

CEA/CADARACHE
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PhD PROPOSAL 2014

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Title : Source and transport of Tungsten in metallic wall tokamak plasmas in presence of electron heating

Summary :

- Context:** since 2011 the largest tokamak in the world, JET (UK), is operating with metallic walls (Tungsten in the divertor and Beryllium on the walls as it will be in ITER). Another important European tokamak (ASDEX Upgrade, Germany) is operating with Tungsten wall and Tungsten divertor. In France, the implementation of a Tungsten divertor in Tore Supra (WEST project) has started. In this context, it is of prime importance to understand the transport of Tungsten from the divertor to the core of the plasma. Indeed Tungsten in the plasma core has to be avoided since it is where it radiates most and cools down the discharge. In JET and ASDEX Upgrade, means of controlling Tungsten accumulation are extensively tested. In particular, central electron heating has been shown to avoid Tungsten accumulation in ASDEX Upgrade and more recently on JET. Understanding these mechanisms will be very important to prepare WEST operation as well as ITER's.
- Goal :** The goal of this PhD is to initiate self-consistent modelling of source and transport mechanisms at play for Tungsten in experimental plasma scenario. The analysis will require including: the source, linked to plasma-wall interaction mechanisms; and the transport, accounting for collisional, turbulent and MHD aspects. The integration platform including the source and transport modules for Tungsten is a European platform, the European Transport Solver. The modelling will be applied on existing results from metallic wall tokamaks: JET (UK) and ASDEX Upgrade (Germany) and will focus on the Tungsten evolution in presence of electron heating. The results of the PhD work will allow improving our predictive capability of Tungsten behaviour in presence of electron heating in future metallic wall machines: WEST and ITER.

Skills : This PhD topic is broad and will require working in a very collaborative way within the IRFM/CEA in France and with the JET team in the UK and the ASDEX-Upgrade team in Germany. Therefore the student needs to be very curious scientifically and forthcoming. A master in plasma physics is required.