Dottorato di Ricerca in Fisica dell'Università degli Studi di Messina

11 Dicembre 2012, ore 15.00, Aula E. Majorana,
Dip.to di Fisica e Scienze della Terra,
V.le F. Stagno d'Alcontres 31, S. Agata, Messina

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Seminar title:

Spontaneously occurring helical states: a new paradigm for magnetically confined fusion plasmas

Abstract

The research on magnetically confined plasmas for controlled nuclear fusion sees Italy deeply involved in the European Fusion Programme with two experiments, one of which is the RFX-mod device operating in Padova. This research is now entering a new phase with the construction of the ITER experiment, which will demonstrate the possibility of obtaining a positive energy balance and will integrate all the tecnologies required for the fusion reactor.

This seminar is intended to give a brief introduction to the different types of magnetic field configuration used to confine fusion-relevant plasmas, and then to show recent developments concerning the Reversed Field Pinch (RFP) configuration, which is the one studied in the RFX-mod experiment.

The RFP configuration, in general, features a wide spectrum of helical perturbations of the equilibrium magnetic configuration. These perturbations break the symmetry with respect to the torus major axis, leading to magnetic chaos and modest confinement properties. In the last years, however, it has been shown that in appropriate conditions of plasma temperature and magnetic boundary the system undergoes a spontaneous transition to a more ordered state, characterized by a single helical perturbation which dominates the spectrum. These states, called Quasi-Single Helicity (QSH), feature transport barriers inside the plasma, and therefore better confinement properties. Their observation thus opens up new perspectives for the RFP configuration. Furthermore, thanks to interesting analogies, the study of their features could allow to shed new light on the not yet fully understood properties of the advanced regimes of tokamak plasmas, which are an important topic of the ITER physics.