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# Overview of TJ-II stellarator results

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The flexibility of TJ-II together with its unique plasma diagnostics makes it an ideal laboratory to study the relationship between magnetic topology, electric fields, transport and model validation.

**Zonal flows and heat transport.** HIBP measurements of zonal electrostatic potential relaxation are consistent with EUTERPE gyrokinetic (GK) simulations. The width of the oscillating zonal flow (ZF) radial electric field (Er) structures depends on its frequency. Additional GK simulations predict the localization of density fluctuations, in line with Doppler Reflectometry (DR) measurements. Transfer Entropy technique-based analyses shows that transport is not smooth and continuous but rather occurs in a stepwise fashion.

**Impurity and particle dynamics**. Neoclassical (NC) theory results show how a negative Er field can coexist with an outward impurity flux. Flux-surface variations of electrostatic potential can have a significant impact on high-Z impurity radial fluxes. Probe measurements of plasma potential asymmetries on magnetic flux surfaces and DR measurements of poloidal asymmetries in Er fields, are consistent with NC simulations. Plasma core fuelling experiments with pellets show that the radial redistribution of particles can be understood qualitatively from NC predictions. Thermal neutrals react to low frequency plasma fluctuations.

**NC and turbulent transport**. Zero frequency Er fields as well as low frequency ZF-like global oscillations have been identified during the Low to High (L-H) transition in H and D plasmas. No evidence of the isotope effect was observed in the L-H transition.

**Power-exhaust physics.** The TJ-II programme on liquid metals address fundamental issues such as the self-screening effect driven by liquid lithium evaporation and the tritium inventory control.

**Stellarator optimization**. Explicit expressions for the radial NC fluxes have been calculated in low collisionality regimes and have been included in a numerical code to deal with magnetic configurations close to omnigeneity. The relaxation of the constraint of periodicity imposed by the external confining magnetic field coils in a Helias configuration produces weak periodicity-breaking deformations of the plasma. The conditions of quasi-isodynamicity are not significantly altered by the periodicity-breaking distortions.

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