# Searching for bound supernova remnants

When a white dwarf explodes in a supernova, it may leave behind a bound remnant that is expelled with a large velocity. Supernovae that involve white dwarfs are classified as Type Ia supernovae. These cataclysmic events are standard candles used to measure cosmological distances and measure the age of the universe. We know that these types of supernovae are caused by the thermonuclear disruption of a white dwarf whose mass has reached the Chandrasekhar limit of 1.4 solar masses, the maximum mass of a white dwarf star. However, we know very little of the evolutionary paths leading to these explosions. A subclass of Type Ia supernovae are the subluminous Type Ia supernovae and these are predicted to leave behind a remnant of the exploding white dwarf. Only a handful of these remnants have been found.

**Research Field**
Stellar astrophysics

**Project Suitability**
PhD
Honours

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The aim of this project will be to search for bound remnants and to study the properties of these stars. These surviving stars can be identified first by their peculiar Galactic motion and also their unusual physical characteristics, such a very low mass and an atmosphere without hydrogen or helium. As part of this project you will measure the stars' motion through the Milky Way and retrace its past motion to identify the position of the supernova event. You will also analyse spectroscopic and photometric data to determine the bound remnants' properties such as the temperature, mass and atmospheric composition using the latest model atmosphere and spectral syntheses codes.

This project will exploit the data from the orbital observatory Gaia that is measuring accurate positions, distances and velocities of over a 100 million stars in the Milky Way. The project will also involve observations obtained using the 4m to 8m optical telescopes of the European Southern Observatory (ESO) that is located in the Chilean Atacama desert and which provides the best observing conditions on Earth. These telescopes are equipped with state-of-the-art instruments covering a vast range of the electromagnetic spectrum from the near ultraviolet and optical to the infrared. Therefore, ESO and Gaia provide the ideal tools that are needed to carry out detailed studies of white dwarf stars, including bound remnants of supernova explosions.

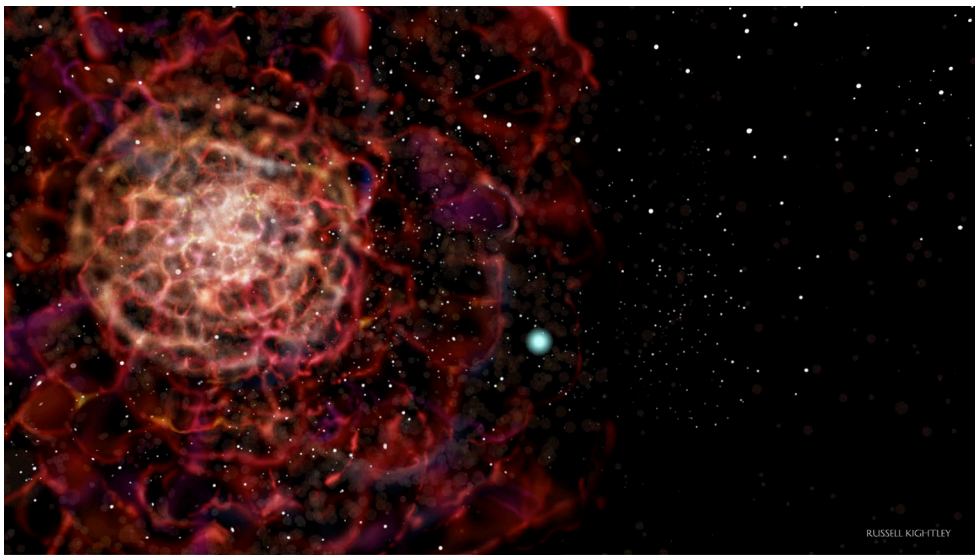


Figure 1: Artistic view of the remnant of a supernova explosion (Copyright Russell Kightley ((http://scientific.pictures), used with permission.