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EX/P6-28: Basic Investigations of Electrostatic Turbulence and its Interaction with Plasma and Suprathermal Ions in a Simple Magnetized Toroidal Plasma

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Progress in basic understanding of turbulence, from unstable electrostatic modes to the formation of blobs, and its influence on the transport both of the plasma bulk and of suprathermal components, is achieved in the TORPEX simple magnetized torus (SMT). This configuration combines a microwave plasma production scheme with a quasi-equilibrium generated by a toroidal magnetic field, onto which a small vertical component is superimposed, and represents a simplified paradigm of the tokamak scrape-off-layer. After having clarified the formation of blobs in ideal interchange turbulence, TORPEX experiments elucidated the mechanisms behind the blob motion, with a general scaling law relating their size and speed. Such analytical scaling is verified over a wide range of parameters in TORPEX data, as well as in the results of 2D fluid numerical simulations. The parallel currents associated with the blobs, responsible for the damping of the charge separation that develops inside them, hence determining their cross-field velocity, have been measured. Methods to control the blob dynamics are now devised, based on creating convective cells using biased electrodes, arranged in an array on a metal limiter. Measurements reveal the formation of convective cells, fairly uniform along the magnetic field. Depending on the biasing scheme, radial and vertical blob velocities can be varied. Suprathermal ion transport in small-scale turbulence is another area in which TORPEX experiments can contribute to understand basic burning plasma physics concepts. Suprathermal ions are generated up to 1keV by a miniaturized lithium source, and are detected using a movable double-gridded energy analyzer. We characterize vertical and radial spreading of the ion beam, associated with the ideal interchange-dominated plasma turbulence, as a function of the suprathermal ion energy and the plasma temperature. Experimental results are in good agreement with global fluid simulations. A closed field line configuration is being implemented on TORPEX using a current carrying filament suspended in the centre of the chamber. This system will allow investigations of the interaction of plasma and suprathermal particles with instabilities and turbulence in magnetic configurations of increasing complexity. This work was partly supported by the Fond National Suisse pour la Recherche Scientifique.

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