The Effect of Plasma Collisionality on Pedestal Current Density Formation in DIII-D*

D.M. Thomas, A.W. Leonard, T.H. Osborne, R.J. Groebner, W.P. West, and K.H. Burrell

General Atomics, P.O. Box 85608, San Diego, California 92186-5608

The evolution and performance limits for the pedestal in H-mode are dependent on the two main drive terms for instability; namely the edge pressure gradient and the edge current density. These terms are naturally coupled though neoclassical (Pfirsch-Schlüter and bootstrap) effects. On DIII-D, local measurements of the edge current density are made using an injected lithium beam in conjunction with Zeeman polarimetry and compared with pressure profile measurements made with other diagnostics. These measurements have confirmed the close spatial and temporal correlation that exists between the measured current density and the edge pressure in H- and QH-mode pedestals, where substantial pressure gradients exist. In the present work we examine the changes in the measured edge current for DIII-D pedestals which have a range of values for the ion and electron collisionalities $\{\nu_i^*, \nu_e^*\}$ due to shaping and fuelling effects. Such changes in the edge collisionality are expected to significantly alter the level of the bootstrap current from the value predicted from the collisionless limit, and therefore should correspondingly alter the pedestal stability limits. The extent to which the measurements agree or disagree with specific bootstrap models is also examined.

*Work supported by the U.S. Department of Energy under DE-FC02-04ER54698.