Shocks in the Cygnus Loop supernovae remnant

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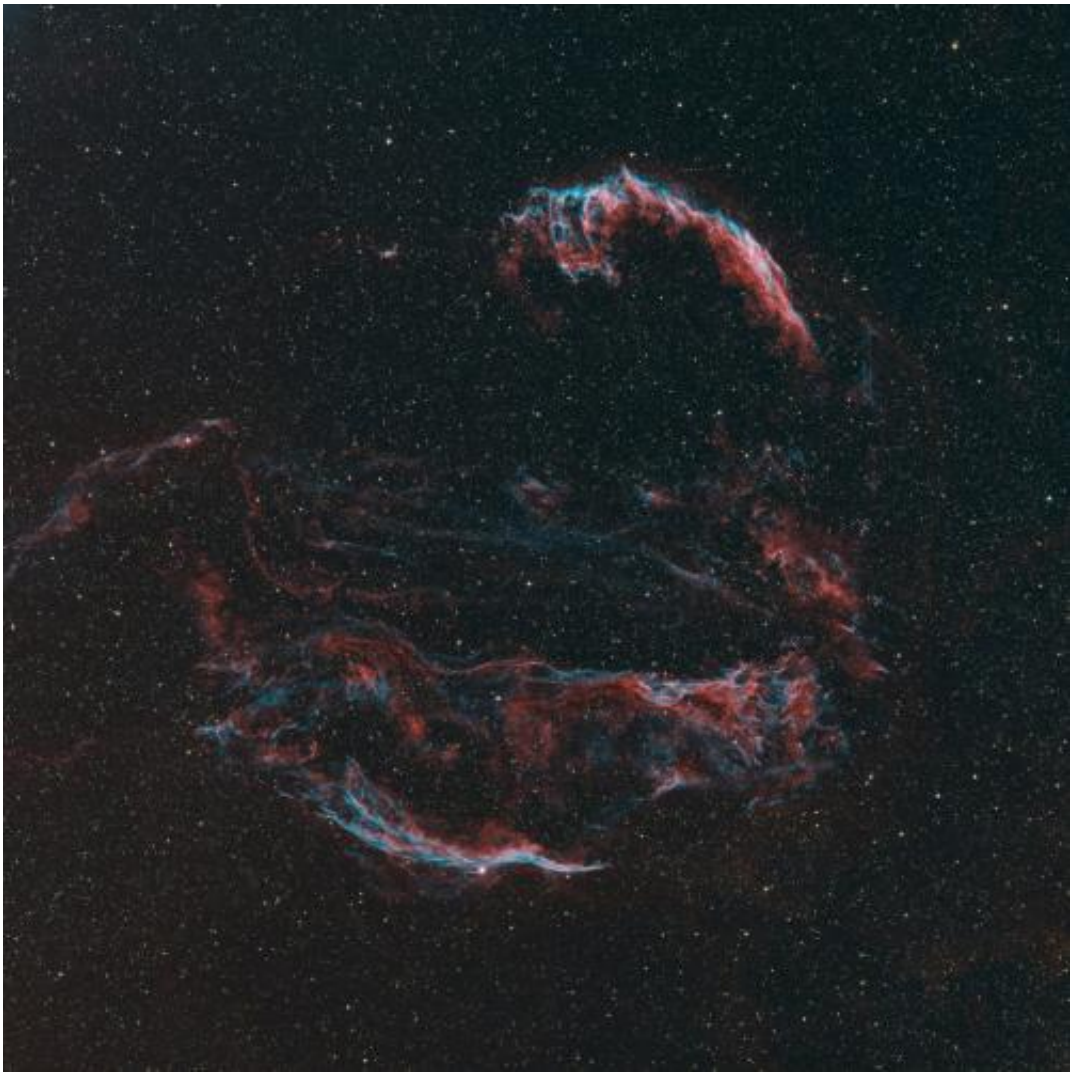

An optical image of the Cygnus Loop. Astronomers used the infrared spectrometer on the Spitzer Space P\Telescope to measure the properties of the shock producing this dramatic loop and the dust and gas associated with it. Credit: Martin Pugh

(Phys.org) —Supernova remnants (SNRs) play a vital role in the lifecycle of dust in the interstellar medium. As shockwaves from supernovae sweep up interstellar material, they heat the gas and dust, and destroy a significant fraction of the grains, releasing refractory elements back into the gas phase. The shock-heated dust emits strongly at infrared wavelengths where many atomic and molecular species emit diagnostically useful lines. Thus, infrared observations of SNR shocks are crucial for studying shock properties.

Most SNRs in the galaxy are obscured by dust and cannot be easily detected at ultraviolet or even optical wavelengths. In these cases, infrared emission offers the primary way to study the radiative shocks.The Cygnus Loop, a middle-aged remnant, is an ideal object for the study. It is bright and relatively nearby (about 1800 light-years away). The Cygnus Loop, so-called because of its dramatic optical appearance, exhibits a classical "shell" morphology and contains a rich set of shock excited emission lines across a broad wavelength range.

he proximity of the Cygnus Loop allows careful modeling of the shock diagnostic infrared lines in considerable detail. CfA astronomers John Raymond and Terrance Gaetz, along with their colleagues, used the infrared spectrometer on the Spitzer Space Telescope to examine the shocks here, and report finding a lack of dust emission, at least in the range they examined,presumably because the shocks destroyed the small grains that contribute at these wavelengths. By combining the IR spectrum some optical and UV spectra, they find among other details that the shock speed is about 150 km/sec and the age of the Loop is about 1000 years.

More information: "Spitzer IRS Observations of the XA Region in the Cygnus Loop Supernova Remnant," Ravi Sankrit, John C. Raymond

Manuel Bautista3, Terrance J. Gaetz, Brian J. Williams, William P. Blair, Kazimierz J. Borkowski, and Knox S. Long, *ApJ* 787, 3, 2014. arxiv.org/abs/1403.3676