

Experimental investigation of effects of the magnetic field geometry on turbulent transport

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From theoretical investigations it is well known that turbulence and turbulent transport in magnetically confined plasmas depend on details of the magnetic configuration such as field curvature and magnetic shear. As an example, turbulence simulations carried out in tokamak geometry show a strong high/low-field asymmetry. But even such a clear prediction has not yet been confirmed experimentally although it has important consequences with respect to confinement optimization. Especially in stellarators, the optimization of the magnetic configuration with respect to low turbulent transport could be carried out in a similar way as it was done with respect to neoclassical transport. A prerequisite of such a procedure would be an experimental confirmation of the theoretical models. The presentation focuses on experiments which exactly aim at that objective. An overview of experimental and theoretical work on geometry effects is given, followed by recent experiments carried out on the stellarator TJ-K. The turbulence characteristics and turbulent transport is measured on 128 positions located on a magnetic surface in regions where the local shear, geodesic and normal curvature are different. The variations of the fluctuation amplitudes, the density-potential cross phases and the turbulent transport are correlated with the local magnetic parameters as calculated with a field-line-tracing code. Although the turbulence in TJ-K has been shown to be dominated by drift waves, which in a simple model do not depend on magnetic geometry, with both probe arrays a strong influence of magnetic curvature on the fluctuation amplitudes is observed. Since the region of bad field curvature around the torus has a different helical pitch than the field lines, it is interesting to observe how the dynamics of the field-aligned drift-wave structures changes when the field line crosses regions of good and bad curvature.