Contribution ID: **93** Type: **Poster**

TH/P4-20: RMP-Flutter-Induced Pedestal Plasma Transport

Wednesday, 10 October 2012 14:00 (4h 45m)

Plasma toroidal rotation can prevent or limit reconnection of externally applied resonant magnetic perturbation (RMP) fields delta B on rational magnetic flux surfaces. Hence, it causes the induced radial perturbations to vanish or be small there, and thereby inhibits magnetic island formation and stochasticity in the edge of high (H-mode) confinement tokamak plasmas. However, the radial component of the spatial magnetic flutter induced by RMP fields off rational surfaces causes a radial electron thermal diffusivity of (1/2) (delta Br / B)**2 times a magnetic-shear-influenced effective parallel electron thermal diffusivity. The resultant RMP-flutter-induced electron thermal diffusivity can be comparable to experimentally inferred values at the top of H-mode pedestals. This process also causes a factor of about 3 smaller RMP-induced electron density diffusivity there. Because this electron density transport is non-ambipolar, it produces a toroidal torque on the plasma, which is usually in the co-current direction. Kinetic-based cylindrical screw-pinch and toroidal models of these RMP-flutter-induced plasma transport effects have been developed. The RMP-induced increases in these diffusive plasma transport processes are typically spatially inhomogeneous in that they are strongly peaked near the rational surfaces in low collisionality pedestals, which may lead to resonant sensitivities to the local safety factor q. The effects can be large enough to reduce the radially averaged gradients of the electron temperature and density at the top of H-mode edge pedestals, and modify the plasma toroidal rotation and radial electric field there. At high collisionality the various effects are less strongly peaked at rational surfaces and thus less likely to exhibit RMP-induced resonant behavior. These RMP-flutter-induced plasma transport processes provide a new paradigm for developing an understanding of how RMPs modify the pedestal structure to stabilize peeling-ballooning modes and thereby mitigate or suppress edge localized modes (ELMs) in tokamak H-mode plasmas.

Country or International Organization of Primary Author

USA

Primary author: Mr CALLEN, James D. (USA)

Co-authors: Prof. COLE, Andrew (Columbia University); Prof. HEGNA, Chris (University of Wisconsin)

Presenter: Mr CALLEN, James D. (USA)

Session Classification: Poster: P4

Track Classification: THD - Magnetic Confinement Theory and Modelling: Plasma–material interactions; divertors, limiters, scrape-off layer (SOL)