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EX/P8-02: 3D Effects on RFX-mod Helical Boundary Region

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In present fusion research strong effort is devoted to the studies of the effects of non-axisymmetric magnetic perturbation or magnetic field ergodization on the external region of the plasma. On this topic interesting results can be drawn from the helical configuration observed in high-current regimes in RFPs where a helical core is surrounded by an almost quasi-symmetric boundary and the small residual helical ripple is sufficient to modulate all the kinetic properties of the plasma and the plasma wall interaction. This contribution presents the most recent experimental results and physical interpretation of the phenomena observed in the edge region of the RFX-mod Reversed Field Pinch experiment, with a strong emphasis on the effects of helical deformation. Experimental observations indicate that plasma pressure and floating potential are found to oscillate in phase with the oscillation of helical radial displacement with increasing values of pressure and pressure gradient and more negative values of floating potential corresponding to more protruding plasma. Helical flow is observed ad the edge, with the same periodicity of the dominant mode. This flow pattern is interpreted in terms of modulation of ion to electron diffusion rate, which is further complicated by the fact that the shift of the dominant mode causes radial displacement of the m = 0 islands which resonate at the reversal surface and are found to deeply influence particle transport in this region. The ambipolar electric field arising in order to ensure quasi-neutrality indeed correctly takes into account the observed flow pattern, interpretation corroborated by comparison with the hamiltonian guiding center code ORBIT. Strong effort will be devoted to the determination of the actual phase relation between magnetic perturbation and velocity perturbation, and its dependence on plasma collisionality. Finally helical ripple is found to influence also turbulence characteristics at the edge with the observation of a ripple of the radial correlation length of short-wavelength fluctuations. Further observation of the effects on blobs will be provided.

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