

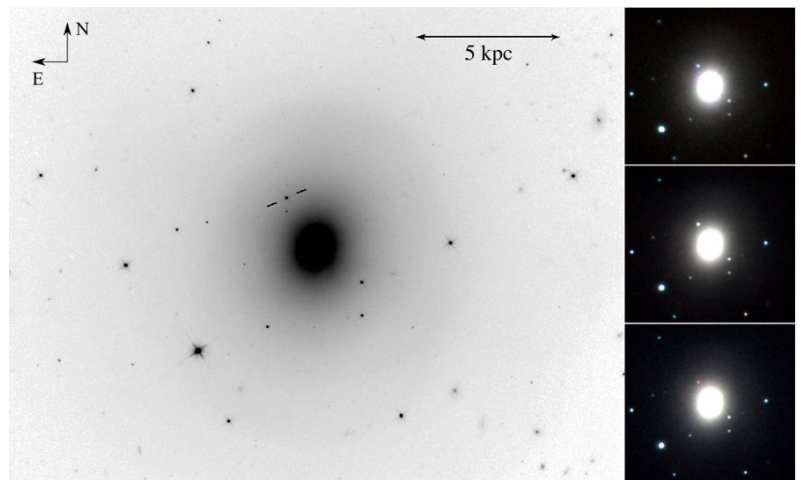
Multi-messenger astrophysics

- Addressing fundamental questions, such as the origin of heavy elements.
- Using data from the world's premier observatories.
- Rapidly growing area of astrophysics, in which Leicester group is amongst the pioneers.

Level	PhD
First Supervisor	Nial Tanvir
Second Supervisor	Rhaana Starling
Application Closing Date	19 January 2022
PhD Start date:	26 September 2022

Project Details:

Binaries consisting of two neutron stars or a neutron star and a black hole, will eventually merge due to orbital decay through the emission of gravitational radiation. The mergers themselves release vast amounts of energy, which is thought in some cases to lead to the production of short-duration gamma-ray bursts. They also expel highly radioactive neutron-rich nuclei, which will decay to form the stable r-process elements (such as gold and platinum), while powering an explosion known as a kilonova. Finally, these systems, as they merge, produce gravitational waves that can be detected using the current generation of terrestrial detectors.



Kilonova associated with GW170817 in NGC4993

In Leicester we have long been at the forefront of the transient astrophysics field, and have led successful observational and theoretical campaigns to advance the understanding of binary mergers including making the first kilonova discovery in 2013, and being centrally involved in the discovery of the first electromagnetic counterparts to the neutron star binary merger, GW170817. The student will benefit from working in the lively astrophysical transients group in Leicester, and from interactions with other astronomers in our extensive global networks, including the large ENGRAVE collaboration, giving access to data from the world's premier telescopes.

The project will involve searches for and characterisation of future kilonovae and the relativistic jets found accompanying gravitational wave detectors or short-duration gamma-ray bursts, and may extend to simulating observations with future facilities. Some experience of computer coding will be helpful, while the student will be trained in necessary data analysis techniques.

References:

- 1 [Tanvir et al. 2013 Nature 500 547](#)
- 2 [Tanvir et al. 2017 ApJ 848 L27](#)
- 3 [Evans et al. 2017 Science 358 1565](#)
- 4 [Abbott et al. 2017 ApJ 848 L12](#)

