SPACE PHYSICS AND SOLAR-TERRESTRIAL COUPLING

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Lecturers: Raffaele MARINO, Christophe CORRE

| Lecturers : 26.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 6.0 | Project : 0.0 | Language : AN

Objectives

Aerospace engineering concerns the development of technologies for atmosphere and space. The design of vehicles, launch systems and payloads cannot thus disregard a deep understanding of such operational environments. The main purpose of this class is to provide a detailed description of the physics of the interplanetary space and of the outermost layers of the Earth's atmosphere, as well as to describe the coupling between solar activity and Earth's dynamics.
The interplanetary medium and the upper atmosphere are in the plasma state and they both develop a strong turbulent character. Theory and modeling of space plasmas and anisotropic turbulence will be proposed here,

Keywords : space plasmas; solar wind turbulence; stratosphere, mesosphere and ionosphere; solar-terrestrial coupling; space weather; space and atmospheric missions; numerical modeling.

Programme

- The Sun and the heliosphere: introductory space physics.
- First space explorations, mission design, in-situ and remote sensing observations.
- Space plasmas: main models for the description of plasmas, magnetohydrodynamic turbulence.
- Notions on statistical data analysis and numerical simulations.
- Solar wind: physical properties and turbulence.
- Plasma instruments, spacecraft measurements and orbital parameters, research articles on space physics.
- Solar-terrestrial coupling: Earth's environment, dynamics of stratosphere, mesosphere

Learning outcomes

- Gain extensive knowledge on space plasma physics and turbulence in the interplanetary medium.
- Understanding dynamics of mid/upper atmosphere and the coupling with the solar activity and the solar wind.
- Acquiring competencies on tools and technologies in space and atmospheric research (space missions, balloon-borne experiments, numerical models, etc.).
- Being able to identify key aspects and major results in a research article, as well as learning how to do a bibliographic search.

Independent study

Objectifs : Study of scientific articles focusing one of the subjects of the class, or development of short scientific projects.

Méhodes : Articles/projects will be assigned to singles or groups of students and a final report will be produced.

Core texts

M.G. Kivelson, C.T. Russell, *INTRODUCTION TO SPACE PHYSICS*, Cambridge University Press, 1995
M. Moldwin *AN INTRODUCTION TO SPACE WEATHER*, Cambridge University Press, 2008

Assessment

Final grade = 70% knowledge grade, 30% know-how grade
Knowledge grade = 100% exam grade
Know-how grade = 100% project grade