Magnetic Geometry, Plasma Profiles and Stability

J W Connor
UKAEA/Euratom Fusion Association, Culham Science Centre, Abingdon, Oxon, OXI4 3DB, UK.

The history of the stability of high mode number modes such as ideal MHD and drift waves is a long and tortuous one as increasingly realistic representations of the equilibrium magnetic geometry have been introduced. Early work began with simple slab or cylindrical models where plasma profiles and magnetic shear was seen to play key roles. Then the effects of toroidal geometry, in particular the constraints imposed by periodicity in the presence of magnetic shear, provided a challenge for theory, which was met by the ballooning transformation. More recently the limitations on the conventional ballooning theory arising from effects such as toroidal rotation shear, low magnetic shear and the presence of the plasma edge have been recognised and have led in turn to modifications and extensions to this theory. This increasing sophistication has led to a changing, indeed 'fluctuating', view of the stability of the 'universal' drift wave for example. After a survey of this background, more recent work of relevance to currently important topics such as transport barriers, characterised by the presence of strong rotation shear and low magnetic shear, and the 'peeling-ballooning' model for ELMs (edge localised modes) that occur at the edge transport barrier in H-mode, is described and illustrated with examples.

This work was funded jointly by the United Kingdom Engineering and Physical Sciences research Council and by the European Communities under the contract of Association between EURATOM and UKAEA. The views and opinions expressed herein do not necessarily reflect those of the European Commission.