Influence of toroidal rotation on transport and stability in hybrid scenario plasmas in DIII-D

P.A. Politzer,[1] C.C. Petty,[1] R.J. Jayakumar,[2] T.C. Luce,[1] M.R. Wade,[1] J.C. DeBoo,[1] J.R. Ferron,[1] P. Gohil,[1] C.T. Holcomb,[2] A.W. Hyatt,[1] J. Kinsey,[1] R.J. La Haye,[1] M.A. Makowski,[2] and T.W. Petrie[1]

[1] General Atomics, P.O. Box 85608, San Diego, California 92186-5608, USA

[2] Lawrence Livermore National Laboratory, Livermore, California, USA

e-mail contact of main author: politzer@fusion.gat.com

Abstract. We report the results of the first experiments on the DIII-D tokamak to examine the dependence of the transport and stability characteristics of ITER hybrid scenario plasmas on the toroidal flow (or rotation) of the plasma. With the new DIII-D capability to independently vary the neutral beam torque and power, the central rotation has been reduced by as much as a factor of 4.6 compared to discharges with unidirectional beams. Although energy confinement decreases and the $m/n = 3/2$ NTM amplitude increases for low rotation speed, the fusion performance figure of merit, $G = \beta_N H_{89P} / {q_{95}}^2$, still exceeds the value required on ITER for $Q_{fus} = 10$. These observations provide optimism about the projections of the hybrid scenario to low rotation plasmas in ITER, but they also indicate the need for a better understanding of the physics of toroidal rotation in order to project present-day results to future experiments.

PACS numbers: 52.55.Fa, 52.25.Fi, 52.30.Cv