

Angular Momentum “Generation”: Theory and Recent Experiments*

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Two of the key elements of the accretion theory [1] of the angular momentum “generation” phenomenon in axisymmetric toroidal plasmas are the transfer of angular momentum to the surrounding material wall by plasma modes excited at the edge of the plasma column and the transport of “negative” angular momentum toward the center of the plasma column by “remnant” ion temperature gradient driven modes. The phase velocity of the edge scattering modes is expected to reverse direction in the transition from poor confinement regime, for the ion thermal energy, to good confinement (e.g. H-regime). Consequently the oppositely directed toroidal velocity within the plasma column also reverses. The relationship of this theory to recent experiments that have provided support for it is pointed out.

The toroidal analysis of the main elements of the theory, that involve the quasi-linear angular momentum “pinch”, the characteristics of the modified ITG modes involved, the excited spectrum and the related transport coefficient for the plasma thermal energy, is presented. The inadequacy of the neoclassical transport theory to explain the experimental observations is also pointed out on the basis of a complete analysis carried out for the regimes of interest.

In particular, the phase velocity of the modes at the edge of the plasma column in the JET machine have been observed to be in the direction of the electron diamagnetic velocity in the H-regime and to reverse in the L-regime [2]. The central toroidal velocity has been related to the peak ion pressure in the Tore-Supra [3] experiments. The formation of a steep density gradient within the plasma column in the Alcator C-Mod [4] has been observed to suppress the plasma rotation in the H-mode regime.

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[4] J.E. Rice, R.L. Boivin, P.T. Bonoli et al., *Nucl. Fus.*, **41**, 3, 277 (2001)

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