Plasma fluctuations study in the new closed flux-surfaces configuration of the TORPEX experiment

F. Avino, A. Bovet, A. Fasoli, I. Furno, S. Jolliet, J. Loizu , P. Ricci

Ecole Polytechnique Fédérale de Lausanne (EPFL), Centre de Recherches en Physique des Plasmas, Association Euratom-Confédération Suisse, CH-1015 Lausanne, Switzerland

The TORoidal Plasma EXperiment (TORPEX) is a Simple Magnetized Torus (SMT) where open helical magnetic field lines are obtained from the superposition of a small vertical component on the main toroidal field. The SMT configuration features the main driving mechanisms of plasma instabilities characterising the Scrape-Off Layer (SOL) of larger tokamak devices, making TORPEX a very attractive machine to perform fusion oriented studies of plasma turbulence.

A new experimental set-up has been recently developed to generate a poloidal magnetic field. It consists in a toroidal copper wire suspended in the middle of the vacuum vessel by seven 1mm stainless steel wires, three vertical and four lateral, plus the vertical electrical coaxial feed-through. A current up to 1kA can be driven in the system, giving us the possibility to include a rotational transform and to deal with a SOL much closer to the one of a fusion device. Moreover plasma core and closed-to-open field line region studies could be performed. The technical details of the set-up will be given together with the experimental results obtained during the first campaigns with Hydrogen plasmas. A magnetic configuration with almost closed flux surfaces has been chosen, resulting from the poloidal magnetic field together with a small vertical component. The radial profiles of the main plasma parameters will be presented, such as plasma density n_e, plasma temperature T_e and plasma potential V_pl. The spectral properties of plasma dominant coherent modes at the position of maxima fluctuations will be provided too, including power spectral density estimates and measurements of vertical and toroidal wave-numbers obtained for different values of poloidal magnetic field. This allows us to calculate the poloidal and toroidal mode-numbers which can be used together with fluid simulations to asses the kind of instability we are dealing with.
An overview of the new accessible magnetic field configurations will be showed as well, ranging from Single Null X-points to magnetic Snowflakes.

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Email: fabio.avino@epfl.ch