Report of July 2011 Meeting
Royal Society
Southern Highlands Branch

Speaker: Dr Marc Duldig
President of the Australian Institute of Physics

Topic: Who Cares About the Weather in Space?

Space weather is the name given to variations in the physical and the radiation environment in the near Earth space and the consequences of those variations. The consequences of these variations can be dramatic and have significant economic impact.

Significant observations of the effects of space weather include, but are not limited to, electricity grid disruption, telecommunication disruption, and increased pipeline joint corrosion. In regard to satellites, memory failure, surface charging, solar cell degradation and increased atmospheric drag are obvious effects. Navigation disruption has also been observed, as has increased aircraft passenger radiation exposure, astronaut radiation hazards and the benign and beautiful aurorae.

It is clear that many of these effects have significant economic impact, making reliable forecasting of space weather storms highly desirable. Dr Duldig said that although the quality of space weather predictions has improved dramatically over the past decade, much still needs to be done. Australia has a significant role to play in both space weather research and prediction. Instruments at the Australian Antarctic bases, at Macquarie Island, in Tasmania, mainland Australia and its offshore smaller islands are essential to space weather research and prediction.

Dr Duldig said that to understand space weather, it is first necessary to understand the processes generating the high-speed solar plasma and its embedded magnetic field. He described the solar wind as plasma at very high temperature with an average radial speed of 400 km/s, although this speed shows huge variations in the range 250-800 km/s. During severe solar eruptive events, the speed can exceed 2000 km/s. This solar plasma affects the earth's magnetic field, and also affects near-earth radiation levels.

A particularly dramatic demonstration of the effects of a coronal mass ejection on earth's atmosphere occurred on 13 March 1989, as a result of a coronal mass ejection which had occurred three and a half days earlier. Variations in the earth's magnetic field on that occasion caused a massive power generation disruption in Canada, the blackout lasting nine hours. It was accompanied by extremely intense aurorae at the poles.

Marc Duldig concluded his lecture with wide-ranging comments on the particular significance of space weather for Australia. Because of our geographic isolation, we are heavily reliant on satellite technology, a dependence which can only increase into the future. Evidence is mounting that the space era may have been an unusually quiet time for space weather activity, and that a greater level of disruption may be possible in the future.

It is in our national interest to develop a space weather strategy that optimizes national research, ensures rapid distribution of observational data for space weather forecasting and develops appropriate forecast warning procedures for industry and government use.

Marc's lecture was very much appreciated by the 45 person audience, who requested him to return to the Southern Highlands for another lecture on this fascinating topic.

Anne Wood