PhD in Electrical, Electronics and Communications Engineering

Research Title: Radio Frequency Plasma Heating in the Divertor Test Tokamak experiment

Funded by	DTT Scarl- ENEA/DET

Supervisor	Giuseppe VECCHI, Daniele MILANESIO

Context of the research activity	**Project context** Nuclear fusion is the process that powers the sun and all other stars, but it is also a promising approach to sustainably generated electricity. Several controlled nuclear fusion experiments have been operated worldwide in the last decades, and a few are going to be built to support the first demonstration fusion reactor, the international project DEMO. In particular, the Divertor Test Tokamak (DTT) is a device designed to study a crucial aspect of the reactor, i.e. the handling of heat load and exhaust in particular with the flexibility for testing possible solutions of the so called divertor, a special part of the device where the power exhaust is diverted. To perform such studies, DTT requires a powerful plasma heating system, mainly operated through coupling of electromagnetic waves ("radio frequency"), DTT will also use high energy negative neutral beam. Antennas are key components of RF heating systems, charged with the task of handling and delivering high power to the plasma, while at the same time operating in prohibitive conditions of thermal and mechanical stresses. In this difficult scenario, the prediction of the antenna performances in coupling electromagnetic energy to the plasma becomes of utmost importance in the design of heating systems and, more in general, fusion experiments. A numerical tool ("code") called TOPICA has been developed and extensively tested in past years and it is now considered a reference tool for the analysis of those antennas. This PhD fellowship is funded by the DTT Consortium, within the EUROfusion framework and the international ITER and DEMO research programs; the PhD will be hosted by Politecnico of Torino Doctoral School.

Objectives	**Objective of the PhD Research project** The aim of this PhD research is to harness the potential of the wave-plasma interaction physics to development and design of the new antennas to be installed in DTT, planned to operate in the Ion-Cyclotron resonance regime. An extension of the wave-plasma physics in the TOPICA code capabilities is part of the activity. The candidate will have the opportunity to present her/his work at international conferences and publish work in leading scientific journals. He/she will also be able to participate to existing fusion experiments and to provide a fundamental contribution to the design of DTT heating systems.

Skills and competencies for the development of the activity	We are looking for candidates with the following qualifications: • Master degree level in physics or electronic/electrical engineering, or mathematical or physical engineering • Experience in (scientific) programming or a strong interest in developing such skill • Good knowledge of English (speaking and writing)