Title: Space Weather extremes and the acceleration of the Earth’s radiation belts

Supervisors: Dr R. T. Desai (enquiries: ravindra.desai@warwick.ac.uk); Dr S. Glauert (BAS, Cambridge)  
www.warwick.ac.uk/go/cfsa/people/desai  
www.bas.ac.uk/profile/sagl

Research Centre: The Centre for Fusion, Space and Astrophysics (CFSA) focuses on plasma physics applied to the grand challenges of fusion power, space physics, solar physics, and astrophysics. Our work spans fundamental theory, observation, and the analysis of experimental data, combined with high performance computing. For more details of the CFSA see www.warwick.ac.uk/go/cfsa.

Project Description:
Space Weather is rapidly growing in importance, due to the increasing number of satellites launched and with human spaceflights once again being planned to the moon and beyond. Central to space weather are the Van Allen radiation belts which consist of intense fluxes of relativistic electrons and protons trapped by the Earth’s magnetic field. Fluxes within these radiation belts can increase through orders of magnitude in response to solar activity and thus form a primary hazard to orbiting satellites and astronauts. Analogous radiation belts at Saturn and Jupiter, and synchrotron emission from beyond our solar system, also demonstrate the universality of the underlying acceleration processes across the observable universe.

This project will combine differing plasma theories to holistically model the response of the Earth’s radiation belts to the most extreme events observed across the Space Age, as well as upcoming events within solar cycle 25. Specific areas of interest include: how particles can be rapidly injected into the magnetosphere and accelerated to relativistic energies; how global magnetospheric waves drive particle transport; and also how external radiation sources are shielded by the magnetosphere.

The project will collaborate with the world-leading British Antarctic Survey Radiation Belt Model, Cambridge, implemented at the UK MET Office, and further potential exists for travelling and collaborating with advanced magnetospheric models in the USA.

Visualisation of the Van Allen radiation belts: Credit NASA