# The cosmic burp of dying stars

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The mysteries of the Universe and how we came to be are set to be unlocked by a technique for modelling fluids, similar to one which is becoming increasingly popular within the film industry to improve the realism of special effects.

Theoretical Astrophysics student, Fergus Wilson from the University of Leicester, is currently utilising a fluid modelling technique within his doctoral research to enable investigation of the mass transfer from one star to another in a binary star system.

Smoothed Particle Hydrodynamics (SPH) is a computational method for modelling fluid as a set of moving particles and can be used to solve the equations of motion between two or more particles. A similar technique has been used to enhance the special effects in blockbuster Hollywood movies such as Tomb Raider and The Matrix Reloaded.

Mr Wilson uses the SPH method to model the explosive eruptions of dying stars to provide vital clues to the current accelerated expansion of the Universe. Preliminary results from the study will be showcased at the University of Leicester's Festival of Postgraduate Research on 24 June.

Mr Wilson's research focuses on Type Ia supernovae, which occur when White Dwarf stars explode upon reaching a critical mass. His simulations model the formation of discs around accreting stars within a binary star system.

Mr Wilson commented:

"Transferred material from one star in the binary system will form a disc with some of it 'gobbled up' by the accreting star. The accreting star then blows off some of this 'gobbled up' material when the pressure becomes too large. This material forms a blast wave and is blown off into the remainder of the disc. How much of the original accreted mass remains on the accreting star will determine how much mass the accreting star will gain or lose during this process. If the accreting star continues to gain mass it will reach a critical limit and the whole star will explode and a supernova will occur.

"All Type Ia supernovae have the same characteristic luminosity which makes them ideal for measuring astronomical distances. They are used as standard candles by astronomers to determine the distance of celestial objects and have allowed astronomers to measure the distances to galaxies at the edge of the known Universe, providing vital clues into the rate the Universe is expanding.

"Clearly understanding how Type Ia supernovae work is of fundamental importance in the quest of understanding how the Universe works as astronomical distances can be measured which are crucial to understanding the fate of the Universe."

His simulations investigate the different effects the wind speed and rotation of the 'mass feeding' stars will have on the disc size and how the energy in the blast waves effects the disc disruption to aid understanding of the process which will hopefully lead to future technological advancements.

"There are also more worldly applications to SPH. It is ideally suited to modelling fluid flow in a variety of situations such as airflow over a car or plane and pyro flows through buildings. There are therefore areas of overlap between the numerical methods employed in astrophysics and situations of more industrial and commercial interest, and vice versa."

Fergus Wilson will be presenting his research to the public at the University of Leicester on June 24. The Festival of Postgraduate Research introduces employers and the public to the next generation of innovators and cutting-edge researchers, and gives postgraduate researchers the opportunity to explain the real world implications of their research to a wide ranging audience.

Provided by University of Leicester