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Who would bet on micro-tearing modes driving a large heavy impurity flux?

In tokamak plasmas, micro-tearing modes (MTMs) are destabilised at high plasma beta and large electron temperature gradient. They are electro-magnetic instabilities particularly prone to be excited in spherical tokamaks, where beta is large, and in improved confinement regimes or in the pedestal for conventional tokamaks.
For MTMs, the transport arising from magnetic flutter scales as the thermal velocity (Rechester-Rosenbluth estimate). It can be very large for the electron channel but is negligible for heavy impurities. This is probably why impurity transport by MTMs has not received much attention until now.
However, MTMs not only lead to radial magnetic field fluctuations, but also to electric potential fluctuations. It is found that these electric potential fluctuations drives a convective flux of heavy impurities. This pinch is directed outward and can reach very large values, with Cp=V/D up to 40. It is due to perpendicular compression from the magnetic and Coriolis drifts in the tail of the electrostatic mode structure. The resulting pinch is particularly large for heavy impurities, when the mode structure is extended along the field lines and strongly increases with toroidal rotation.
The main mechanism of the MTM impurity pinch will be presented together with its main parametric dependencies and quasi-linear estimates for realistic cases.

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