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**Coupling of turbulent energy and momentum transport** A.I. SMOLYAKOV[1], X. GARBET, C. BOURDELLE, CEA Cadarache, IRFM. Saint Paul Lez Durance, France — The parallel momentum balance in low pressure tokamak plasma is analyzed in the framework of fluid theory. It is shown that inertial effects and gyroviscosity lead to coupling of parallel momentum balance with fluctuations of electrostatic potential and plasma pressure [1]. Such coupling, mediated by magnetic field curvature, was earlier identified in gyrokinetic theory [2, 3]. Set of evolution equations for plasma density, energy and parallel momentum are formulated in the form of the conservation laws for Lagrange invariants $r_1$=ln(n/B$^2$), $r_2 = ln(p^{3/2}/B^5)$ and $r_3 = ln(V_\parallel/B)$. Coupling of the evolution of parallel momentum to fluctuations of the potential and pressure leads to the modification of the Lagrange invariants. In linear theory, the gradients of the equilibrium profiles of $r_1$, $r_2$ and $r_3$ serve as generalized thermodynamic forces responsible for the slab ITG, toroidal ITG, and parallel flow shear instabilities. Coupled equations for energy and momentum transport are derived in quasilinear approximation.

[1] A.I. Smolyakov, X. Garbet, C. Bourdellle 2009, Nuclear Fusion
[2] Hahm T S, Diamond P H, Gurcan O D and Rewoldt G 2007 Physics of Plasmas 14 072302
[3] Peeters A G, Angioni C and Strintzi D 2007 Physical Review Letters 98 265003

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