Impact of poloidal asymmetries on transport

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Physics of turbulent transport in tokamaks has long relied on the paradigm of helical fluctuations on top of a fully symmetrical equilibrium. Symmetry is still preserved whenever zonal fields or zonal flows are generated by turbulence, since these structures are left invariant by rotations in both poloidal and toroidal directions. However it turns out that turbulence generates flows that are not poloidally symmetric, while still zonal in the toroidal direction. These structures are dubbed “poloidal convective cells”.

Poloidal convective cells affect transport, via several processes - some similar to those at play for neoclassical transport. It appears in particular that these cells contribute to a significant fraction of heavy impurity fluxes [1] and stress tensors [2]. Mechanisms for the formation and sustainment of these cells will be discussed.

Evidence of flow poloidal asymmetries has been found in measurements by Doppler backscattering in the Tore Supra tokamak [3]. A possible explanation based on convective cells will be discussed.

[1] D. Estève et al., https://hal-insu.archives-ouvertes.fr/cea-01380649/, to appear in Nucl. Fusion.

[2] X. Garbet et al., New J. Phys. **19**, 015011 (2017).

[3] L. Vermare et al., 44th EPS conference on plasma physics (2017).