

# ICHEC Research Proposal



## **Relativistic Shock Acceleration In A Fully Turbulent Magnetic Field**

Principal Investigator: Prof. Peter Duffy, UCD School Of Physics

The basis for this research project is the physics behind relativistic outflows from compact objects ranging from galactic micro-quasars, with masses of order a stellar mass, to the cores of active galactic nuclei which are up to nine orders of magnitude more massive. Observations (in radio, X-ray and gamma-ray wavelengths) of these systems raise some of the most fundamental questions in high energy astrophysics such as the accretion-ejection connection and the role played by high lorentz factor, non-thermal particles. Such questions are addressed, both analytically and computationally, using the principles of plasma astrophysics and the hydrodynamics of relativistic outflows. The particular hypothesis under investigation and the main aims of this project are to investigate the production and acceleration of highly energetic particles in fully turbulent magnetic fields at relativistic shock fronts. These issues are crucial to the overall problem of relativistic jet outflows in astrophysics and will play an important role in the next generation of radio (LOFAR, ALMA) and TeV gamma ray telescopes. This research forms part of the collaboration between the UCD team led by Prof Peter Duffy and Prof Katherine Blundell of Oxford University. The outcome, from production runs using ICHEC machines, will be two papers submitted to leading peer-reviewed journals.