PhD in "Fusion Science and Engineering"
Università di Padova - Napoli "Federico II"

Call for admission to the PhD courses 2021/22 (XXXVII cycle)

Research Topics reserved to employees of Consorzio RFX

PROJECT TITLE	**High performance networks for control and data acquisition in modern fusion experiments**
CONTACT PERSON	Gabriele Manduchi gabriele.manduchi@istp.cnr.it
SHORT DESCRIPTION	The project addresses the study of the required networks in control and data acquisition systems. Based on the ITER experience, the following network classes have been identified to provide the component integration: - Plant operation network, providing communication for plant control; - Data archiving network, for bulk data transfer in data acquisition - Synchronous databus network, for real-time communication in the plasma control system - Time communication network, for time distribution and synchronization Whilst the plant operation network is normally based on rugged technologies largely used in industrial control, the other three networks address specific requirements of nuclear fusion experiments and do not rely yet on widely accepted technologies. The proposed research will investigate how emerging technologies can be used for this purpose, considering in particular the candidate technologies for the ITER Neutral Beam Test facility

PROJECT TITLE	**Technology R&D for H&CD Power Supplies for DEMO**
CONTACT PERSON	Elena Gaio elena.gaio@istp.cnr.it
SHORT DESCRIPTION	This PhD thesis proposal is in the frame of the Programme for the development of fusion energy, part of Horizon Europe: the research and innovation framework programme running from 2021-2027 (FP9). Technology R&D will accompany the development of the Conceptual Design (CD) of the European fusion DEMOnstration reactor in FP9 not only to find solutions for the main showstoppers and issues, but also to identify possible improvements toward the overall assessment of the technical and economic viability of commercial fusion. As for the EU DEMO Heating and Current Drive (H&CD) systems, the Electron Cyclotron Resonance Heating (ECRH) has been recently selected as the reference one, thus in FP9 the conceptual design will be developed for ECRH. However, technological studies will proceed also for the other heating systems, namely Neutral Beam Injector (NBI) and Ion Cyclotron Resonance Heating (ICRH), to be ready to include them in the heating mix, if envisaged necessary during the development of the DEMO CD. In this context, this thesis proposal will deal with two main topics: - investigation on possible alternative technologies for the High Voltage (PS) of ECRH systems; - studies on solid state RF generators for NBI ion sources With reference to the first topic, Pulse Step Modulator technology if the reference one, adopted in the majority of fusion experiments and does not show special issues, even if there is still room for improvements in terms of accuracy and ripple of the HV PS output voltages. The thesis work will explore alternatives technologies in comparison with the PSM one. As for the second topic, the RF generators for NBI ion sources were based on self-excited oscillators with tetrods; this technology showed limits in terms of instabilities in frequency, preventing the possibility to operate at full power. An upgrade is in progress for the projects of the ITER Neutral Beam Test Facility and for ITER NBIs, consisting in the adoption of solid-state RF amplifiers, based on mosfet. The thesis work will contribute to the studies for the application of this technology to the ITER NBI, for the analysis of the specific implementation issues and of possible further improvements in future perspective for DEMO.