L-H transition and power threshold studies in the DIII-D tokamak

T.N. Carlstrom

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

Contact Author: T.N. Carlstrom, General Atomics, P.O. Box 85608, San Diego, California 92186-5608, Phone: (858) 457-8818, email: Tom.Carlstrom@gat.com

Total pages: 51 total pages (35 text, 16 figures, 0 tables)

Abstract. DIII-D contributions to H-mode transition physics and power thresholds are reviewed. Two general approaches were pursued: establishing scaling relations based on empirical observations, and acquiring a theoretical understanding of the physics of the transition. The interaction of experiment results and the development of theories over the early 1990's led to the highly successful and widely accepted model of shear suppression of turbulence by crossed electric and magnetic fields ($E \times B$) as the cause of improved confinement in H-mode. Experimental studies have also examined parameters at the edge of the plasma in order to identify a control parameter for the transition and to test various theories of the transition. The effect of the direction of the ∇B drift on the H-mode power threshold is used as a tool to further understand the physics of the L-H transition. Results on DIII-D and other tokamaks have guided researchers to study turbulent generated flows as a possible trigger for the L-H transition. Access to H-mode is controlled by a power threshold and it is important to predict the threshold for next generation tokamaks. In addition to electron density and toroidal field dependencies, it is found that many other parameters affect the power threshold. Studies of plasma size, magnetic configuration, and neutral effects have been performed. DIII-D data has been used in

an international tokamak database to help establish scaling relations to predict power thresholds in future devices.