Project Description

Accretion discs are central to much of astronomy: they are the birth sites of stars and planets, and they surround supermassive black holes in active galaxies and quasars. These discs form when gas moves on orbits in the gravity field of a star or black hole, balancing the central gravitational pull with the centrifugal effect of rotation.

Angular momentum is transported outwards by a viscosity, allowing most of the gas to spiral inwards. This process turns gravitational potential energy into light, and is the most efficient way of extracting energy from ordinary matter. In some systems this can be observed across much of the entire visible Universe. Supermassive black hole accretion can outshine galaxies and significantly affect the hole’s surroundings through energy and momentum feedback.

When we observe these systems they always show complex time variability, and our theoretical models are now starting to produce plausible mechanisms to explain these phenomena. We will use state-of-the-art computational fluid dynamic modelling on high performance computing facilities (HPC) to create sophisticated models of astrophysical fluid flows. Motivated by observations, we will target these simulations at explaining unsolved problems in astrophysics.

As the project develops we can connect these simulations with observed data sets, or focus on code development to enable and perform simulations with unprecedented detail and new physics. There are a wide range of possible applications that could be investigated, for example the interaction of dust and gas in planet-forming discs with the aim of learning more about how worlds are constructed in nature, or simulating chaotic gas flows around supermassive black holes in galaxy centres to understand the processes which shape galaxies in our Universe.

References

Simulations of dynamic discs

Two examples of simulations of dynamic discs in astronomy. The left hand image is a disc around a spinning black hole. The black hole warps the disc, and the forces are so strong that the disc breaks apart into discrete rings. The right hand image shows a disc in a binary system. The disc becomes warped and eccentric, allowing significant mass transfer to the other star in the binary system.

Application Instructions

When applying, please ensure we have received all of the following required documents by Wednesday 29th January 2020:

- Submit an online application form [https://le.ac.uk/study/research-degrees/funded-opportunities/stfc-studentships](https://le.ac.uk/study/research-degrees/funded-opportunities/stfc-studentships)
- 2 academic references
- STFC Research Interests Form
- CV
- Undergraduate transcripts
  - If you have completed your undergraduate degree, we will also require your undergraduate degree certificate
  - If you have completed a postgraduate degree, we will also require your transcripts and degree certificate

If we do not have the required documents by the closing date, your application may not be considered for the studentship.