# ELECTRON THERMAL TRANSPORT IN ENHANCED CORE CONFINEMENT REGIMES*

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A number of enhanced core confinement regimes have been observed in tokamaks. Neoclassical ion thermal transport has been achieved in an “internal transport barrier” (ITB) which covers part or all of the plasma. However, the electron thermal transport is observed to be larger than neoclassical predictions, even in the ITB. An investigation of the linear gyrokineitc stability of various enhanced core confinement regimes is reported here. Experimental plasmas are analyzed using a comprehensive gyrokinetic stability code. Nonlinear simulations have shown that turbulence due to ion temperature gradient (ITG) modes is quenched when the E×B velocity shear exceeds the maximum linear growth rate. It is conjectured that other modes will also follow this rule. It has been widely reported that the low wavenumber part of the growth rate spectrum (trapped ion modes, ITG and trapped electron modes) have growth rates below the measured level of E×B velocity shear in the ITB. The high wavenumber electron temperature gradient (ETG) mode has a growth rate much higher than the E×B velocity shear measured in the core. The level of electron thermal transport computed from the ETG mode is in reasonable agreement with the measured values within an ITB. The combination of E×B velocity shear to suppress low wavenumber modes and density peaking or Shafranov shift to reduce the ETG mode leads to regimes with improvement in just the ion or both the ion and electron thermal channels in qualitative agreement with the experimental observations. This suggest that the electron and ion thermal transport can be independently controlled. Transport modeling predicts that strong localized electron cyclotron heating (ECH) can move the front of the ITB to near the resonance absorption location. Recent fast wave heating experiments on the DIII–D tokamak have demonstrated that central electron heating inside of an ITB moves the leading edge of the ITB to smaller radius. The power balance electron thermal transport also increases. Linear stability calculations show that the low wavenumber modes have a reduced growth rate but the ETG mode growth rate is increased during the fast wave heating. Experiments are planned to try moving the barrier out with ECH. A systematic study of the effect of density peaking and magnetic shear on the ETG modes and electron thermal transport in negative central shear plasmas on DIII–D will be reported. The ETG mode has also been found to play an important role in the reduced electron thermal transport observed with neon injection. The ETG growth rate decreases with the mass of the impurity species.

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