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Effects of Resonant Magnetic Field Perturbations on Density Profiles, Particle Transport, and Turbulence in DIII-D*

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Here, we report the first measurements of particle diffusivities (D) and pinch velocities (V) in DIII-D plasmas with applied resonant magnetic field perturbations (RMPs), obtained using perturbative modulated gas puff techniques and high resolution profile reflectometry. Suppression of edge localized modes (ELMs) using RMPs is a well established technique on DIII-D [1], and such a system is currently planned for ELM mitigation on ITER. RMP application stabilizes ELMs by reducing the edge pedestal pressure, primarily by increasing edge particle transport, and reducing the density [2]. This latter reduction in operating density ("density pump-out"), can be obtained over a broader operating space (e.g. in q_{95}) than that in which ELM suppression is obtained [3]. Significant results include: (1) The first direct confirmation of an increase in D and reduction in inward pinch V with RMP application, in both L- and H-mode plasmas; (2) consistent with the increase in D and decrease in V is an increase in density fluctuation levels at $\rho \sim$ 0.6-0.9, along with a decrease in **ExB** shearing levels; (3) calculations using the linear TGLF code indicate a change in the mode type and growth rate, potentially providing insight into the transport change; (4) the relative role of the RMP magnetic field perturbation versus changes in neutral fueling in contributing to the observed transport changes is being investigated using SOLPS5 modeling; and; (5) finally, and of significant interest, a set of discharges will be presented that show no decrease in density with application of the RMP and the implications this might have will be discussed.

[1] T.E. Evans, et al., Nature Phys. **2** (2006) 419
[2] P.B. Snyder, et al., Nucl. Fusion **47** (2007) 961–968
[3] T.E. Evans, et al., Nucl. Fusion **48** (2008) 024002

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