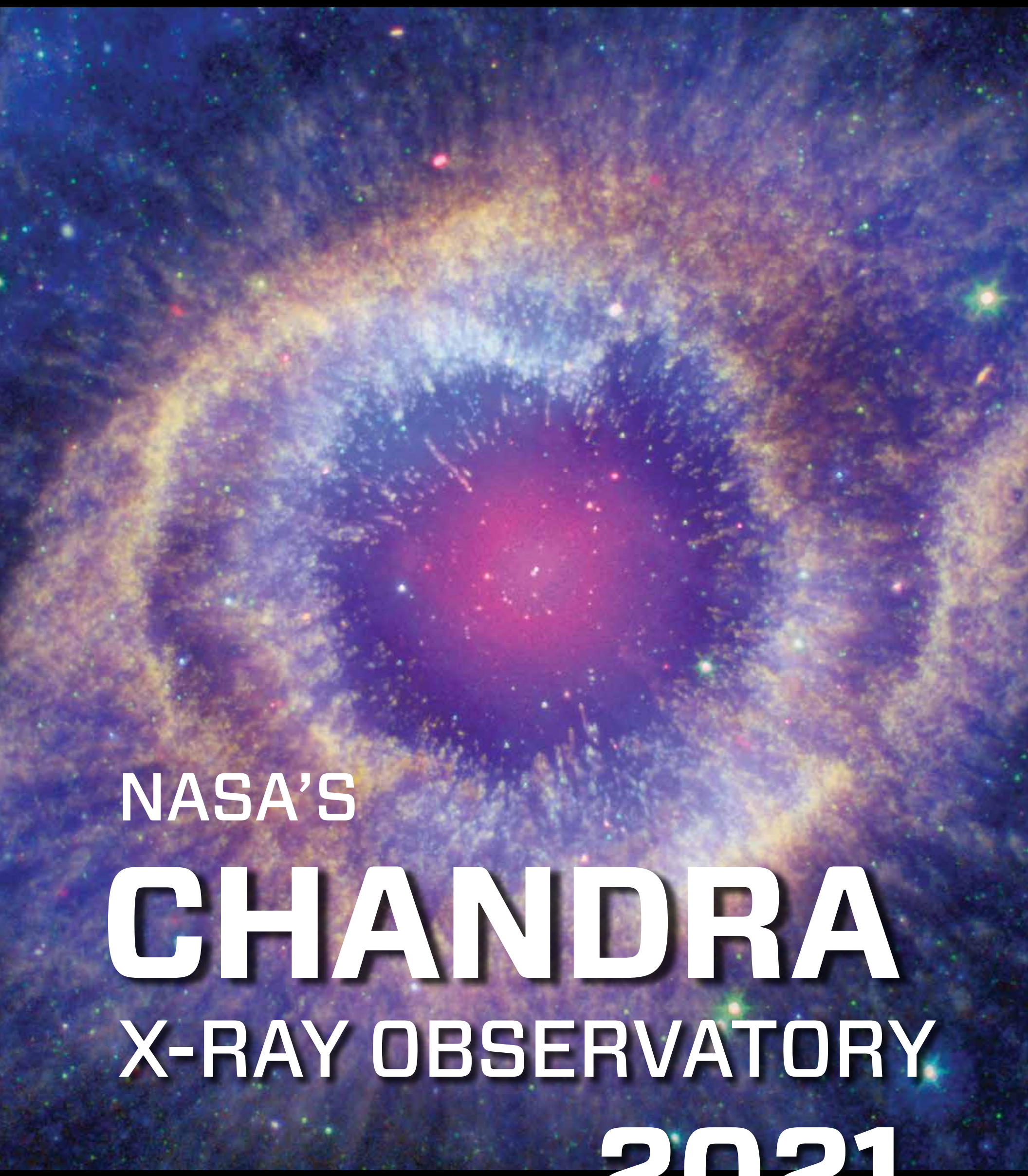
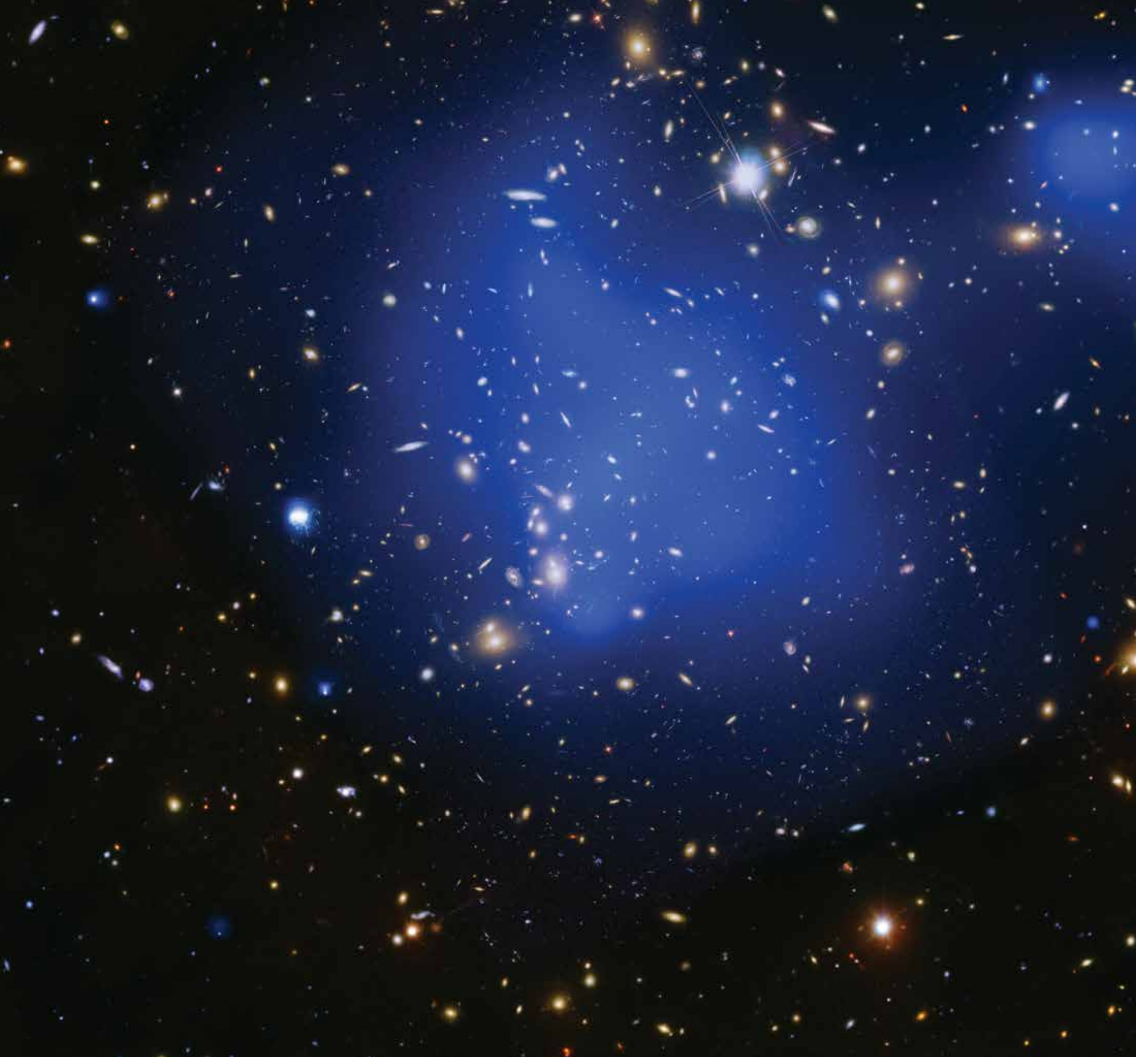
National Aeronautics and
Space Administration



NASA'S CHANDRA X-RAY OBSERVATORY 2021

chandra.si.edu

nasa.gov



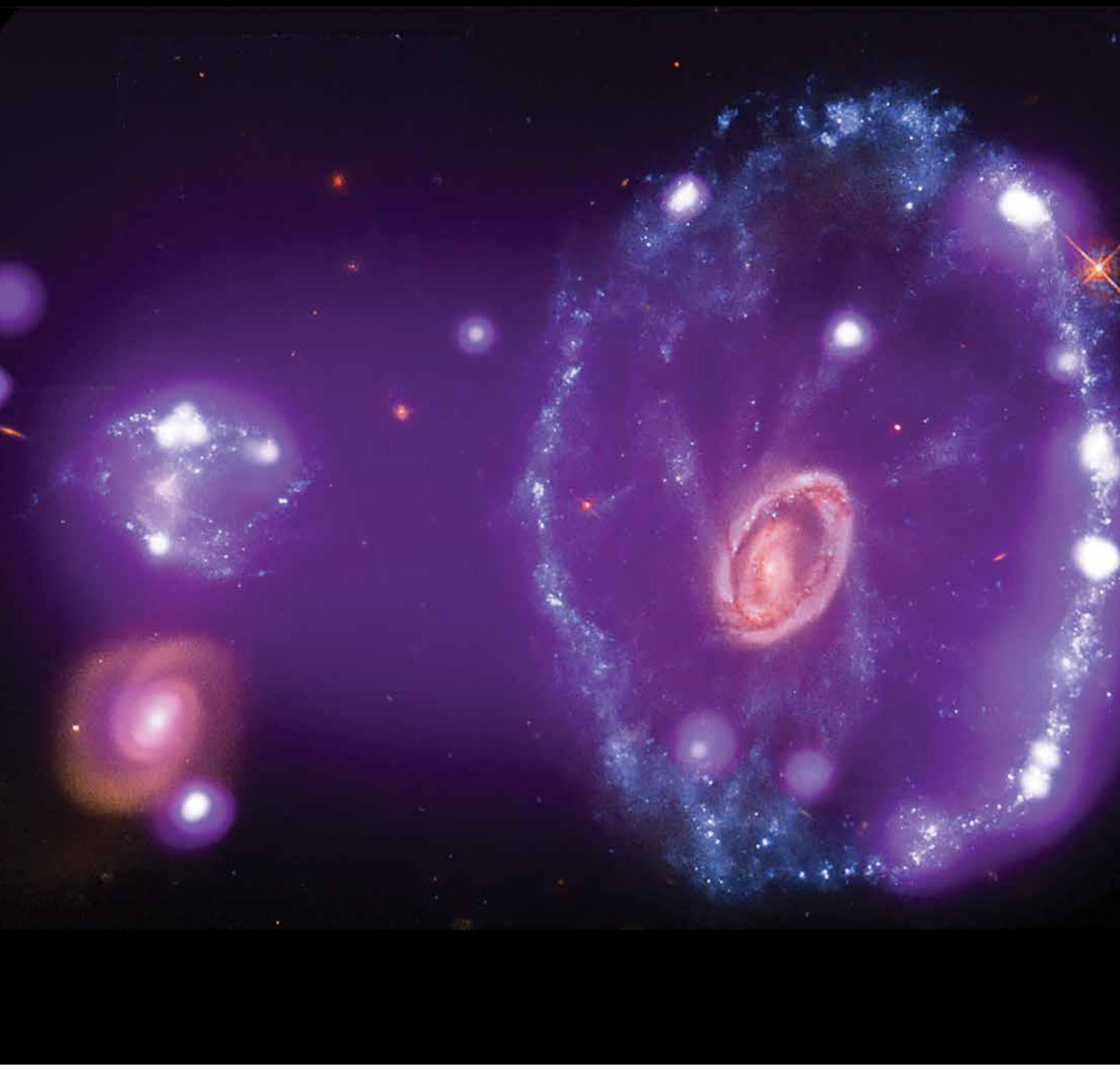
JANUARY 2021

S	M	T	W	Th	F	Sa
					1 New Year's Day	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18 Martin Luther King, Jr.	19	20	21	22	23
24	25	26	27	28	29	30
31						

ABELL 2744

Galaxy clusters are the largest objects in the universe held together by gravity. They contain enormous amounts of superheated gas with temperatures of tens of millions of degrees, which glows brightly in X-rays and can be observed across millions of light years between the galaxies. This image of the Abell 2744 galaxy cluster combines X-rays from NASA's Chandra X-ray Observatory (diffuse blue emission) with optical light data from Hubble (red, green, and blue).

Credit: X-ray: NASA/CXC; Optical: NASA/STScI



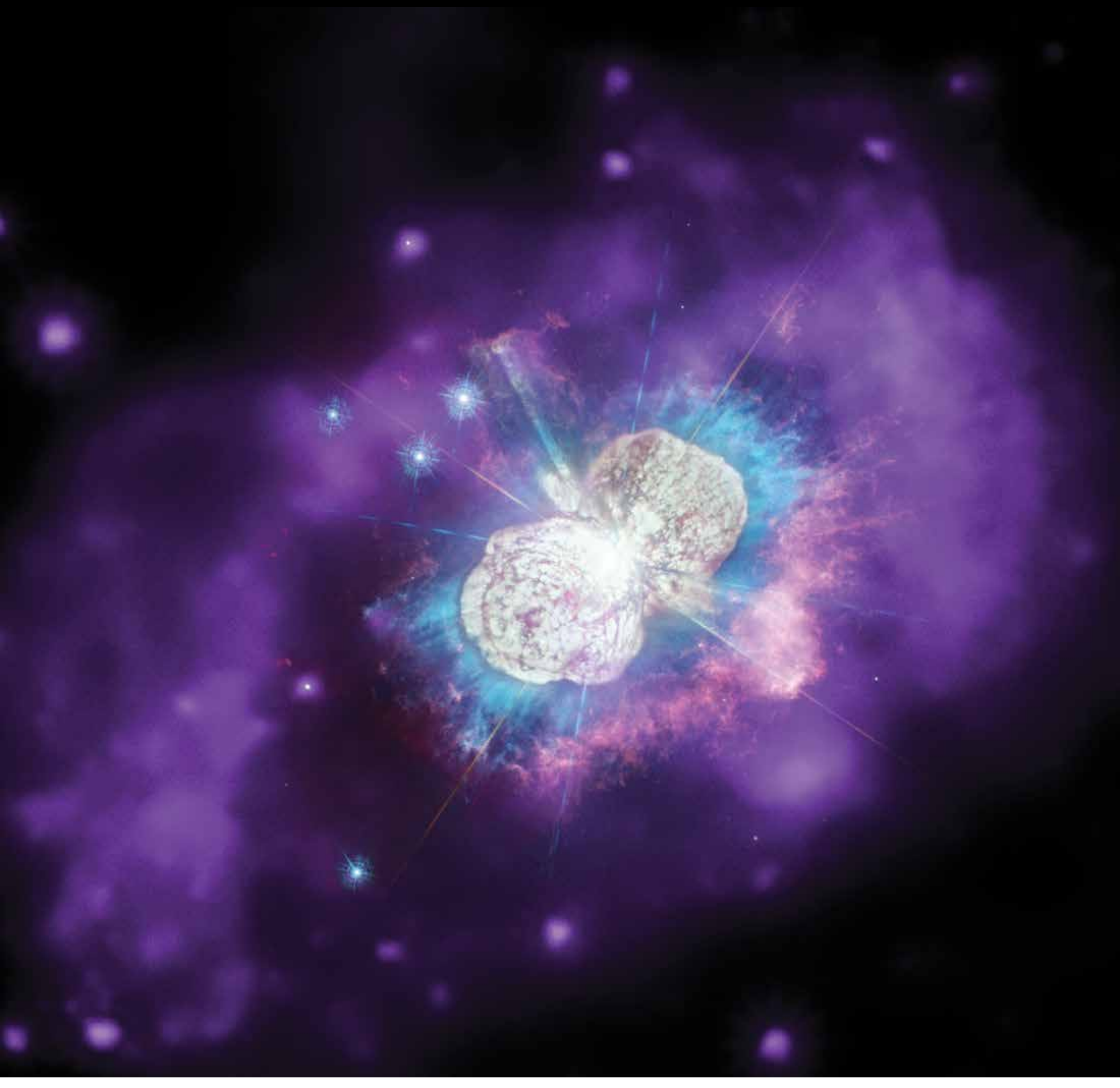
FEBRUARY 2021

S	M	T	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14 Valentine's Day	15 Presidents' Day	16	17	18	19	20
21	22	23	24	25	26	27
28						

CARTWHEEL GALAXY

This galaxy resembles a bull's eye, which is appropriate because its appearance is partly due to a smaller galaxy that passed through the middle of this object. The violent collision produced shock waves that swept through the galaxy and triggered large amounts of star formation. X-rays from Chandra (purple) show disturbed hot gas initially hosted by the Cartwheel galaxy being dragged over more than 150,000 light years by the collision. Optical data from Hubble (red, green, and blue) outline where this collision may have triggered the star formation.

Credit: X-ray: NASA/CXC; Optical: NASA/STScI



MARCH 2021

S	M	T	W	Th	F	Sa
	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			

ETA CARINAE

What will be the next star in our Milky Way galaxy to explode as a supernova? Astronomers aren't certain, but one candidate is in Eta Carinae, a volatile system containing two massive stars that closely orbit each other. This image has three types of light: optical data from Hubble (appearing as white), ultraviolet (cyan) from Hubble, and X-rays from Chandra (appearing as purple emission). The previous eruptions of this star have resulted in a ring of hot, X-ray emitting gas about 2.3 light years in diameter surrounding these two stars.

Credit: X-ray: NASA/CXC; Ultraviolet/Optical: NASA/STScI; Combined Image: NASA/ESA/N. Smith (University of Arizona), J. Morse (BoldlyGo Institute) and A. Pagan

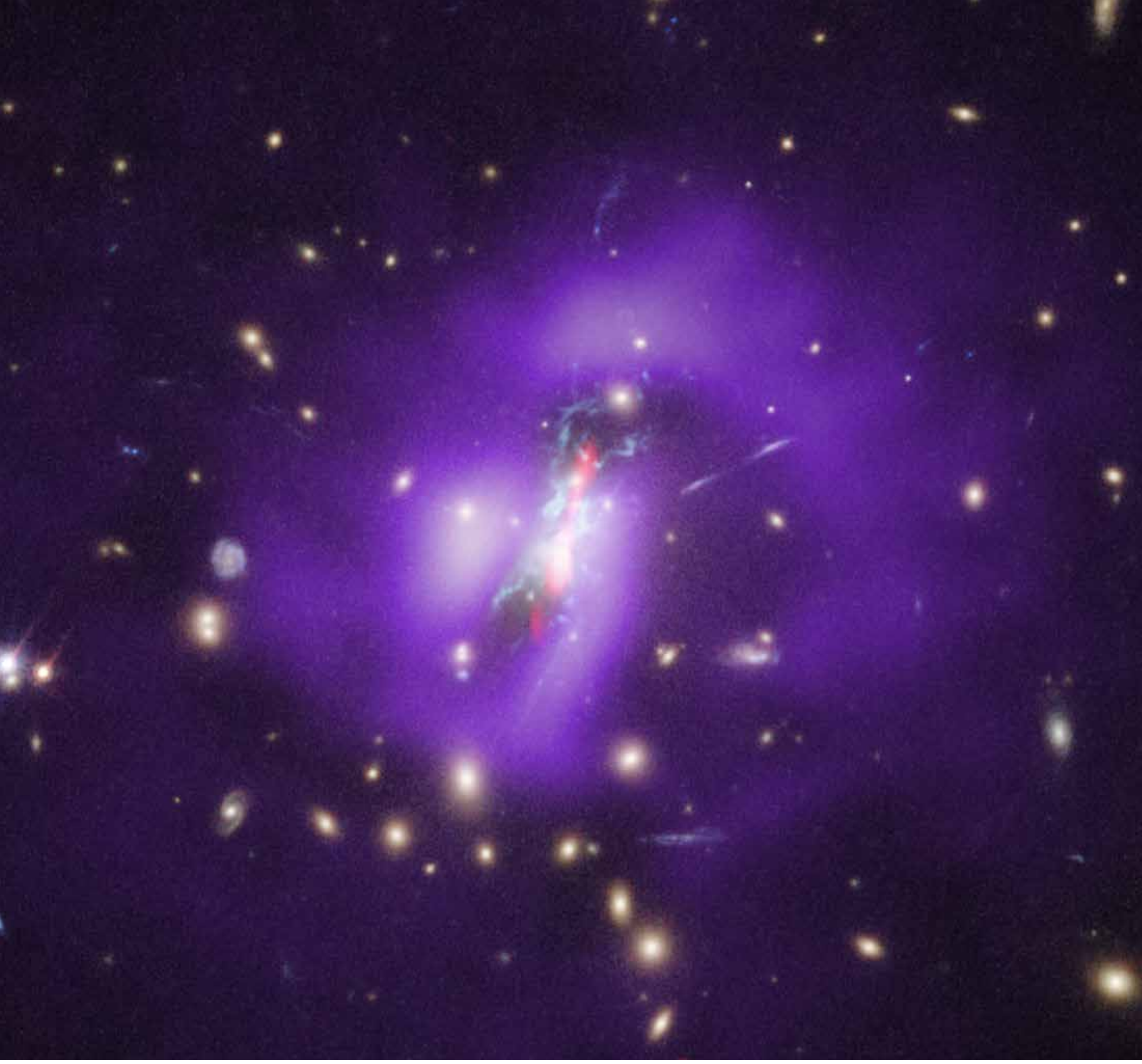
APRIL 2021

S	M	T	W	Th	F	Sa
				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	

HELIX NEBULA

When a star like the Sun runs out of fuel, it expands and its outer layers puff off, and then the core of the star shrinks. This phase is known as a “planetary nebula,” and astronomers expect our Sun will experience this in about 5 billion years. This Helix Nebula image contains infrared data from NASA’s Spitzer Space Telescope (green and red), optical light from Hubble (orange and blue), ultraviolet from NASA’s Galaxy Evolution Explorer (cyan), and Chandra’s X-rays (appearing as white) showing the white dwarf star that formed in the center of the nebula. The image is about four light years across.

Credit: X-ray: NASA/CXC; Ultraviolet: NASA/JPL-Caltech/SSC; Optical: NASA/STScI(M. Meixner)/ESA/NRAO(T.A. Rector); Infrared: NASA/JPL-Caltech/K. Su



MAY 2021

S	M	T	W	Th	F	Sa
						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 Memorial Day					

PHOENIX GALAXY CLUSTER

The supermassive black hole in the center of galaxy clusters usually stifles star formation, but the one in Phoenix Cluster is not. By combining data from Chandra (purple), Hubble (yellow and light blue), and the Very Large Array (red), astronomers found evidence the black hole is actually boosting star formation. This result shows the dramatic consequences supermassive black holes may have on how many stars form in their surroundings.

Credit: X-ray: NASA/CXC/MIT/M.McDonald et al.; Radio: NRAO/VLA; Optical: NASA/STScI

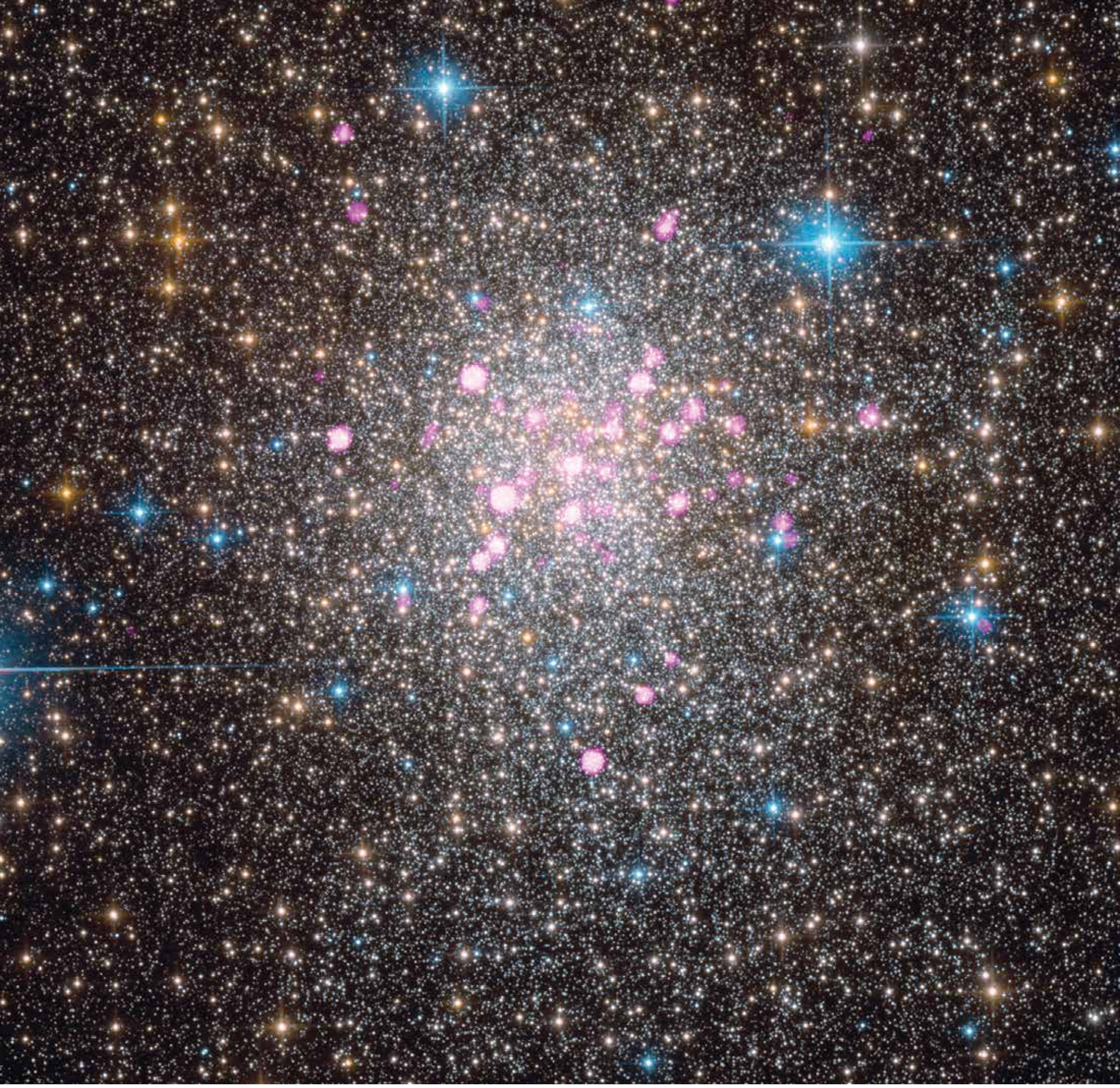
JUNE 2021

S	M	T	W	Th	F	Sa
		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			

SDSS J1030

This image contains a black hole, seen as the pink object to the right of the bright central source, that is triggering star formation across the longest distance ever observed. This black hole is located in a galaxy, called SDSS J1030+0542, about 9.9 billion light years from Earth. In this composite image, X-rays from Chandra (red) have been combined with radio emission detected by the NSF's Karl Jansky Very Large Array, or VLA, (blue), and an optical image from NASA's Hubble.

Credit: X-ray: NASA/CXC/INAF/R. Gilli et al.; Radio NRAO/VLA; Optical: NASA/STScI



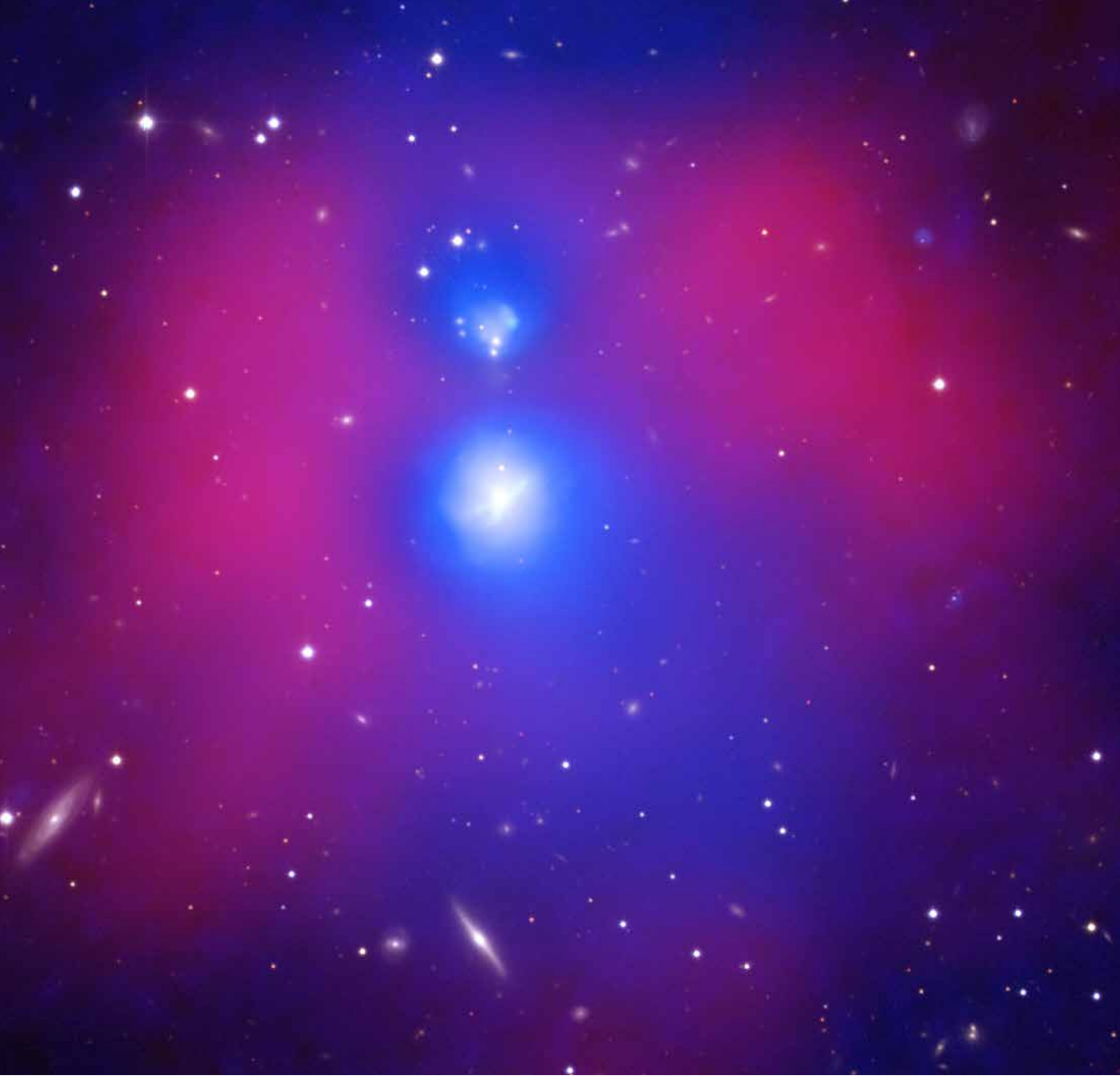
JULY 2021

S	M	T	W	Th	F	Sa
				1 ◖	2	3
4 Independence Day	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 ◖

TERZAN 5

Astronomers observed a neutron star in orbit with a low-mass companion acting in an unusual way. Using X-ray data from Chandra (purple), researchers saw that Terzan 5 CX1 had traits of a “low-mass X-ray binary” before it started behaving like a millisecond pulsar, and then years later returned to its original role. In this image, Chandra data were combined with optical data from Hubble of the Terzan 5 globular cluster, located about 19,000 light years from Earth.

Credit: NASA/CXC/Univ. of Amsterdam/N.Degenaar, et al.



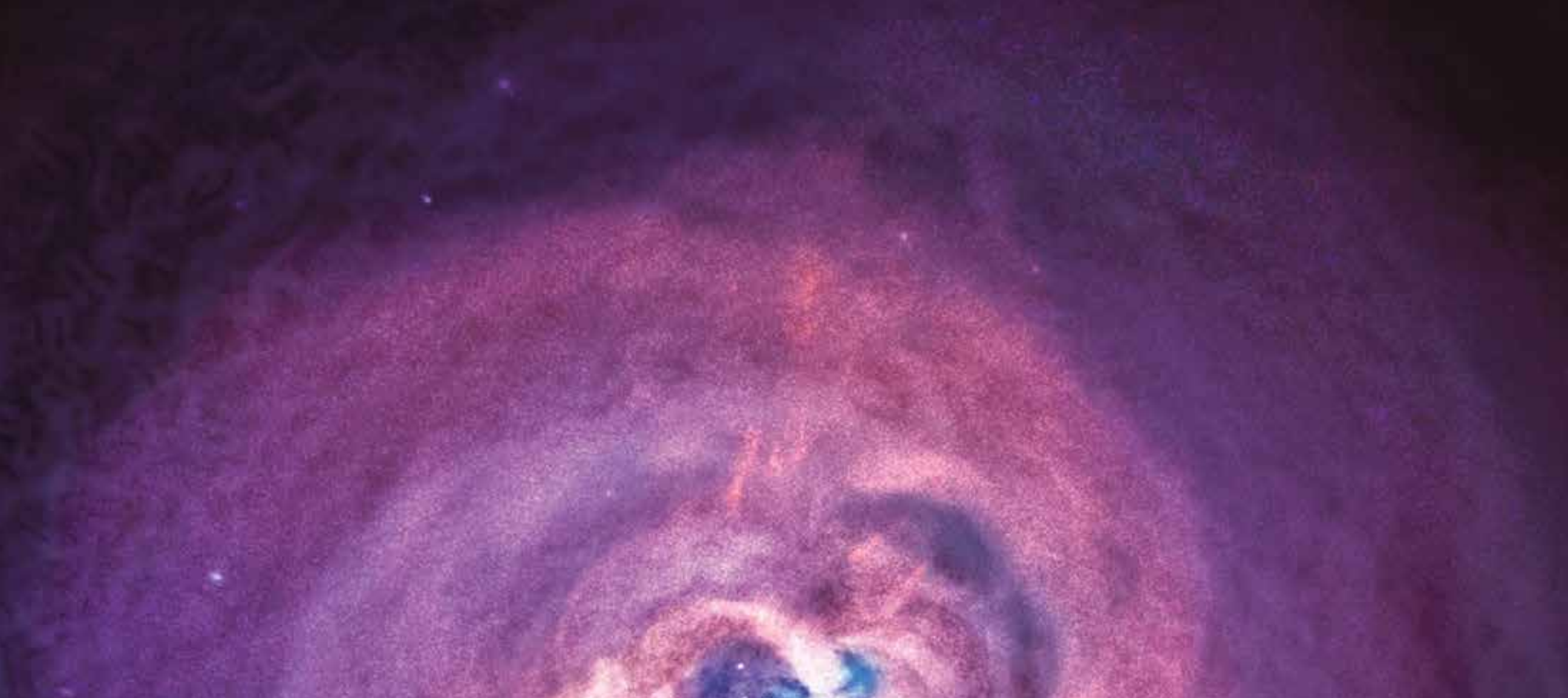
AUGUST 2021

S	M	T	W	Th	F	Sa
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				

NGC 6338

NGC 6338 is a system where two groups of galaxies are slamming into each other at millions of miles per hour. This image contains X-ray data from Chandra (red) that shows hot gas with temperatures upward of about 20 million degrees Celsius, as well as cooler gas that also emits X-rays detected with Chandra and ESA's XMM-Newton, another orbiting X-ray telescope (blue). The X-ray data have been combined with an optical image from the Sloan Digital Sky Survey, showing the galaxies and stars in white.

Credit : X-ray: Chandra: NASA/CXC/SAO/E. O'Sullivan, XMM: ESA/XMM/E. O'Sullivan; Optical: SDSS



SEPTEMBER 2021

S	M	T	W	Th	F	Sa
			1	2	3	4
5	6 ○ Labor Day	7	8	9	10	11
12	13 ◗	14	15	16	17	18
19	20 ●	21	22	23	24	25
26	27	28 ◖	29	30		

PERSEUS GALAXY CLUSTER

Astronomers used Chandra to look for extraordinarily low-mass “axion-like” particles in the Perseus galaxy cluster, which is located about 240 million light years from Earth. A Chandra observation lasting over five days of the central supermassive black hole in the center of the cluster showed no evidence for certain axion-like particles, which some theorists think can explain dark matter. This image contains Chandra data of Perseus where the X-rays are red, green, and blue.

Credit: NASA/CXC/Univ. of Cambridge/C. Reynolds et al.

OCTOBER 2021

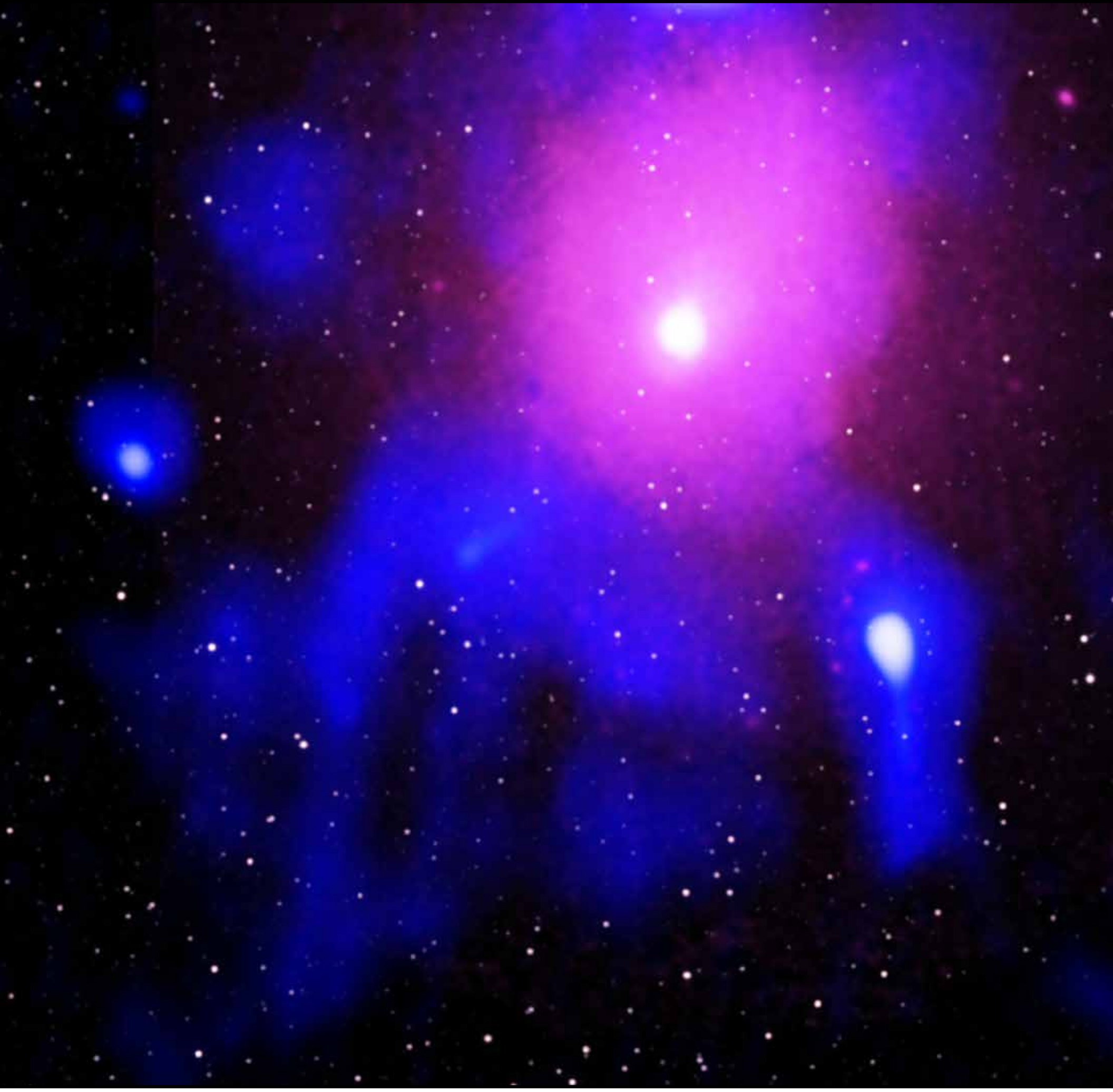
S	M	T	W	Th	F	Sa
					1	2
3	4	5	6 ○	7	8	9
10	11 Columbus Day	12 ◗	13	14	15	16
17	18	19	20 ●	21	22	23
24	25	26	27	28 ◖	29	30
31						

DATA SONIFICATION: SOUNDS FROM AROUND THE MILKY WAY

By turning NASA astrophysics images into sounds, a new project allows users to ‘listen’ to the center of the Milky Way and other objects. As the bar moves from left to right over the multiwavelength Galactic Center image (top), the sounds correspond to the position and brightness of the sources. Users can listen to the X-ray, optical, and infrared image layers separately or simultaneously. The project also translated images from Cassiopeia A (lower left) and the “Pillars of Creation” in M16 (lower right), creating novel ways to explore these well-known objects through sound.

Credit: NASA/CXC/SAO/K.Arcand, M.Russo & A.Santaguida

SCAN TO EXPLORE SOUNDS FROM AROUND THE MILKY WAY



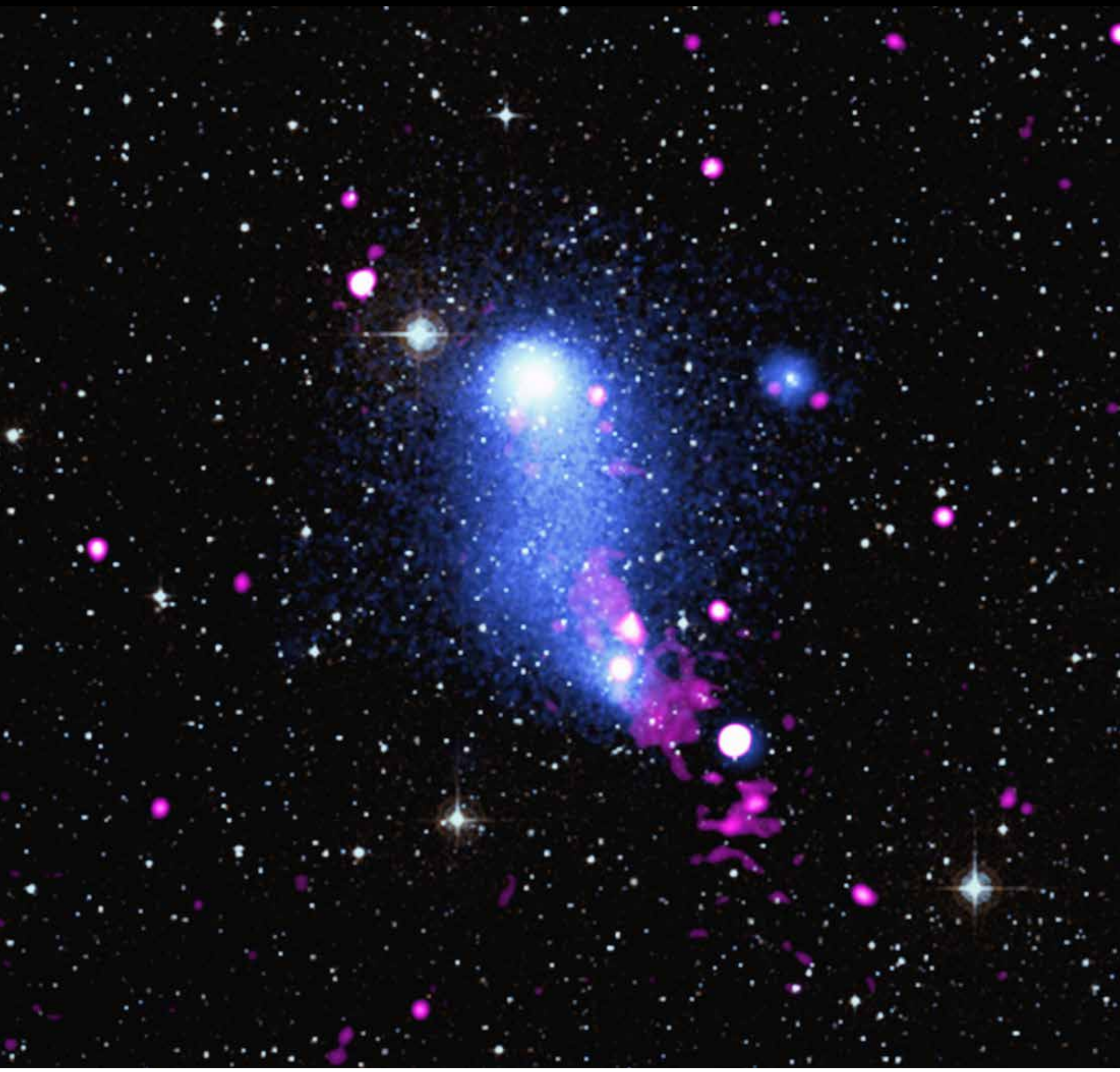
NOVEMBER 2021

S	M	T	W	Th	F	Sa
	1	2	3	4 ○	5	6
7	8	9	10	11 ◗ Veterans Day	12	13
14	15	16	17	18	19 ●	20
21	22	23	24	25 Thanksgiving Day	26	27 ◖
28	29	30				

OPHIUCHUS GALAXY CLUSTER

Astronomers discovered the biggest explosion seen in the Universe in the Ophiuchus galaxy cluster, which is located about 390 million light years from Earth. Galaxy clusters are the largest structures in the Universe held together by gravity, containing thousands of individual galaxies, dark matter, and hot gas. The hot gas that pervades clusters like Ophiuchus gives off much of its light as X-rays. This image contains X-rays from Chandra and XMM-Newton.

Credit: X-ray: Chandra: NASA/CXC/NRL/S. Giacintucci, et al., XMM: ESA/XMM; Radio: NCRA/TIFR/GMRT; Infrared: 2MASS/UMass/IPAC-Caltech/NASA/NSF



DECEMBER 2021

S	M	T	W	Th	F	Sa
			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 Christmas Day
26 ◖	27	28	29	30	31	

ABELL 2384

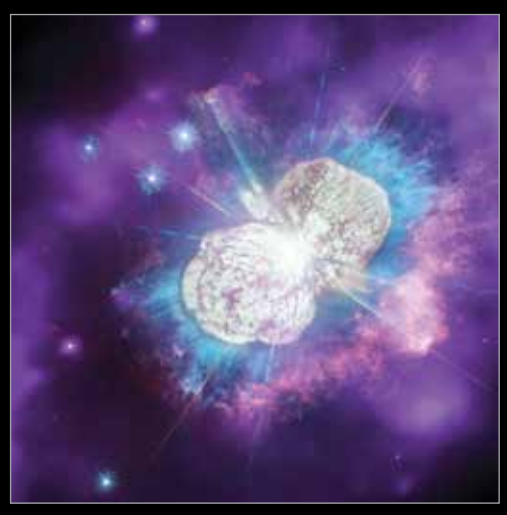
This image shows a superheated gas bridge that was created when two galaxy clusters collided. Abell 2384, located about 1.9 billion light years from Earth, has a jet shooting away from a supermassive black hole in the center of a galaxy in one of these clusters. This image contains X-rays from Chandra and XMM-Newton (blue), radio emission from the GMRT (red, and optical data from the Digitized Sky Survey (yellow).

Credit: NASA/CXC/SAO/V.Parekh, et al.

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."

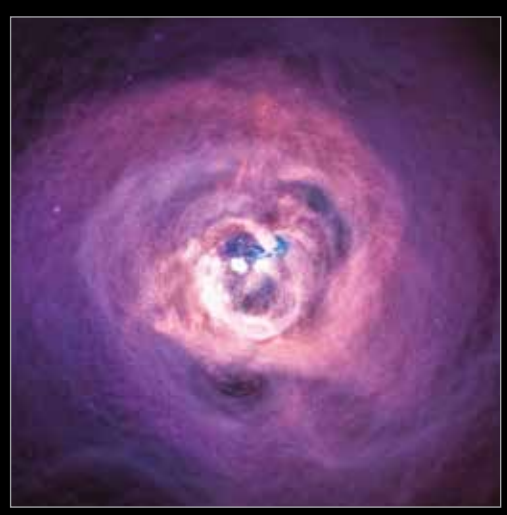
NASA's Chandra X-ray Observatory is a telescope specially designed to detect X-ray emission from very hot regions of the Universe such as exploded stars, clusters of galaxies, and matter around black holes. Because X-rays are absorbed by Earth's atmosphere, Chandra must orbit above it, up to an altitude of 139,000 km (86,500 mi) in space.









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