Proposta di tesi magistrale

Thesis level: Master
Corso di Laurea: Physics
Thesis type: Diagnostic modelling/Experimental
Title: Design/analysis of a dispersion interferometer for DTT
Thesis description:

Interferometry is used in plasma physics experiments and in particular in nuclear fusion experiments to measure the time evolution of electron density with high time resolution and low measurement error. Since the plasma refractive index depends upon the electronic density, a measure of the interferometric phase shift between an electromagnetic wave traveling through the plasma and one traveling outside plasma allows assessing the electron density.

In the frame of the diagnostic development for the Divertor Tokamak Test facility (DTT), a new Italian tokamak device dedicated to investigate alternative power exhaust solutions for the nuclear fusion DEMOnstration Power Station (DEMO), a master thesis is proposed to study a specific interferometer concept knows as "dispersion interferometer" which does not need the wave traveling outside plasma. With respect to other interferometric optical schemes adopted in nuclear fusion experiments (e.g. the two color interferometers), a dispersion interferometer has the double advantage of simplicity and insensitivity to vibrations, which are the main source of error in the electron density measurement with interferometry.

The thesis work can have both design/modelling and experimental activities. The design/modelling task will consist in: determining a suitable dispersion interferometer optical scheme/set-up that fits the DTT mechanical structure; dimensioning and modelling the critical elements of the system, such as the nonlinear crystal (by considering thermal and walk-off effects), detectors and electronics; studying an appropriate technique of phase modulation for heterodyne detection and of signal extraction. The experimental work will concern tests on solutions previously designed as described above and the realization of a prototype dispersion interferometer to be built by considering the mentioned modelling and experimental test.

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Required Skills (if necessary):---
Submission date: November the 04th, 2020
Status: not assigned