Dynamic Sub-Grid Scale Modeling of Tearing Mode Interaction with Turbulence

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The development of the tearing mode instability is significantly affected by the existence of anomalous dissipation resulting from small-scale turbulence. Using the scale separation between the micro-turbulence and the large-scale fields associated with the tearing mode, a multi-scale analysis has been applied to the reduced resistive MHD equations yielding a set of wave-kinetic equations describing the evolution of small scale MHD turbulence in the presence of large scale fields and flows. Both the effect of the turbulence on the tearing mode and the back-reaction of large-scale fields on the turbulence are treated self-consistently. Application to the description of the single helicity state of the RFP is considered. In particular, the single helicity state requires both turbulent momentum transport and turbulent heat transport (due, in all likelihood, to ambient mirco-instabilities) for self-maintenance.