Turbulence stabilization due to dilution of deuterium ions in C-Mod ohmic plasmas and GYRO simulations.

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Dilution of deuterium ions (reducing n_D/n_e) by low-Z impurities was found to have a stabilizing effect on ion-scale turbulence in experiments on Alcator C-Mod and nonlinear gyrokinetic simulations with GYRO, in both the linear ohmic confinement (LOC) and saturated ohmic confinement (SOC) regimes. Past experiments on C-Mod and gyrokinetic studies indicated that dilution of the deuterium ion species decreased the ion energy transport in ohmically heated deuterium plasmas. Recently controlled seeding experiments were performed on C-Mod and found that low-Z seeding caused a reduction in the ion thermal diffusivity, and a reduction in density fluctuations as measured with a recently upgraded phase contrast imaging (PCI) diagnostic. The low-Z seeding also resulted in a change in the intrinsic rotation that appears to be unrelated to a change in the electron collisionality, but may be related to a change in the ion collisionality. Comparisons between ion-scale nonlinear gyrokinetic simulations with GYRO and experimental measurements of energy transport and turbulence in low-Z seeded ohmic plasmas found good agreement with simulations where the turbulence is well above marginal stability. In regions where the turbulence is closer to marginal stability, the electron energy transport is significantly under-predicted. This points to the possibility of ETG turbulence as a mechanism for the electron transport in the experiments. ETG linear growth rates were also found to be significantly affected by changes in the ion fraction (n_D/n_e) in GYRO simulations.

Work supported by US DOE awards DE-FG02-94-ER54235 and DE-FC02-99-ER54512.