Current density in turbulent magnetically confined plasmas

I. Chavdarovski[1] and R. Gatto[2]

[1] National Fusion Research Institute, Gwahangno 113, Yuseong-gu, Daejeon 305-333, Korea
[2] Department of Mathematics, Natural Sciences and Computer Sciences, John Cabot University, 00165 Rome, Italy

Abstract.
A turbulent extension of the Ohm's law, derived from the action-angle transport formalism, is presented. The equation describes the evolution of the current density in the presence of magnetic turbulence in axisymmetric magnetized plasmas. The hyper-resistive helicity-conserving contribution, usually derived in the framework of MHD, is recovered, and the hyper-resistive coefficient is defined. Additionally, the generalized Ohm's law contains an anomalous resistivity term and a term proportional to the first derivative of the current density. The numerical solution for given thermodynamic profiles puts in evidence the role of each turbulent term in shaping the steady-state current density profile. Considering a turbulent generalization of Ohm's law of the kind presented here is essential in investigating the feasibility of advanced scenarios with high confinement properties and large fractions of bootstrap current.

E-mail: chavdarovski@gmail.com
Re.Gatto@roma2.infn.it