## El Gordo

This young galaxy cluster, nicknamed “El Gordo” for the “big” or “fat” one in Spanish, is a remarkable object. Found about 7.2 bil lion light years away, El Gordo appears to be the most massive, hottest, and most powerful X-ray emitter of any known cluster at its distance or beyond. In this composite image, X-rays are blue, opti cal data from the Very Large Telescope are red, green, and blue, and infrared emission from Spitzer is red. The comet-like shape of the X-rays, along with optical data, shows that El Gordo is actually two galaxy clusters in the process of colliding at several million miles per hour.

## January 2013

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## NGC 3627

NGC 3627 is a spiral galaxy located about 30 million light years from Earth. A survey of 62 galaxies with Chandra revealed that many of these galaxies contained supermassive black holes that previously were undetected. This study showed the value of X-ray observations for finding central black holes that have relatively low er masses, as is the case for NGC 3627. This composite image of NGC 3627 includes data from Chandra (blue), Spitzer (red), as well as optical data from Hubble and the Very Large Telescope (yellow).

## February 2013

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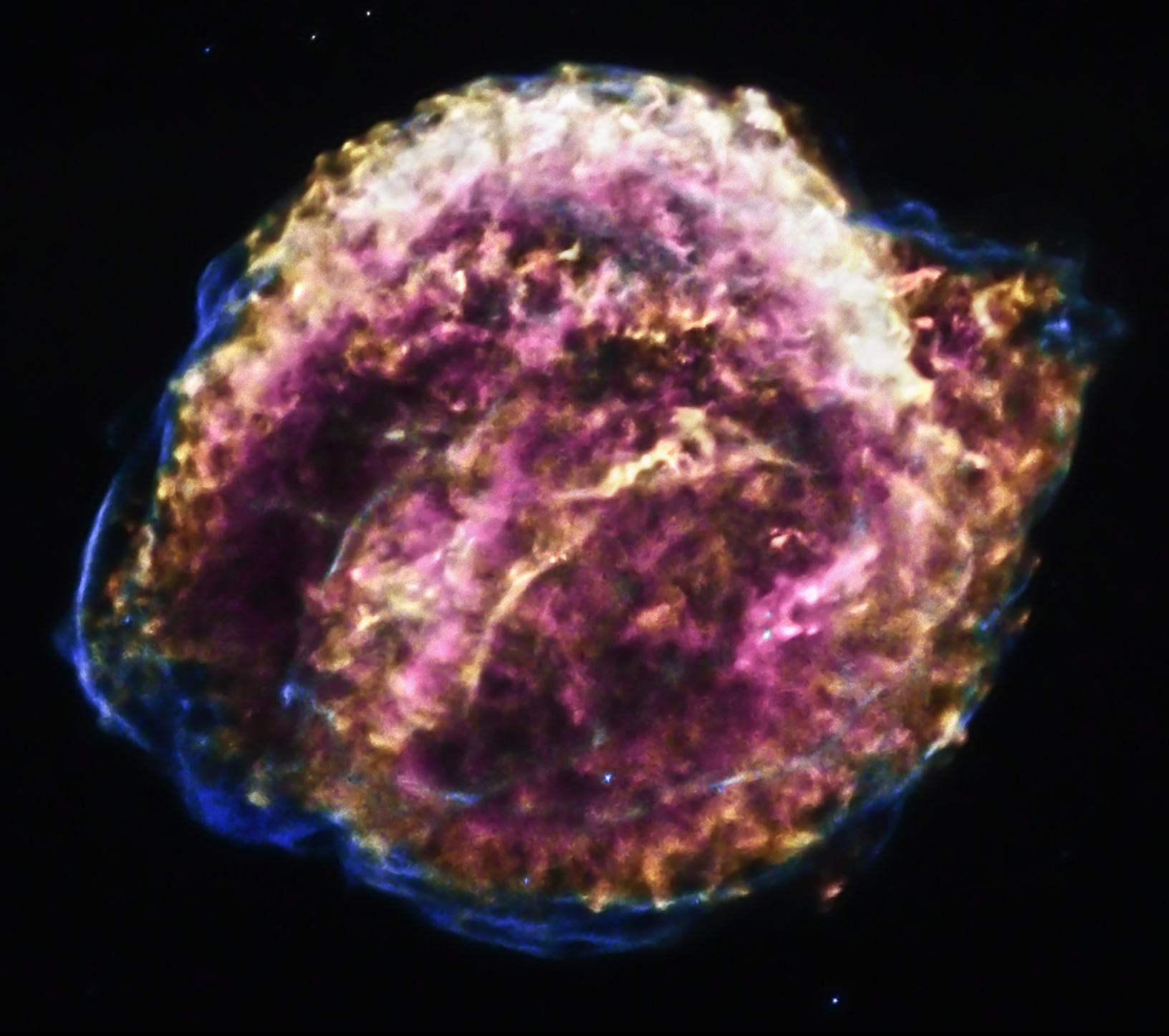

## Kepler's Supernova Remnant

In 1604 A.D., a bright new object appeared in the night sky. This object, which became known as Kepler's supernova after the famous astronomer Johannes Kepler who studied it in detail, created an expanding remnant of hot gas and high energy particles. A long Chandra observation provided the basis for detailed computer modeling of the interaction of the expanding debris with the surrounding gas, and showed that the explosion produced an amount of radioactive nickel roughly equal to the mass of the Sun. In this image, the shock front generated by the supernova is shown in cyan, and the other colors show material heated by the explosion.

## March 2013

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## Abell 520

Abell 520 is the site of a collision of massive galaxy clusters lo cated about 2.4 billion light years from Earth. Data from Chan dra (green) reveal large clouds of multimillion degree gas in the clusters and provide evidence for a collision. Optical data from Hubble and the Canada-France-Hawaii Telescope ap pear white and yellow, while starlight from galaxies within the clusters is colored orange. This result confirms the pres ence of a concentration of dark matter near the peak of the X-ray emission, where very few galaxies are found. The origin of this “dark core” is still a puzzle.

## April 2013

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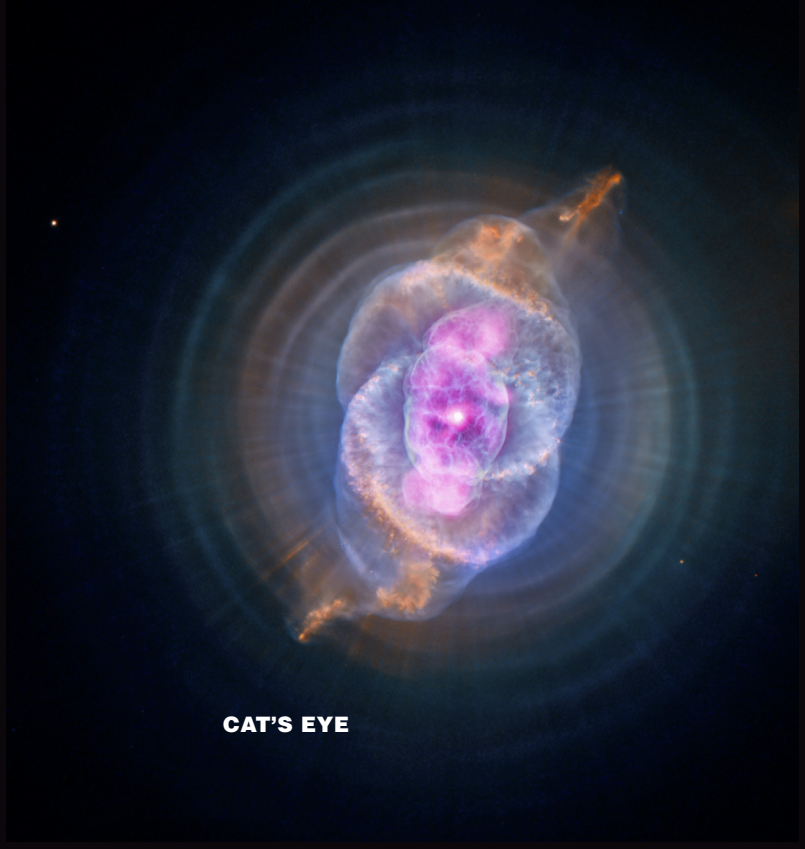
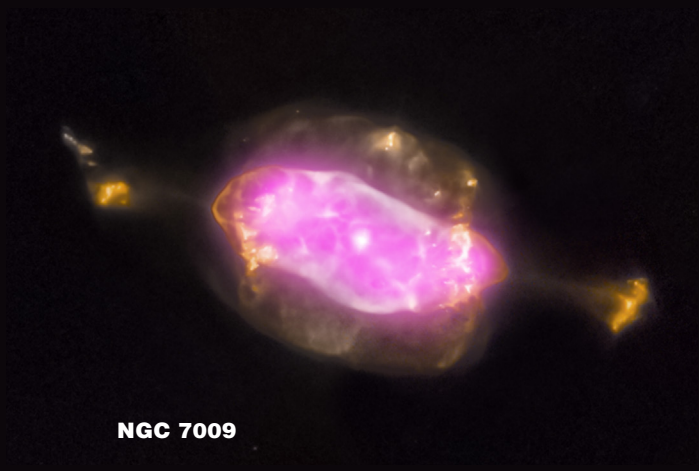


CAT'S EYE

NGC 7662



NGC 7009

NGC 6826

## Planetary Nebulas

When a star like our Sun runs out of hydrogen, it puffs off its outer layers and leaves behind a hot core. Winds from this core create a complex and graceful filamentary shell called a planetary nebula (so called because it looks like the disk of a planet when viewed with a small telescope). This panel of images shows four examples of planetary nebulas where Chandra's X-ray data (purple) have been combined with optical images from Hubble (yellow and cyan). X-ray images reveal clouds of multimillion-degree gas that have been compressed and heated by these winds.

## May 2013

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## Abell 383

Two teams of astronomers used data from Chandra and other tele scopes to map the distribution of dark matter in three dimensions in the galaxy cluster Abell 383. Analysis of the data shows that the dark matter in Abell 383 is stretched out like a gigantic football with the point of the football aligned close to the line of sight. The Chan dra X-ray data (purple) show the hot gas, which is by far the domi nant type of normal matter in the cluster. Galaxies are shown with the optical data from the Hubble, the Very Large Telescope, and the Sloan Digital Sky Survey, colored in blue and white.

## June 2013

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## NGC 1929

This composite image shows a superbubble in the Large Magellanic Cloud, a small satellite galaxy of the Milky Way. Many new stars, some of them very massive, are forming in the star cluster NGC 1929, which is embedded in the nebula N44. The massive stars produce intense radiation, expel matter at high speeds, and race through their evolution to explode as supernovas. The winds and supernova shock waves carve out huge cavities called superbubbles in the surrounding gas. X-rays from Chandra (blue) show hot regions created by these winds and shocks, while infrared data from Spitzer (red) outline where the dust and cooler gas are found. Optical light from MPG/ESO (yellow) shows where radiation from young stars is causing gas in N44 to glow.

## July 2013

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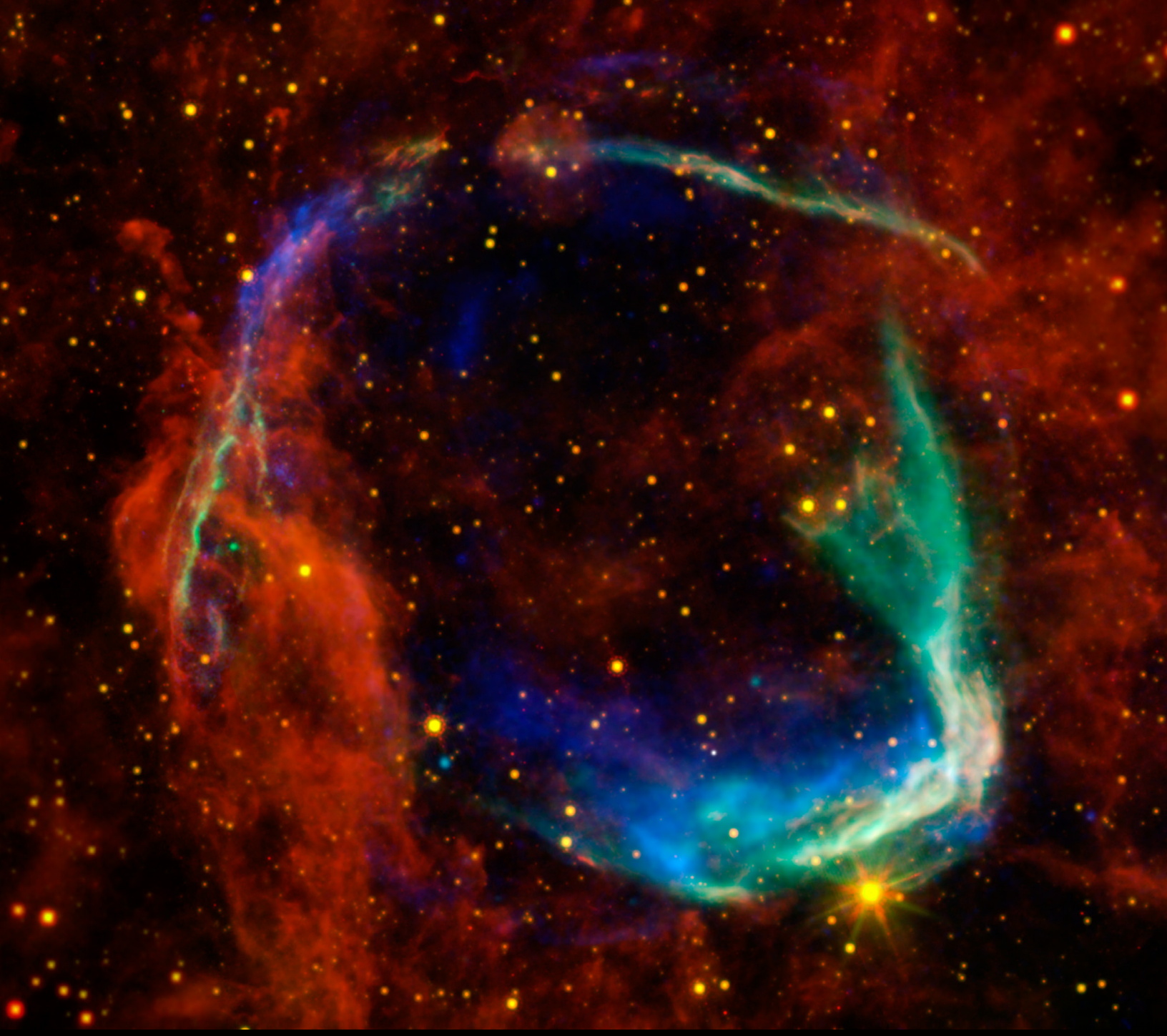

## RCW 86

A supernova at the location in the sky of RCW 86 was witnessed by Chinese astronomers in 185 A.D.. Data from four space telescopes were combined to determine the type of stellar explosion that pro duced the supernova remnant RCW 86. X-ray data from Chandra and XMM-Newton (blue and green) showed that the remnant con tains a large amount of iron, pointing toward the explosion of a white dwarf star that became unstable, and infrared data from Spitzer and WISE (yellow and red) showed that the star exploded in a nearly empty region of space, accounting for the large diameter (85 light years) of the remnant.

## August 2013

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## Cygnus OB2

The Milky Way and other galaxies in the Universe harbor many young clusters and associations that each contain hundreds to thou sands of hot, massive, young stars known as O and B stars. The star cluster Cygnus OB2 contains about 2,000 of these stars at a relatively nearby distance to Earth of about 5,000 light years. Chan dra observations have helped to find the young stars in the dusty en vironment of the cluster, and provided evidence for a range of ages for the stars (two million to five million years). In this image, X-rays from Chandra (blue) have been combined with Spitzer data (red) and optical emission (orange).

## September 2013

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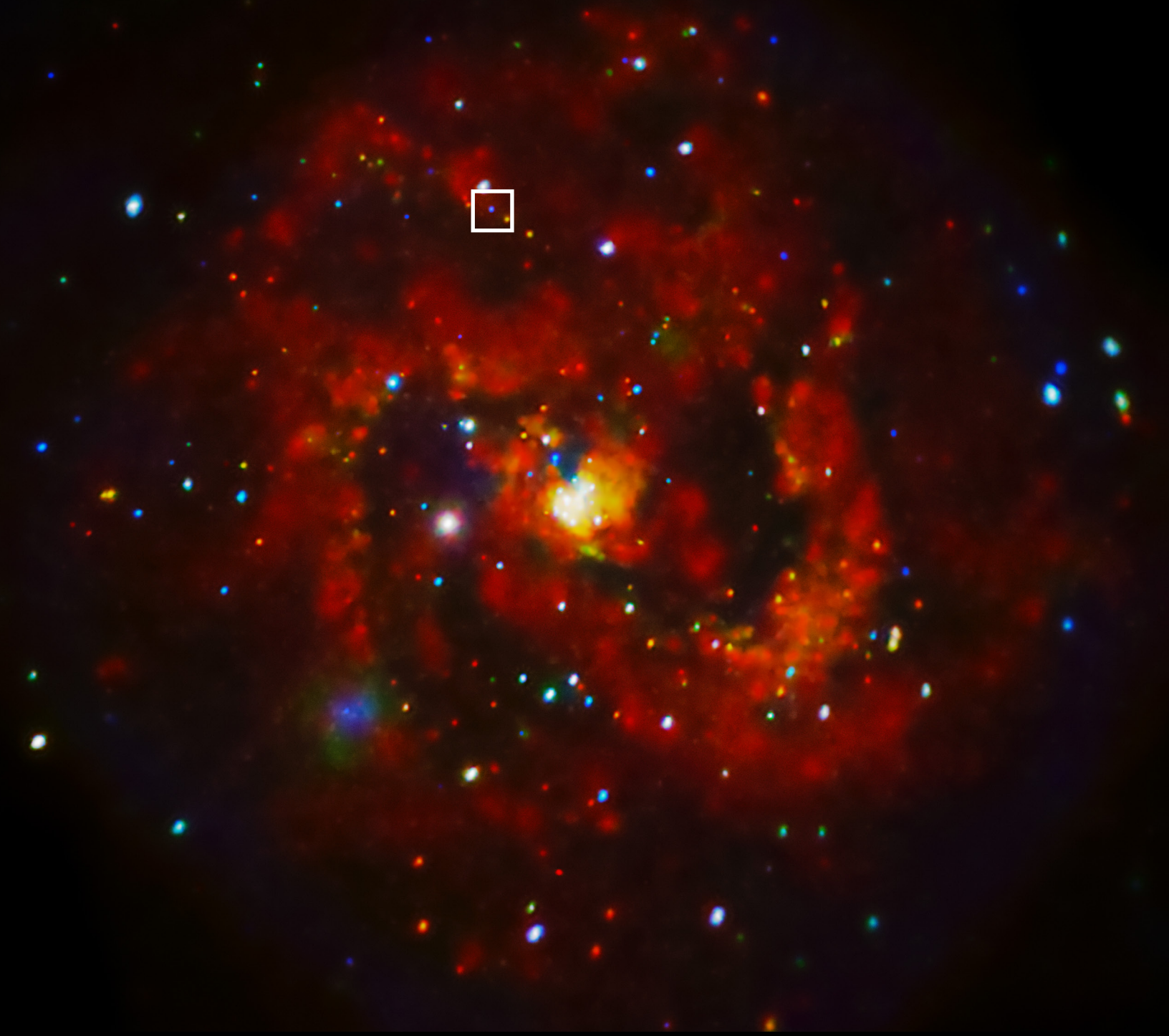

## M83

In 1957, a supernova was discovered in the spiral galaxy M83. Since then, astronomers have been able to detect the debris of the explo sion, known as SN 1957D, in both radio and optical wavelengths. However, until a long observation with Chandra—totaling nearly 8 and ½ days of time—astronomers were not able to detect X-rays from the remnant. The new X-ray data from Chandra suggest that SN 1957D contains a rapidly rotating neutron star, or pulsar. If con firmed, it would be one of the youngest known pulsars. The super nova is the blue X-ray source in the middle of the box.

## October 2013

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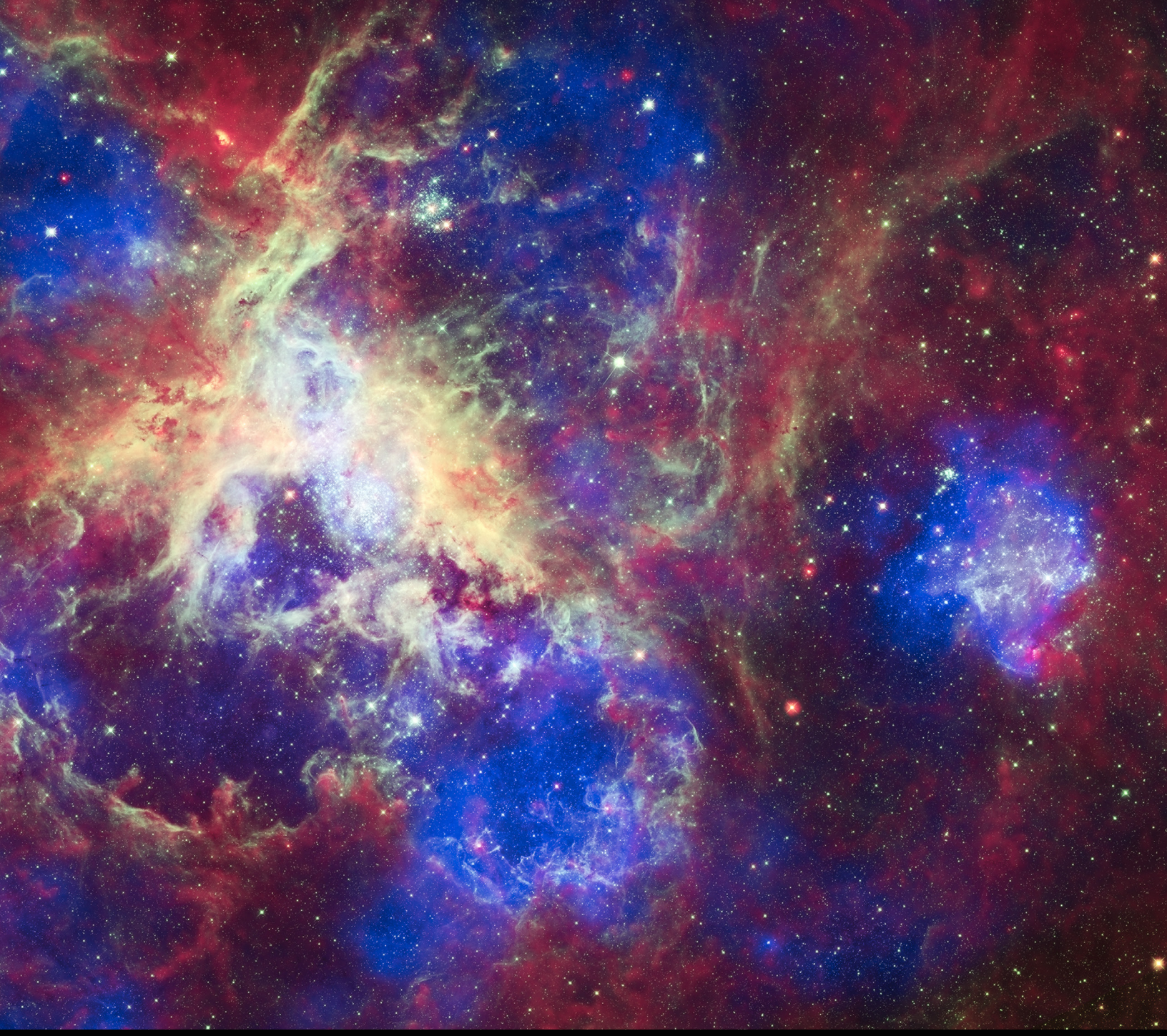

## 30 Doradus

Located 160,000 light years away in the Large Magellanic Cloud, a satellite galaxy of the Milky Way, 30 Doradus is one of the largest star-forming regions close to our galaxy. This composite of 30 Dora dus (a.k.a., the Tarantula Nebula) contains data from Chandra (blue), Hubble (green), and Spitzer (red). At the center of 30 Doradus, thou sands of massive stars are blowing off material and producing in tense radiation along with powerful winds. Chandra detects gas that has been heated to millions of degrees by these stellar winds and also by supernova explosions. The X-rays come from shock fronts, similar to sonic booms, formed by this high-energy stellar activity.

## November 2013

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## Musket Ball

A composite image of the 700 million year old “Musket Ball” cluster shows how hot gas has been wrenched apart from dark matter in a collision between clusters containing thousands of galaxies. This separation occurs because dark matter, unlike the particles of hot gas, is essentially frictionless. It has been observed in a few other clusters and is the most direct proof yet of the existence of dark mat ter. Chandra detects the normal matter as hot gas (red-purple), while optical emission from several telescopes reveals the presence of dark matter through the effect of gravitational lensing (blue). Hubble optical data also show galaxies which appear yellow and white.

## December 2013

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