# ICPP-CLUSTER: Recent Experimental Studies of Edge and Internal Transport Barriers in the DIII-D Tokamak

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**Abstract.** Results from recent experiments on the DIII-D tokamak have revealed many important details on transport barriers at the plasma edge and in the plasma core. These experiments include: (a) the formation of the H-mode edge barrier directly by pellet injection; (b) the formation of a quiescent H-mode edge barrier (QH-mode) which is free from edge localized modes (ELMs), but which still exhibits good density and radiative power control; (c) the formation of multiple transport barriers, such as the quiescent double barrier (QDB) which combines a internal transport barrier with the quiescent H-mode edge barrier. Results from the pellet-induced H-mode experiments indicate that: (a) the edge temperature (electron or ion) is not a critical parameter for the formation of the H-mode barrier, (b) pellet injection leads to an increased gradient in the radial electric field, $E_r$, at the plasma edge; (c) the experimentally determined edge parameters at barrier transition are well below the predictions of several theories on the formation of the H-mode barrier, (d) pellet injection can lower the threshold power required to form the H-mode barrier. The quiescent H-mode barrier exhibits good density control as the result of continuous magnetohydrodynamic (MHD) activity at the plasma edge called the edge harmonic oscillation (EHO). The EHO enhances the edge particle transport whilst maintaining a good energy transport barrier. The ability to produce multiple barriers in the QDB regime has led to long duration, high performance plasmas with $\beta_N H_{89}$ values of 7 for up to 10 times the confinement time. Density profile control in the plasma core of QDB plasmas has been demonstrated using on-axis ECH.

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