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Evolution of the Radial Electric Field and Ion Parallel Flow in HSX with Nonlinear Viscosity[1] DIMITRIOS MICHAELIDES, JOSEPH TALMADGE, SANTHOSH KUMAR, University of Wisconsin - Madison, HSX TEAM
— The time dependent momentum balance equations have been solved in two directions on a flux surface with the assumption that the viscosity is linear with the flow. The results show that, due to the quasihelical symmetry in HSX, the parallel flow evolves slower than the radial electric field (Er) in the presence of a driven radial plasma current. At higher flow speeds, the radial current can cause an ion resonance in the plasma at which point the viscosity becomes nonlinear. Due to the lack of toroidal curvature in HSX, the peak in the viscosity occurs at a poloidal Mach number (Mp)=3, where in tokamaks the peak occurs at Mp=1. Here we model the evolution of the mean ion parallel flow and Er when the viscosity becomes nonlinear. Damping due to neutrals is also included to ascertain when the neutrals might obscure the nonlinearity. A charge exchange recombination spectroscopy (CHERS) system has been used in HSX to determine Er and the mean ion parallel flow from measurements of the inboard/outboard asymmetry of the C+6 parallel flow. An experimental program using the CHERS system, a Mach probe and floating probes is detailed that will enable comparisons to the modeling.

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