Basic Toroidal Effects on Alfvèn Wave Current in Small Aspect Ratio Tokamaks

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The Alfvèn wave current drive (AWCD) in small aspect ratio tokamaks is properly calculated, with consideration of the basic toroidicity effects present in (i) *the dielectric tensor-operator* (involving the strongly toroidal equilibrium profiles), (ii) *the structure of the r.f. fields* obtained as a solution of the wave equation (through Maxwell's equations' toroidal operators as well as the conversion rate and conversion layer location, depending also on the equilibrium profiles) and (iii) the *formulation of the AWCD* (which, besides its dependence on the r.f. fields — affected by toroidicity as mentioned at points (i) and (ii) — also requires the equilibrium-magnetic-surface averaging of non-resonant forces involved).
Thus, (1) we consider *consistent equilibrium profiles* with neo-classical conductivity corresponding to an ohmic START-like discharge [1]; (2) use a *resistive (anisotropic) MHD dielectric tensor-operator with practically no limitations*, adequate to describe the plasma response in the pre-heated stage [2]; (3) solve numerically the $2\frac{1}{2}$D *full-wave equation* by the aid of an advanced finite element code developed in [3]; and (4) evaluate the AWCD by the aid of the recently proposed, quite general formulation holding in the case of *strongly toroidal fusion devices* [4] and including contributions due to helicity injection, momentum transfer and plasma flow.
A general discussion of the results obtained in this work is presented.

[1] H R Wilson, *SCENE-Simulation of Self-Consistent Equilibria with Neoclassical Effects*, Report of UKAEA Government Division - Fusion, UKAEA FUS 271.
[2] K Komoshvili, S Cuperman and C Bruma, *Toroidal Dielectric Tensor-Operator for Arbitrary Aspect Ratio and Wave Frequency: an Anisotropic-Resistivity MHD Formulation* (this conference).
[3] S Cuperman, C Bruma and K Komoshvili, *Solution of Full Wave Equation for Global Modes in Small Aspect Ratio Tokamaks with Non-Circular Cross-Section* (this conference).
[4] V S Tsypin *et al.* Phys. of Plasmas **2** (1995) 2784.