Experimental study of the electromagnetic component of drift-wave turbulence

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In previous experiments, the drift wave has been identified to be the primary instability driving turbulence in the low-temperature plasma of the torsatron TJ-K. Since the TJ-K plasma is dimensionally similar to the edge of fusion plasmas, this is evidence that drift waves are important for transport close to the separatrix of fusion plasmas, too.

An important element of drift-wave turbulence is a finite parallel wavenumber of the fluctuations parallel to the magnetic field. This allows for pressure-driven parallel electron currents causing fluctuations in the perpendicular magnetic field component $\tilde{B}$. In the presentation, detailed measurements of this electromagnetic component of drift-wave turbulence will be presented and the related transport will be compared to the electrostatic one. Using highly sensitive pickup probes, the turbulent magnetic fluctuation spectrum was measure down to the nanotesla range. The shape of the spectrum is similar to the ones of density and potential fluctuations, but the power is a few orders of magnitude lower. The comparison with results from the turbulence codes DALF3 and GEM3 yields excellent agreement. The results are also consistent with previous direct measurements of the parallel wavenumber of the turbulent fluctuations. By varying the magnetic field, the expected dependence of the amplitude of $\tilde{B}$ on β has been verified successfully both in experiment and simulation. Furthermore, a poloidal array of pickup probes was used to measure the poloidal mode structure of the fluctuations. All results will be closely compared with simulations.