ΓΕΝΙΚΟ ΣΕΜΙΝΑΡΙΟ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ

PHYSICS COLLOQUIUM

Thursday, 10 December 2009
17:00-18:00

3rd Floor Seminar Room

"Analysis and Interpretation of Plasma, Particle and Magnetic Field Measurements by ESA/NASA Space Missions"

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Abstract

Basic principles of plasma physics are introduced: definition and characteristic parameters of a plasma, plasmas in space, energetic particle motions in electromagnetic fields with emphasis on magnetic bottles, magnetic field convection and diffusion in the context of Magnetohydrodynamics, plasma waves and instabilities. Solar, Heliospheric and Magnetospheric Space Plasma Physics is then introduced: what is the solar wind, why the Interplanetary Magnetic Field (IMF) lines are shaped in Archimedean spirals, Solar eruptions in terms of Flares and Mass Ejections from the solar corona (CMEs) and acceleration of Solar Energetic Particles (SEPs), what is a Corotating Interaction Region (CIR) and how it forms in space, Cosmic rays and associated Forbush decreases (FDs) and Ground Level Events (GLEs), the formation of the Earth's magnetosphere, the aurora, and main models for substorm initiation. After a description of the relevant ESA/NASA space missions, research results are presented: SEP intensities and their angular distributions measured in and out of the ecliptic plane are utilized as diagnostics of the large-scale structure and topology of the IMF embedded within Interplanetary CMEs. Scenarios in terms of open and/or closed magnetic field topologies consistent with the observations are discussed. The study of unique observations obtained during the recent extreme solar events is then presented. The elemental composition particle signatures are used in order to discriminate between SEPs accelerated by CMEs and CIR-accelerated particles. The nature of particle propagation over the poles of the Sun is also assessed. Ongoing research: CIR-accelerated particles using multi-s/c observations during the recent very low solar activity period, Forbush Decrease effects observed by neutron monitors during extreme solar events and plasma, wave and magnetic field signatures by THEMIS during substorms. Advances in SEP research in the context of data obtained by future missions e.g. Solar Orbiter in which I participate as a Co-I, are also discussed.