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ELM-free, Quiescent H-mode Operation in DIII-D Under Reactor-relevant Conditions Using Non-Axisymmetric Magnetic Fields from Coils Outside the Toroidal Field Coil[1] K.H. BURRELL, A.M. GAROFALO, General Atomics, W.M. SOLOMON, Princeton Plasma Physics Laboratory, M.E. FENSTERMACHER, Lawrence Livermore National Laboratory — Application of static, non-axisymmetric magnetic fields (NAMFs) to DIII-D plasmas allows sustained quiescent H-mode (QH-mode) operation under reactor-relevant conditions of beta, collisionality and torque from neutral beam injection (NBI). QH-mode is an ideal plasma for next step devices, exhibiting H-mode confinement levels while operating without edge localized modes at constant density and radiated power. Peeling-ballooning mode stability theory suggests, and previous studies confirm, that QH-mode operation requires sufficient radial shear in the toroidal rotation near the plasma edge. In past experiments, this rotation shear was predominantly produced by torque from counter-directed NBI. In recent experiments, co-NBI torque was overcome by the counter torque due to neoclassical toroidal viscosity (NTV) produced by the NAMFs. The latest experiments have demonstrated that sufficient NTV torque can be created using NAMFs produced by coils outside the toroidal field coil. These new results open a path for QH-mode utilization in self-heated, burning plasmas, where toroidal momentum input from NBI will be small or absent.

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