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Beta Optimization in High Temperature Steady-State Tokamaks¹ M.S. CHU, Y.R. LIN-LIU, R.L. MILLER, *General Atomics*, F.L. WAELBROECK, *IFS, University of Texas at Austin* —

In recent quasi steady-state experiments with low plasma density and high temperature, the maximum achievable beta has been observed to fall substantially below the ideal MHD (Troyon) limit. These experimental data supports the interpretation that tearing modes set limits to the beta value, and agree with theoretical predictions that bootstrap current in collisionless plasmas cause substantial deterioration of the tearing mode stability of tokamaks. Our work explores the consequence of deterioration of the tearing mode stability due to bootstrap current on the achievable beta value. The tokamak under study is assumed to be stable to the localized ballooning mode and the tearing mode. The effect of steady state bootstrap current affect both the current profile and the tearing mode stability. Since the neoclassical islands are initiated by seed islands, various possible scenarios are compared. The resultant current profile and beta value was compared with that given by the ideal theory and previous tearing mode theory. Substantially lower beta value consequently is predicted for a steady-state tokamak nearly fully maintained by the bootstrap current.

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