Classical transport of impurity ions in the reversed field pinch

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In the Madison Symmetric Torus (MST) reversed field pinch, the C^{+6} impurity density exhibits a hollow radial profile in improved-confinement plasmas with reduced tearing fluctuations (and therefore reduced stochastic magnetic transport). The core impurity density decays in time, after the transition to the reduced fluctuations mode, concurrent with an increase of impurity density outside mid-radius, indicating an outward convection of impurities from the core of the plasma. The decay time of the core density is close to the classical impurity ion confinement time calculated for the measured MST plasma parameters. Analysis using collisional transport theory shows that the impurity transport is dominated by classical flux, and the observed hollow profile could be explained by a mechanism known as temperature screening. Experiments with impurity pellet injection have provided supporting experimental evidence that impurity ion confinement is approaching classical for improved confinement discharges.

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