IAEA FEC 2014

Contribution ID: **653** Type: **Poster**

Current Drive by Electron Temperature Gradient Turbulence in Tokamak Pedestal Region

Tuesday 14 October 2014 08:30 (4 hours)

In this paper, the quasilinear version of the current evolution equation in the presence of ETG turbulence in the tokamak pedestal region is written down. It has been shown that the current drive has to fight the conventional resistive dissipation mechanism as well as new dissipation mechanisms, such as a turbulence driven hyper-resistivity coefficient associated with the ETG turbulence. It is likely that the ETG turbulence tends to saturate at amplitudes much larger than what the mixing length theory would predict, primarily because of nonlinear radial streamer like mechanisms, which encourage big radial steps across the magnetic fields and give appropriate and reasonable magnitudes of the cross field transport due to this instability. We have used these saturated ETG turbulence levels to estimate the magnitudes of the spontaneous source of toroidal current injection as well as the anomalous hyper resistivity coefficient. These estimates of turbulence driven current are compared with the background bootstrap current in the pedestal region. It is concluded that significant modification of the equilibrium currents as well as current profiles may arise in the pedestal region as a consequence of the turbulent injection of current in the basic pedestal plasma.

Country or International Organisation

India

Paper Number

TH/P1-3

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Session Classification: Poster 1