Exploration of negative triangularity discharges on DIII-D

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DIII-D has characterised turbulence and investigated transport in L-mode discharges at negative triangularity, with emphasis on measuring changes in turbulence characteristics between positive/negative triangularity. This study is motivated by improved electron energy confinement obtained on the TCV tokamak at low collisionality in negative triangularity plasmas [1]. In the DIII-D experiment, up-down symmetric L-mode, inner-wall limited discharges at triangularity δ = -0.4, with 1 MA plasma current, 3.8 MW NBI and 2.7 MW ECH attained βN of 1.6 and enhanced confinement H98,y2 of 0.85. Preliminary modeling performed with the TGLF code indicated that the turbulence regime is dominated by electron modes, probably the Trapped Electron Mode. Fluctuation data were acquired near ρ ~ 0.7 and compared to similar, but not matched, discharges at positive triangularity: the intensity of density fluctuations as measured by the Beam Emission Spectroscopy and the Doppler Back-Scattering systems showed a 20% decrease at ion scales and an even larger reduction at intermediate wave-vectors, respectively; electron temperature fluctuations, however, were comparable to levels typically observed in positive triangularity L-mode plasmas. Wall conditions in this unusual shape presumably affected operations as the desired low density target was not achieved and radiated power was higher than expected. New experiments that will systematically compare matched discharges at positive and negative triangularity by varying the ratio of electron to ion auxiliary heating will be discussed. These experiments will also attempt to attain H-mode at reversed triangularity.

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