Investigation of the poloidal asymmetries on the radial electric field in FELTOR gyro-fluid simulations

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Recent studies have investigated the role of the ExB flow and its shear in the transition from L to H mode in tokamak devices [1,2]. Understanding the sources of the radial electric field in the edge of the plasma is crucial to produce a theoretical model that can reproduce the L-H transition.

Some of the experimental observations of the radial electric field present the diamagnetic flows, with the radial force balance, as the most important mechanism to explain the edge radial electric field and the profiles in the region [3,4].

However, the radial electric field and thus the electrical potential are usually computed in fluid codes by the so-called “vorticity equation”. This equation is in reality the conservation of currents, as presented in our recent publications [5,6]. In these references, it is presented that the radial electric field is locally driven by the balance of the polarization current with the rest of the currents present in the plasma (mainly the parallel and the curvature currents). As this equation give a local description, it is possible that poloidal asymmetries in the currents can drive poloidal asymmetries of the polarization current and therefore, on the radial electric field.

In this contribution, we will present the preliminary analysis of the poloidal distribution of currents and radial electric field in the edge and SOL of tokamak plasmas done with the gyro-fluid code FELTOR [7]. We will present the relative relevance of each current in the conservation of current equation and the poloidal asymmetries that can arise from it.

References:

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