CENTRE FOR SPACE PHYSICS

FACULTY OF SCIENCE AND INFORMATION TECHNOLOGY

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

OVERVIEW

The Earth lives in the Sun's outer atmosphere. The properties of our environment are therefore controlled by the dynamic interaction between the Earth's magnetic field with the solar wind, and the connection to the underlying atmosphere. Solar disturbances result in magnetic storms that drive space weather. These can have catastrophic effects on modern technology, including spacecraft operations, communications, GPS navigation, radar surveillance and remote sensing.

The Centre for Space Physics is Australia's leading group for the study of the near-Earth space environment. The Centre's strong international reputation means that it collaborates closely with many leading overseas agencies, and graduates find employment there or in a variety of high level sectors in Australia.

OBJECTIVES

Research in the Centre for Space Physics aims to improve our understanding of space weather processes using observations to support theoretical modelling. Specific projects focus on particular problems of practical concern. For example, about $200billion of spacecraft alone are affected by space weather, and space weather related effects are of concern to the aeronautical, geophysical exploration, communication, navigation, defence, and a variety of other communities.

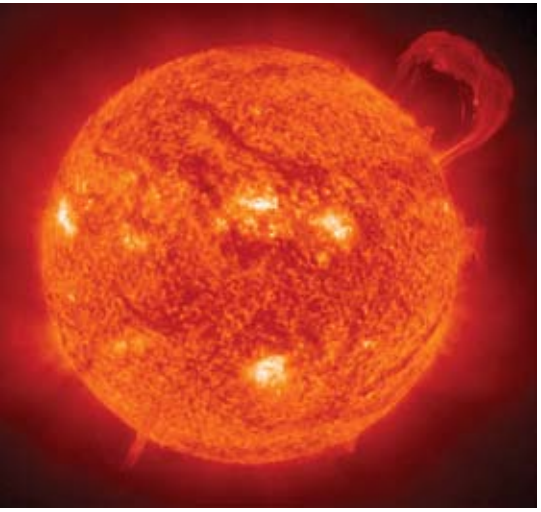
RESEARCH SUPPORT

The Centre has instruments operating in Australia and Antarctica, including magnetometers (to measure currents originating in space) and over-the-horizon radars (to measure effects in the ionosphere).

The global nature of the phenomena we study means that the Centre obtains data from, and contributes to, a wide variety of international programs, including from NASA, European Space Agency, National, Oceanic and Atmospheric Administration (USA) and Japan Aerospace Exploration Agency satellites.

EXTERNAL COLLABORATORS

- Australian Antarctic Division
- La Trobe University, Victoria
- IPS Radio and Space Services, Bureau of Meteorology, Australia
- University of Adelaide
- University of Sydney
- DSTO, Department of Defence
- Japan Aerospace Exploration Agency
- National Institute of Polar Research, Japan
- Kyushu University, Japan
- Nagoya University, Japan
- University of Alberta, Canada
- British Antarctic Survey, UK
- Institute of Geophysics, UCLA
- Finnish Meteorological Institute
- Space Science Lab., UC Berkeley
- Space Weather Prediction Centre, NOAA, Colorado
- University of Iowa, USA
- Polar Research Institute of China
- Applied Physics Laboratory, Johns Hopkins University, Baltimore, USA
- Otago University, New Zealand
- Antarctica New Zealand
- University of Minnesota, USA



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EXAMPLES OF CURRENT PROJECTS

Extremely high energy particles collect in the radiation belts surrounding the Earth through largely unknown mechanisms. We are studying the role of plasma waves in these processes.

The Iridium constellation of satellites is used to look at the energy input to the ionosphere and to the lower atmosphere.

Australian gas pipeline corrosion is being studied in relation to space weather using magnetometer data and modelling.

Perturbations in near-Earth space caused by ULF plasma waves may affect GPS, surveillance and radio astronomy systems. These are under study using a variety of observations and modeling approaches. With La Trobe University, the Centre operates two HF research radars in Tasmania and New Zealand to measure effects of auroras and other processes on the ionosphere.

RESEARCH OUTCOMES

Over the past five years the Centre has attracted $2.8M in research funding and contributed to over 100 refereed publications. Six Research Higher Degree students and six research postdocs were involved in Centre projects, including in Antarctica. The Centre developed a magnetometer payload that was flown on FedSat, Australia's most successful spacecraft, over 2001 – 2005.

RESEARCH TOPICS

- Ultra-low frequency (ULF) waves in the Earth's magnetosphere.
- Radar studies of ULF waves in the ionosphere.
- Ion cyclotron waves and particle loss in the magnetosphere.
- Remote sensing the magnetosphere and ionosphere
- Interplanetary Magnetic Field control of field-aligned currents
- ULF waves and radiation belt particles
- Magnetic topology using ULF waves observed in Antarctica

GROUP MEMBERS

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