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EXPERIMENTAL INVESTIGATION OF ACTIVE FEEDBACK CONTROL OF TURBULENT TRANSPORT IN A MAGNETIZED LABORATORY PLASMA*

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Many toroidal fusion devices now routinely generate edge and/or core transport barriers, where heat and particle transport are reduced far below Bohm diffusion levels. However, minimal particle transport is not necessarily desirable, since it can lead to core impurity accumulation, or alpha particle buildup. Ideally, active, stable control over the transport, rather than simple minimization, could be obtained. To this effect, research is now underway to investigate active control of particle transport. Turbulence and transport dynamics are, of course, strongly nonlinear, and apparently not deterministic. However, modern nonlinear control methods now exist, such as chaotic control and fuzzy control, which do not rely on a model of the system dynamics to affect stable control. Experiments are being conducted in the new HELCAT (HELicon-CAThode) linear device at UNM. HELCAT is a 4 m long device, with $B < 0.22$ T, and cathode-produced densities, $n \sim 1\text{-}5 \times 10^{12}$ cm^{-3}. Sheared ExB flows, generated via biased concentric rings, will be utilized to modify the transport. Fluctuations and flux will be monitored with probe arrays. Additionally, a 1D transport code is being utilized to model the system in order to investigate possible control methods numerically. Initial experimental and modeling results will be presented.

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