Control of Global Plasma Oscillations in TCV

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In the Tokamak à Configuration Variable (TCV; R/a = 0.88 m/ 0.24 m, $B_T < 1.54$ T), global plasma oscillations have been discovered in fully non-inductively driven plasmas featuring Electron Internal Transport Barriers (eITBs) with strong Electron Cyclotron Resonance Heating and Current Drive (ECRH/ECCD). This phenomenon is akin to the so-called Oscillatory, or O-regime, first observed in Lower Hybrid (LH) driven plasmas on Tore Supra [1]. In TCV, the O-regime is closely linked to the evolution of the magnetohydrodynamic (MHD) modes in the reversed magnetic shear plasmas [2]. It is demonstrated that the O-regime can be effectively suppressed by ECCD-induced local current density perturbation or by adding an Ohmic current perturbation. In these experiments MHD activity is modified through current density profile tailoring rather than local deposition within an island. The suppression of the O-regime usually leads to improved energy confinement, which is characterized by exceeding the TCV L-mode scaling (the Rebut-Lallia-Watkins scaling), to obtain H_{RLW} above 3.5. The detection of the MHD modes by various diagnostics (Electron Cyclotron Emission, soft X-ray, Mirnov coils etc) has aided in the correct identification of rational q-surfaces and in the understanding their role in the evolution of the O-regime. The evolution of the safety factor during the O-regime has been studied by means of combined CQL3D/ASTRA simulations. High-frequency modes, most likely electron fishbones, and broadband temperature fluctuations in plasmas with global oscillations have been observed by means of recently installed correlation ECE diagnostic [2]. Their influence on the confinement properties will be discussed in the paper.

[1] G. Giruzzi *et al*., Phys. Rev. Lett. **91**, 135001 (2003)
[2] V.S. Udintsev *et al*., Fusion Sci. Technol. **52**, Special Issue (2007)