Study the effect of core turbulence suppression on edge plasma profiles and fluctuations in Wendelstein 7-X stellarator

Student project description

TDK, BSc, MSc level

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Date: 25. January 2024

EUROFusion collaboration

Status: Opened

Comments: paid internship position, participation in physics experiments in Greifswald

Keywords: plasma physics, data analysis, turbulence, stellarator

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Project description

The Wendelstein 7-X stellarator, currently the largest and most advanced fusion device of its kind in operation, is located at the Max Planck Institute for Plasma Physics in Greifswald, Germany. Designed to demonstrate the feasibility of fusion power, it features a unique twisted, helical design that allows for stable plasma confinement without the need for a central solenoid. The machine has undergone significant upgrades and experiments to optimize its performance. The researchers of HUN-REN Centre for Energy Research are participating in person in the experiments and operate several vital diagnostics.

An important result was in the latest campaign that an improved confinement scenario was observed, which was accompanied by improved energy confinement and peaked profiles. It was identified in simulations that the ion-scale turbulence is supressed in the core plasma in these time periods. In earlier studies performed by ELTE BSc student [Edes et al. EPS-2021] the edge turbulence behaviour was studied in details before, during and after the transient of the enhanced confinement. Decreased fluctuation apmplitude was clearly observed also in the edge region with Alkali Beam Emission Spectroscopy (ABES) diagnostic during the high-performance periods. The spatio-temporal structure of fluctuations revealed that underlying turbulence is also different in these periods. The dynamics and the temporal evolution of the measured fluctuations with respect to the change of profiles simultaneously in the core and edge could not yet be performed due to lack of ABES data. An interesting question, if a direct interaction between the core and edge turbulence could be experimentally revealed with this experiment. The end of the good confinement transient is accompanied with increased fluctuation amplitude and flattened profiles. The temporal evolution of the confinement collapse will also be studied. A dedicated experimental program was proposed for 2024 campaign to answer these questions.

In this project the candidate is required to analyse the measured ABES data using appropriate statistical functions, as well as compare these results with other fluctuation diagnostics. Understanding of fusion physics is necessary but can be obtained during the project. In the case of appropriate performance and interest paid internship position is available at CER.

Prerequisite skills

python programming, English language skills

Application

Applications are open until the position is filled.
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