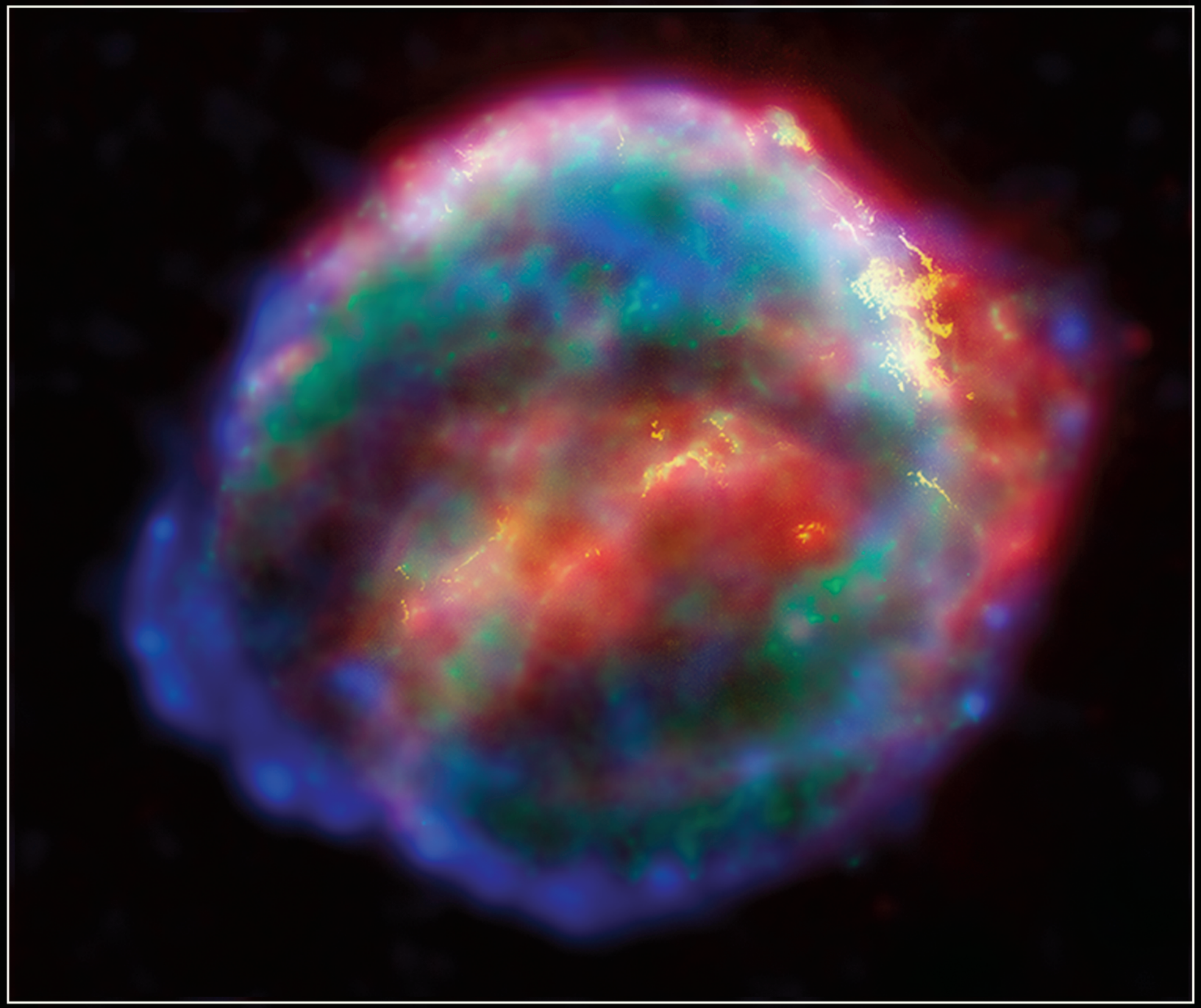
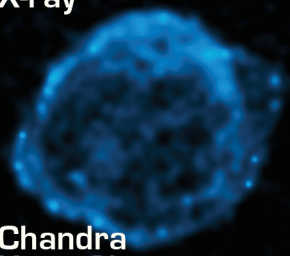
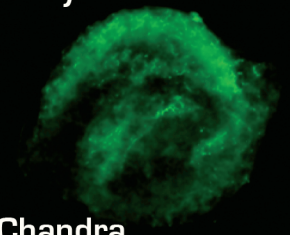


X-ray



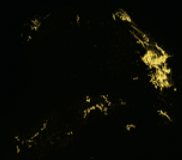
Chandra
X-ray Observatory

X-ray



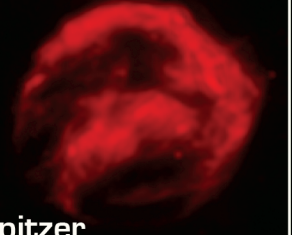
Chandra
X-ray Observatory

Visible



Hubble
Space Telescope

Infrared



Spitzer
Space Telescope

Kepler's Supernova Remnant • SN 1604

NASA, ESA / JPL-Caltech /
R. Sankrit & W. Blair
(Johns Hopkins University)

SPITZER SPACE TELESCOPE

Kepler's Supernova Remnant • SN 1604

Four hundred years ago, sky-watchers were startled by the sudden appearance of a "new star" in the western sky. The famous astronomer Johannes Kepler, best known for his empirical laws of planetary motion, undertook a systematic study of this remarkable object. It is known today that the appearance of this object was caused by the catastrophic explosion of a star, an event called a supernova. Now, astronomers using NASA's three Great Observatories are unraveling the mysteries of the expanding remains of Kepler's supernova.

Johannes Kepler (1571-1630)

When this "new star" appeared alongside Jupiter, Mars, and Saturn on Oct. 9, 1604, astronomers could use only their eyes to study it. The telescope would not be invented for another four years. Modern-day astronomers, however, have the combined abilities of the Spitzer Space Telescope, the Hubble Space Telescope, and the Chandra X-ray Observatory at their disposal.

The combined image unveils a bubble-shaped shroud of gas and dust that is 14 light-years wide and is expanding at 4 million miles per hour (2,000 kilometers per second). Observations from each of the Great Observatories highlight distinct features of the supernova remnant, which is a fast-moving shell of iron-rich material from the exploded star surrounded by an expanding shock wave that is sweeping up interstellar gas and dust.

Visible-light images from Hubble reveal where the supernova shock wave is slamming into the densest regions of surrounding gas. The bright glowing knots are dense clumps that form from instabilities in the wake of the shock front as it plows into material lost from the progenitor star earlier in its lifetime before the supernova event.

Spitzer was used to probe material that radiates in infrared light. These observations show microscopic dust particles that have been swept up and heated by the supernova shock wave. Hubble sees only the brightest, densest regions, but Spitzer is sensitive enough to detect the entire expanding spherical cloud of material.

X-ray observations from Chandra show regions containing very hot gas. The hottest gas is primarily located directly behind the shock front. These regions also show up in the Hubble observations, and align with the faint rim of glowing material seen in the Spitzer image. Cooler gas resides in a thick interior shell and emits X-rays that mark the location of heated material expelled from the exploded star.

This broad study of Kepler's supernova remnant will help astronomers identify the type of star that produced the explosion. Supernovae arise from two very different types of stars: low-mass white dwarf stars and massive stars. Of the six known supernovae in our Milky Way Galaxy over the last 1,000 years, Kepler's supernova is the only one for which astronomers are still uncertain of the type of star that exploded.

NASA's Jet Propulsion Laboratory manages the Spitzer Space Telescope mission for NASA's Science Mission Directorate, Washington, D.C. JPL is a division of Caltech. For more information about Spitzer visit http://www.spitzer.caltech.edu.