Recently Observed Features of the Quasi-Coherent Mode and Relevant Theory

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Recent experiments [1] have brought to light new features of the so-called Quasi Coherent Mode (QCM) that is observed when the EDA H-Confinement regime is produced by the Alcator C-Mod machine. This mode has been found to: 1) have a phase velocity in the direction of the electron diamagnetic velocity in the reference frame where no equilibrium electric field is present; 2) involve relatively high electron temperature fluctuations; 3) be highly localized radially at the outer edge of the plasma column and extending beyond the Last Closed Magnetic Surface (LCMS). Therefore, we have developed a novel theoretical model [2] for which: i) The relevant resistive mode driving factor is the sharp plasma pressure gradient that develops at the edge when the plasma enters the EDA H-Regime. ii) A new kind of mode topology is identified, as the usual "disconnected mode approximation" cannot be applied given that the rotational transform $\iota(\psi)/(2\pi) \equiv 1/q(\psi) = 0$ on the LCMS. This approximation was introduced with the original collisionless trapped electron mode and applied later to ideal MHD ballooning modes excited within the main body of the plasma column where $dq/d\psi$ is finite. iii) The mode localization in the poloidal direction (ballooning) is related to the limited region around the equatorial plane where the pitch of the magnetic field is about constant [3]. The magnitude of the electron temperature fluctuations is consistent with the low longitudinal thermal conductivity expected in the low temperature edge region where the mode is radially localized.

References

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