Milky Way — that we see face-on from our vantage point on Earth about 32 million light-years away. M74 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. Chandra data (purple) spotlights high-energy activity from stars at X-ray wavelengths while Webb outlines gas and dust in the infrared. Hubble optical data showcases additional stars and dust along the dust lanes.

Credit: X-ray: NASA/CXC/SAO; Optical: NASA/ESA/STScI; IR NASA/ESA/CSA/ STScI, J. Lee and the PHANGS-JWST Team

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18	19 Presidents' Day	20	21	22	23	24
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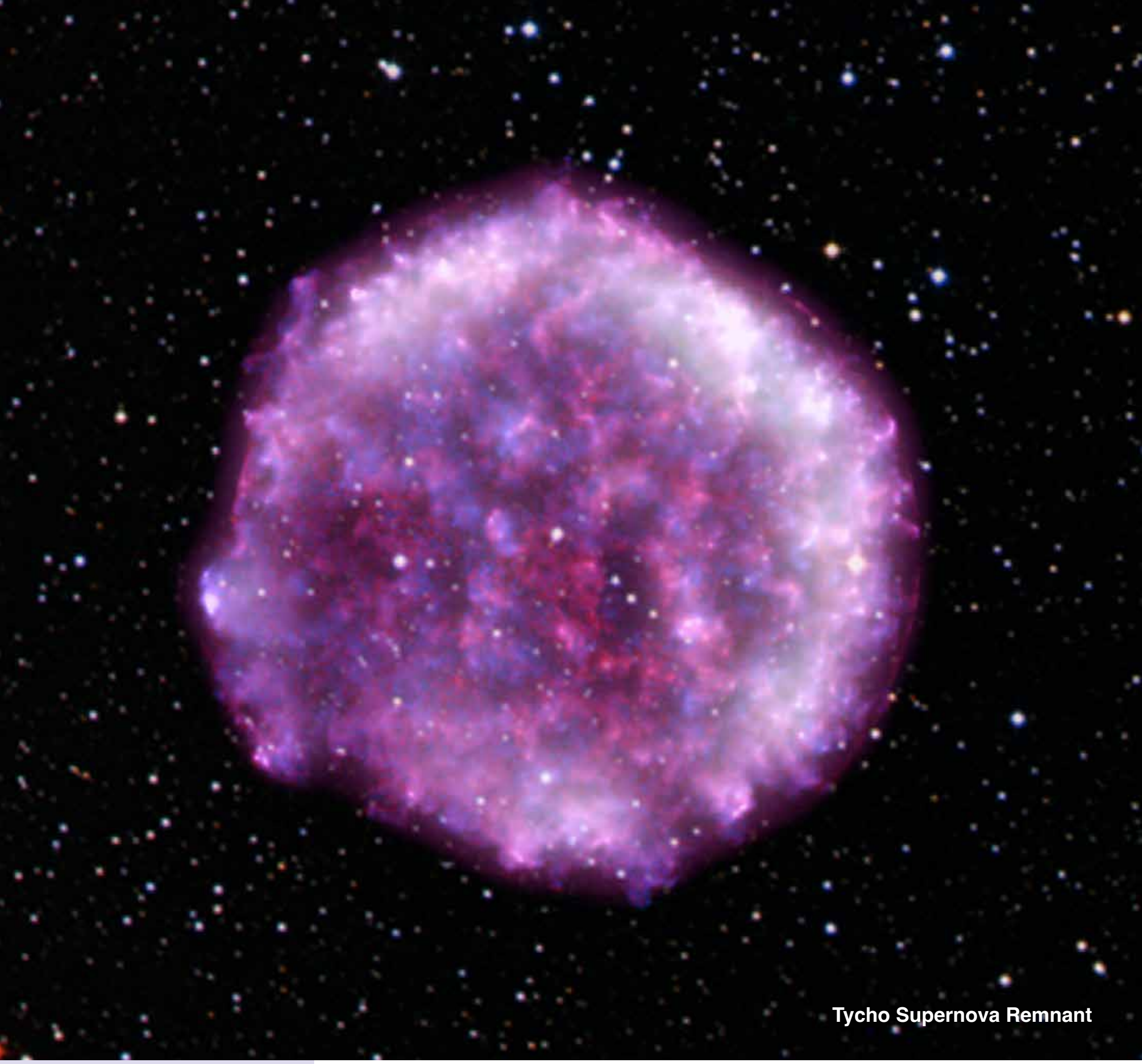

Tycho Supernova Remnant

MARCH

This image provides a new look at the Tycho supernova remnant, named for Danish astronomer Tycho Brahe who noticed the bright glow of this new “star” in the constellation Cassiopeia more than 450 years ago. Astronomers used NASA’s Imaging X-ray Polarimetry Explorer (IXPE) to study polarized light from Tycho and combined it with Chandra data obtained over many years of observations of this remnant. This composite image contains data from IXPE (dark purple and white), Chandra (red and blue), as well as the stars in the field of view seen by the Digitized Sky Survey in optical light.

Credit: X-ray (IXPE: NASA/ASI/MSFC/INAF/R. Ferrazzoli, et al.), (Chandra: NASA/CXC/RIKEN & GSFC/T. Sato et al.) Optical: DSS

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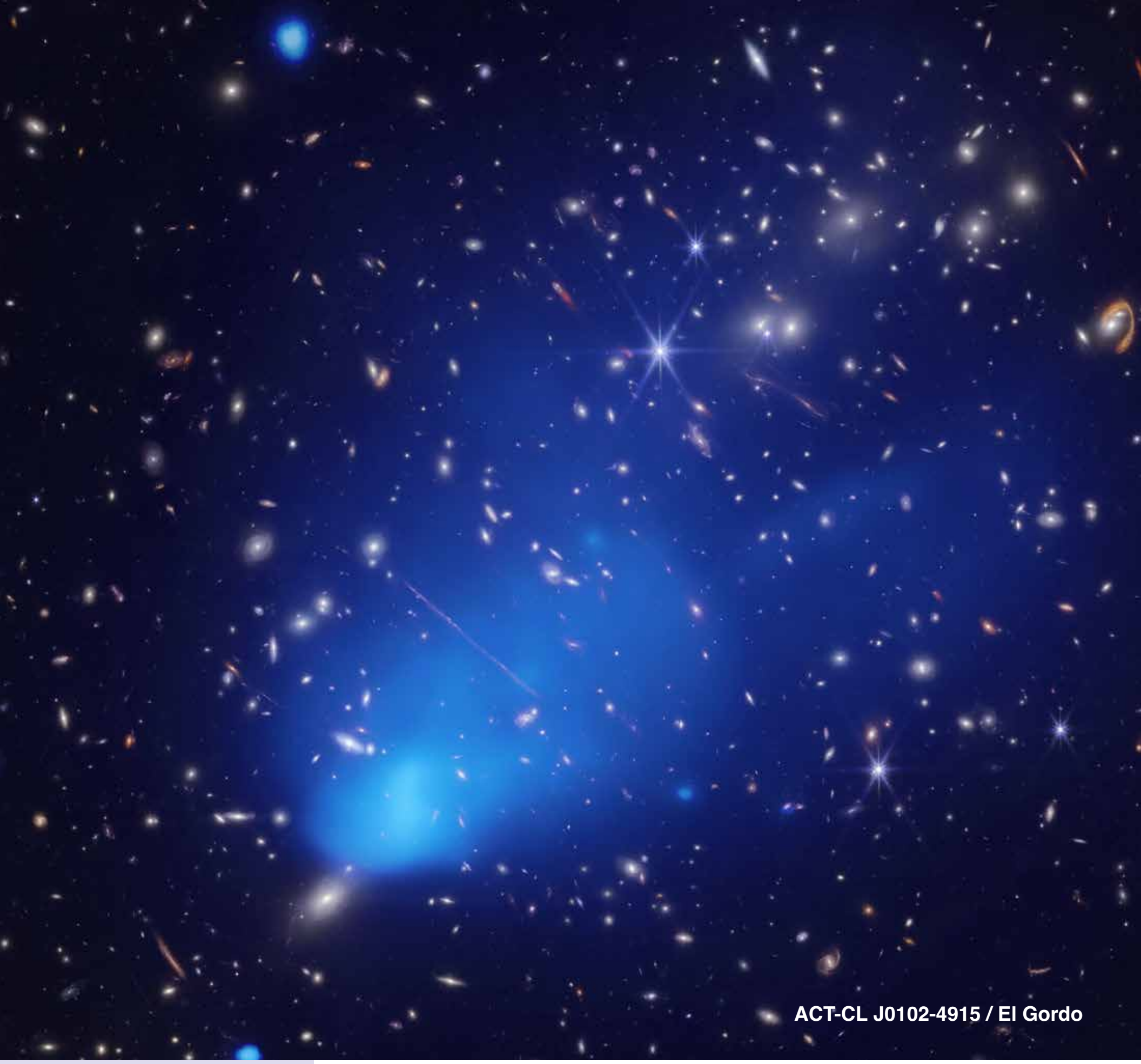

APRIL

This composite image of galaxy cluster ACT-CL J0102-4915 contains X-rays from Chandra (blue) and infrared data from Webb (appearing yellow and white) and is located about 7 billion light-years from Earth. The cluster was nicknamed “El Gordo” (or, “the fat one” in Spanish) because of its gigantic mass. Scientists first announced the discovery of El Gordo with Chandra and ground-based optical telescopes in 2012. They determined that El Gordo is the most massive, the hottest, and gives off the most X-rays of any known galaxy cluster at its distance or beyond.

Credit: X-ray: NASA/CXC/Bogdan, et al; Infrared: NASA/STScI/JWST

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MAY

Messier 16 (M16), also known as the Eagle Nebula, is a famous region of the sky often referred to as the “Pillars of Creation.” The Webb image shows the dark columns of gas and dust shrouding the few remaining fledgling stars just being formed. The Chandra sources, which look like dots, are hot young stars that give off large amounts of X-rays. M16 is also known as NGC 6611 and it is located about 7,000 light-years away from Earth.

Credit: X-ray: NASA/CXO/SAO; Infrared: NASA/ESA/CSA/STScI

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JUNE

This image showcases the Vela supernova remnant. About 10,000 years ago, light from the explosion of a giant star in the constellation Vela arrived at Earth. This supernova left behind a dense object called a pulsar, which appears to brighten regularly as it spins, like a cosmic lighthouse. In this image, the hazy light blue halo corresponds to the first-ever X-ray polarization data for Vela, which comes from IXPE. The pulsar itself is located at the white circle at the center of the image. Pink and purple colors correspond to data from Chandra, which has observed Vela several times previously. The golden stars were captured by Hubble.

Credit: X-ray: (IXPE) NASA/MSFC/Fei Xie & (Chandra) NASA/CXC/SAO; Optical: NASA/STScI

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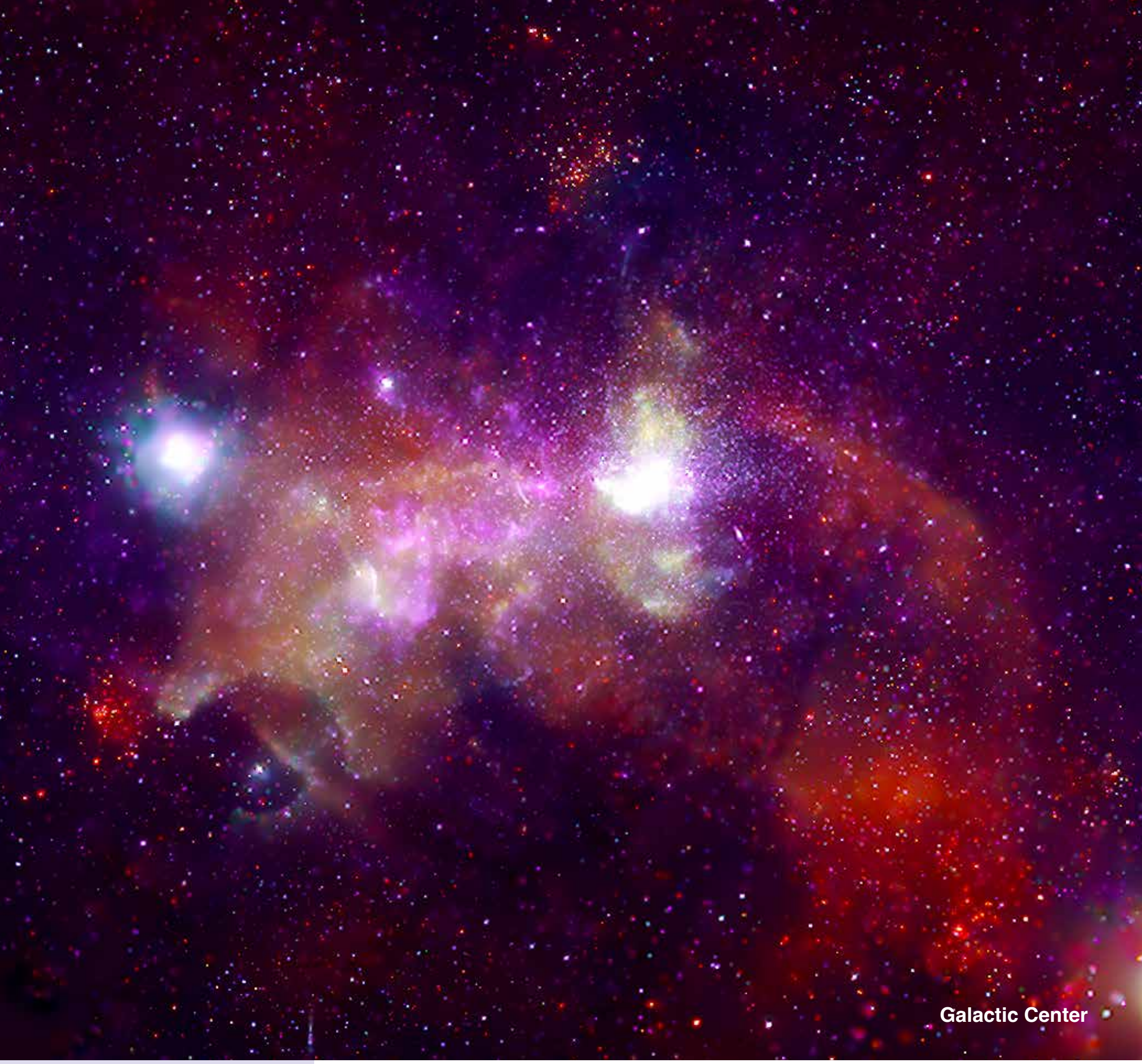

JULY

In this image of the Galactic Center, threads of superheated gas are weaving a tapestry of energy at the center of our Milky Way galaxy. This cosmic masterpiece was made using a deep mosaic of data from Chandra. In the image, X-rays from Chandra are orange, green, blue, and purple, showing different X-ray energies. The center of the Milky Way contains a supermassive black hole, called Sagittarius A*, that contains the mass of about four million suns.

Credit: NASA/CXC/UMass/D. Wang et al.

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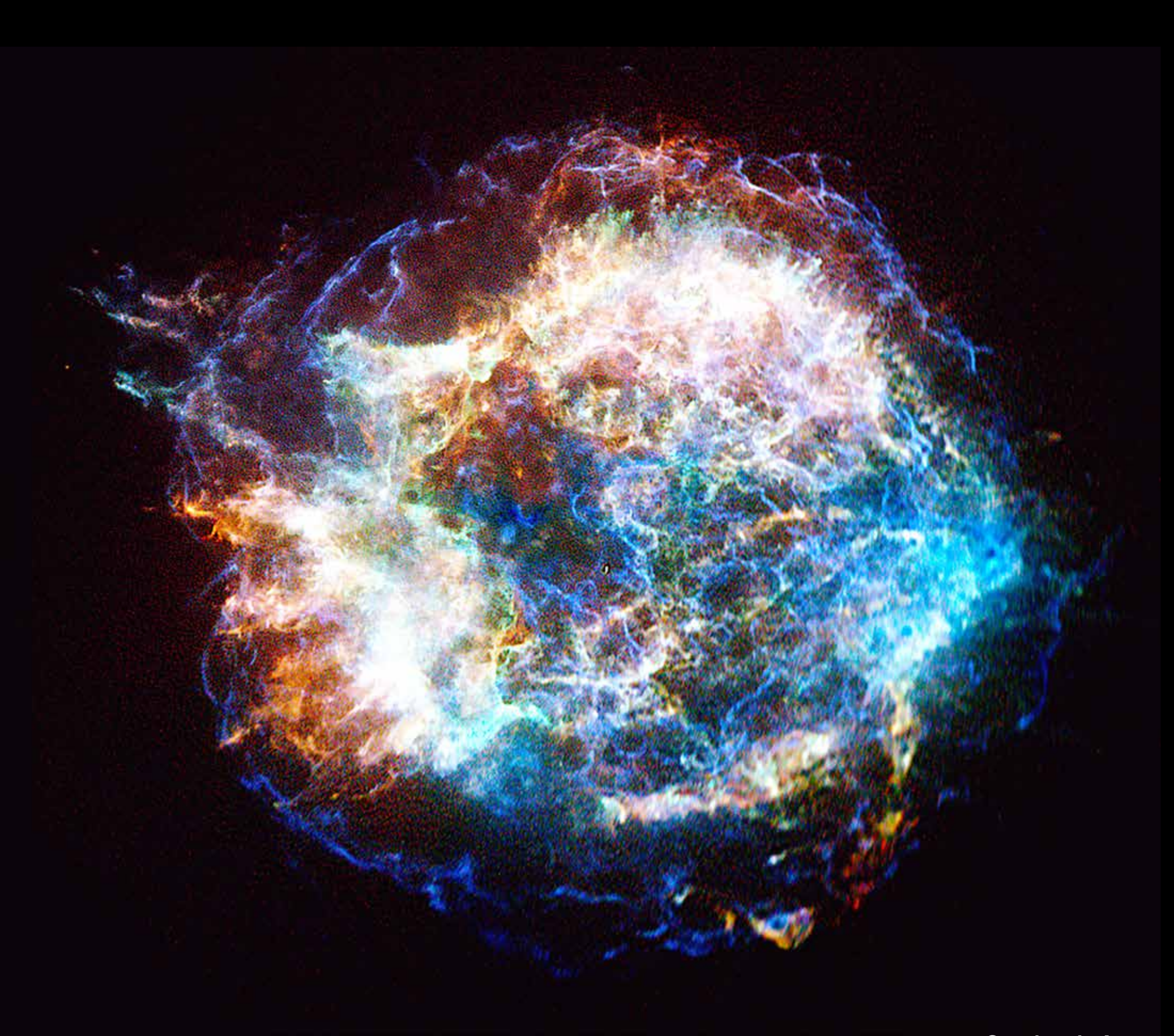

Cassiopeia A

AUGUST

Cassiopeia A (Cas A), the debris from an exploded star, was one of the first images Chandra observed after it was launched into space in July 1999. The telescope has repeatedly looked at Cas A over its quarter century of operation, improving our X-ray view each time. A team of researchers recently developed a new way to process X-ray data from Chandra. This technique can improve the clarity, or sharpness, of some of Chandra's images, including the Cas A supernova remnant shown here.

Credit: NASA/CXC/SAO/Rikkyo Univ./Y. Sakai et al.

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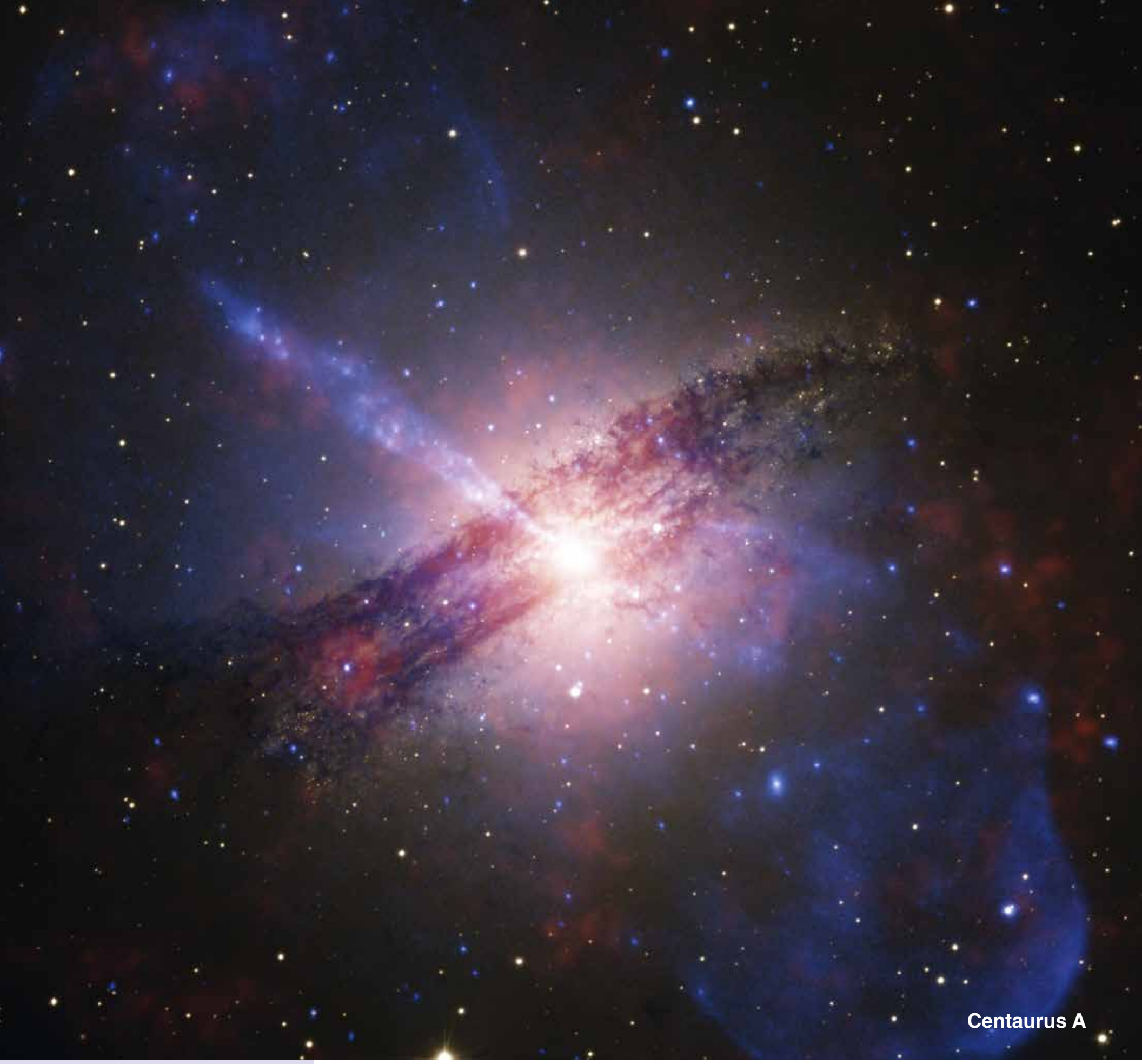

SEPTEMBER

A supermassive black hole in the center of the Centaurus A galaxy is feeding off the gas and dust encircling it, while spewing out jets of high-energy particles and other material. One jet shown at the upper left extends about 13,000 light-years away from the black hole. A dust lane wrapping around the middle of the galaxy may have resulted from a collision with a smaller galaxy millions of years ago. Blue shows X-rays captured by Chandra, orange represents X-rays detected by IXPE, and optical light seen by the ESO in Chile is white/gray.

Credit: X-ray: (IXPE): NASA/MSFC/ IXPE/S. Ehlert et al.; (Chandra): NASA/ CXC/SAO; Optical: ESO/WFI

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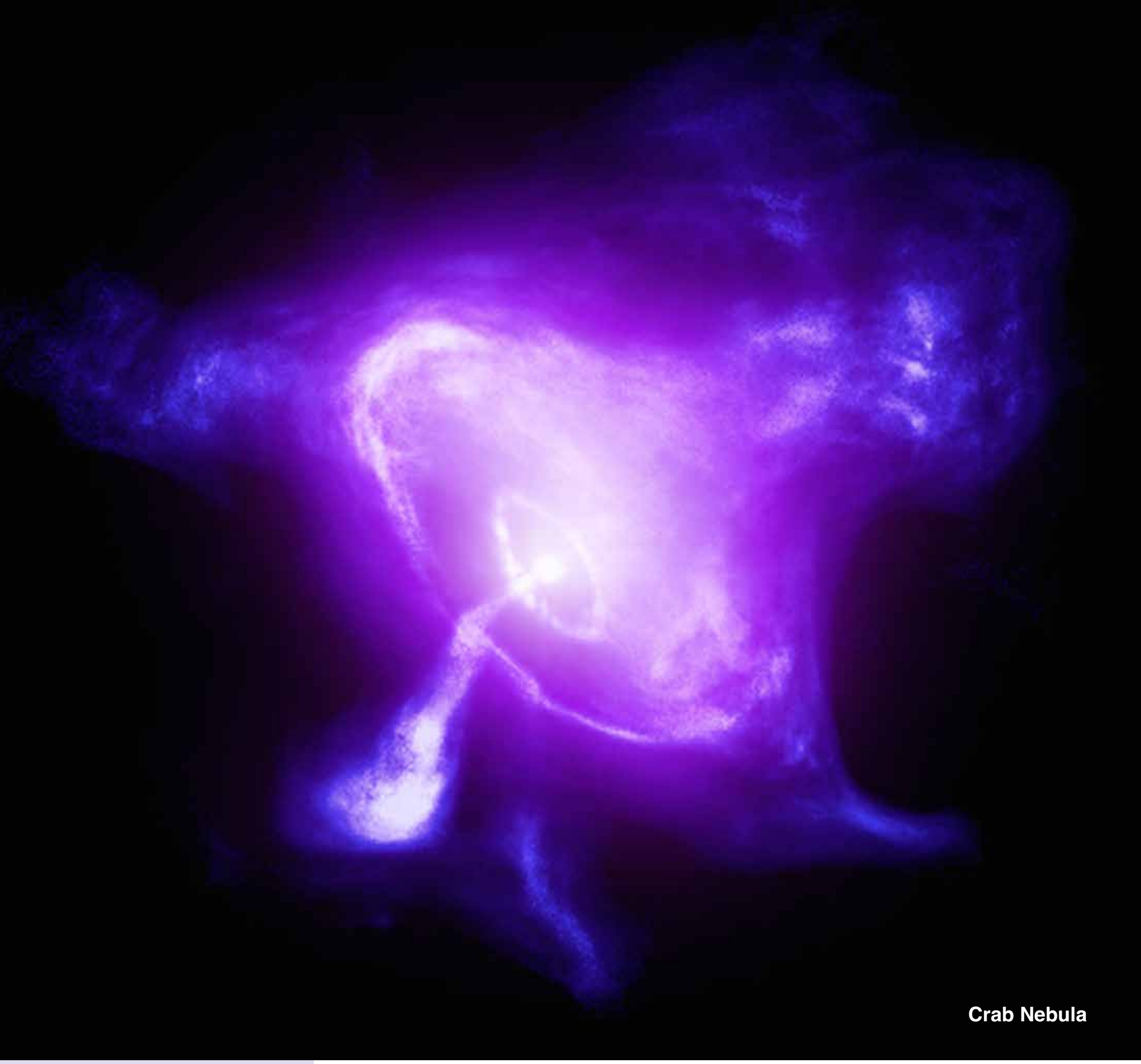

Crab Nebula

OCTOBER

The Crab Nebula has been studied by rockets and telescopes that detect X-ray light for over 50 years. This image shows the Crab Nebula from two current NASA X-ray telescopes, Chandra (blue and white) and IXPE (purple). The Crab Nebula is the aftermath of a supernova documented in the year 1054 that left behind a dense object with a diameter about the length of Manhattan, but as much mass as about two Suns. These extreme conditions make for a bizarre environment that is not yet thoroughly understood.

Credit: X-ray (IXPE: NASA/MSFC), (Chandra: NASA/CXC/SAO)

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13	14 Columbus Day	15	16	17	18	19
20	21	22	23	24	25	26
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NOVEMBER

This image of Abell 2256 shows X-ray and radio data, plus optical and infrared data. X-rays reveal the superheated gas within the clusters, while radio emission arises from a complex set of sources including particles blasting away from supermassive black holes. This jumbled scene of mergers and collisions represents the main way that galaxy clusters grow into some of the Universe's largest structures. Data from Chandra, XMM-Newton, and three radio telescopes are helping astronomers to understand this ongoing collision of at least three galaxy clusters

Credit: X-ray: Chandra: NASA/CXC/Univ. of Bolonga/K. Rajpurohit et al.; XMM-Newton: ESA/XMM-Newton/Univ. of Bolonga/K. Rajpurohit et al. Radio: LOFAR: LOFAR/ASTRON; GMRT: NCRA/TIFR/GMRT; VLA: NSF/NRAO/VLA; Optical/IR: Pan-STARRS

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10	11 Veterans Day	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28 Thanksgiving Day	29	30

DECEMBER

This composite image of 30 Doradus combines X-ray data from Chandra observations with an infrared image from Webb. X-rays (royal blue/purple) reveal gas that has been heated to millions of degrees by shock waves — similar to sonic booms from airplanes — generated by the winds from massive stars. Chandra data also identify the remains of supernova explosions, which will ultimately send important elements such as oxygen and carbon into space where they will become part of the next generation of stars.

Credit: X-ray: NASA/CXC/Penn State Univ./L. Townsley et al.; IR: NASA/ESA/CSA/STScI/JWST ERO Production Team

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22	23	24	25 Christmas Day	26	27	28
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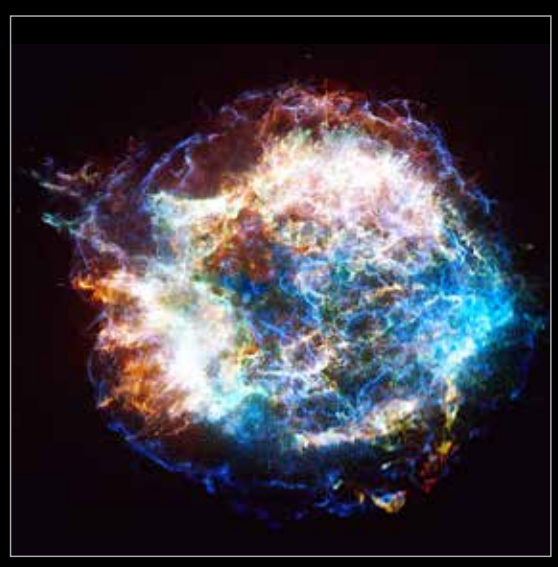
On July 23, 1999 at 12:31 a.m. EDT, the solid rocket motors in the Solid Rocket Boosters on NASA Shuttle Transportation System 93 (STS-93) ignited. Under the command of Col. Eileen Collins, the shuttle lifted off the launch pad at John F. Kennedy Space Center in Cape Canaveral, Florida. Its mission: to carry NASA's Chandra X-ray Observatory into space.

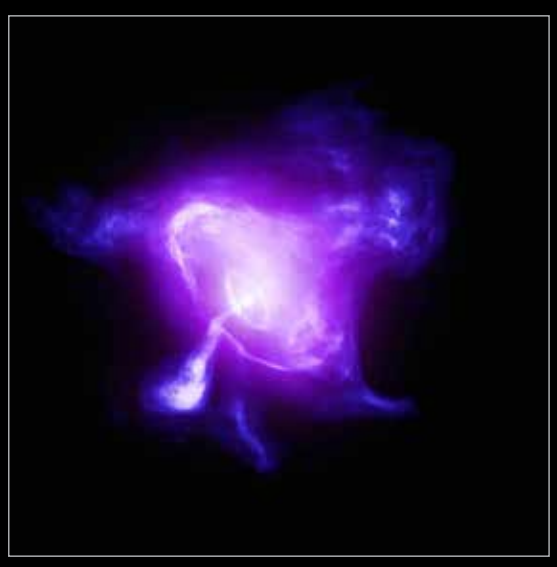
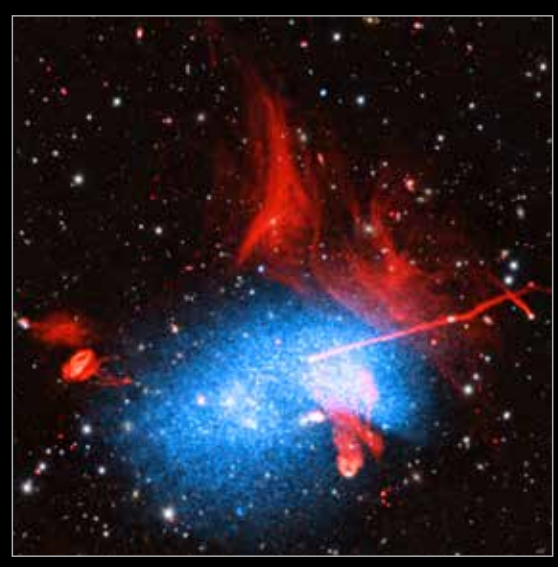
> "There's nothing as beautiful as Chandra sailing off on its way to work.
>
> Astronaut Cady Coleman, STS-93 Mission, 1999





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