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Localized Alfvén wave current drive in axisymmetric toroidal geometry.  (English)


Summary: We develop the theory of the production of a steady state current in the Alfvén resonance region for an incompressible resistive plasma in axisymmetric toroidal geometry. We discover the existence of a net total current associated with externally excited Alfvén waves. The physics of the current generation lies within a dynamo mechanism, which assumes the form of a nonlinear wave mixing process caused by the plasma medium nonlinearities. The efficiency of the current drive is high and comparable to ohmic and the position of the current can be controlled externally. Therefore, Alfvén waves can be successfully used to modify existing current profiles in order to improve confinement in nuclear fusion reactors. In the process of deriving the current drive theory, we analytically solve the linearized equations of resistive MHD in a boundary layer about the Alfvén resonance surface.

MSC:
81-XX Quantum theory
82-XX Statistical mechanics, structure of matter

Keywords:
plasma physics

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References:

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