ETG turbulence driven parallel current in tokamak plasmas TH/P1-3

- The ETG turbulence in the tokamak pedestal region is capable of spontaneously injecting toroidal momentum into the electron fluid species, thereby leading to the possibility of anomalous current sustenance in the tokamak pedestal region.
- The electron transport equation for mean parallel current $< J_{||} >$ can be written as:

$$\left(\frac{\partial}{\partial t}+\nu\right)\left\langle J_{\parallel}\right\rangle+\frac{1}{r}\nabla_r r\left[-\mu_{||}\frac{\partial\left\langle J_{||}\right\rangle}{\partial r}+V_c\left\langle J_{||}\right\rangle+S\right]=A_{\parallel}$$

$$\mu_{\parallel}=\sum_k\frac{\rho_e^2c_e^2k_y^2}{\mid\omega\mid^2}\gamma\mid\tilde{\phi}_k\mid^2;\quad a_{\parallel}=\sqrt{\pi}\tau\sum_k en_0c_e^2k_{\parallel}\frac{\omega_r}{k_\perp v_T}\exp\left(-\frac{\omega^2}{k^2v_T^2}\right)\mid\tilde{\phi}_k\mid^2$$

$$S=\sum_k en_0\rho_ec_e^2\frac{k_yk_{\parallel}c_e}{\mid\omega\mid^2}\gamma\mid\tilde{\phi}_k\mid^2+\sum_k en_0\rho_ec_e^2\frac{k_yk_{\parallel}c_e\left(1+\eta_e\right)\omega_*^2\gamma}{\mid\omega\mid^4}\mid\tilde{\phi}_k\mid^2$$

- The estimation (such as $\left\langle J_{||}\right\rangle/en_0c_e$) suggest that the parallel currents can be obtained up-to a significant percentage of Bootstrap current driven in the Edge region of Tokamak. Thus the current drive due to the turbulence and its profile is likely to be a dominant factor in determining the MHD stability in pedestal plasmas.