Peak neoclassical toroidal viscosity at low toroidal rotation in the DIII-D tokamak

A. J. Cole[1], J. D. Callen[1], W. M. Solomon[2], A. M. Garofalo[3],
C. C. Hegna[1], H. Reimerdes[4], and and the DIII-D Team
[1] *University of Wisconsin, 1500 Engineering Dr., Madison, Wisconsin 53706-1609, USA*
[2] *Princeton Plasma Physics Laboratory, P.O. Box 451, Princeton, New Jersey 08543-0451, USA*
[3] *General Atomics, P.O. Box 85608, San Diego, California 92186-5608, USA*
[4] *Columbia University, 2960 Broadway, New York, New York 10027-1754, USA**

(Dated: April 6, 2011)

Abstract

Observation of a theoretically-predicted peak in the neoclassical toroidal viscous (NTV) force as a function of toroidal plasma rotation rate Ω is reported. The NTV was generated by applying $n = 3$ magnetic fields from internal (I-)coils to low Ω plasmas produced with nearly balanced neutral beam injection. Locally, the peak corresponds to a toroidal rotation rate Ω_0 where the radial electric field E_r is near zero as determined by radial ion force balance. The value of Ω_0 depends critically on the poloidal rotation value, and is consistent with conventional axisymmetric neoclassical theory to within a factor of two.

PACS numbers: 52.25.Xz, 51.20.+d, 52.25.Fi, 52.55.Fa, and 52.55.Hc

*Electronic address: acole@cae.wisc.edu