

Justification for Accelerated Publication

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We require an accelerated publication process, since the Letter we submit addresses for the first time in a complete and self-consistent way the problem of the electrostatic response to an edge island in a fusion plasma. We present evidence that a magnetic island in the plasma edge of a fusion device can generate enhanced radial particle transport by acting as a convective cell in the plasma potential, causing strong $\vec{E} \times \vec{B}$ flow and hence a radially outward directed net transport. We find a clear and simple explanation for the origin of such convective cells, in the ambipolar constraint on electron/ion fluxes, which in presence of islands are strongly influenced by fixed points (X- and O-points).

This is relevant for a series of issues in plasma research, such as

- the effectiveness of Resonant Magnetic Perturbations (RMPs) in mitigating ELMs, and the problem of the density “pump-out” mechanism associated with RMPs, which are ITER-relevant issues;
- the problem of the Greenwald density limit, and its relationship with edge islands and patterns of radial electric field E^r ;
- more generally, the generic question of plasma flows and their relationship with islands generated by magnetic reconnection in space and terrestrial plasma physics.