Submitted: 16 January 2013
Accepted: 05 March 2013
Published Online: 21 March 2013

Traveling wave current drive theory for an arbitrary m-polar configuration

Physics of Plasmas **20**, 032513 (2013); https://doi.org/10.1063/1.4796089

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ABSTRACT

An extension of the formalism employed to describe current drive in magnetized plasmas by means of traveling magnetic fields (or double-helix configuration) is presented. In all previous theoretical studies, only driving fields with dipolar topology have been employed and the figure of merit of the current drive mechanism has never been analyzed in terms of the dissipation in the power feeding circuit. In this paper, we show how to express the model equations in terms of the current amplitude in the coils, for an arbitrary number of equally spaced coils wound around the plasma column. We present a brief review of the existing theory and a theoretical formulation, valid for an arbitrary *m*-polar helical symmetry, which removes the above mentioned complications and limitations. In the limit of straight coils, our magnetic field expression agrees exactly with well-established results of the literature for rotating magnetic field current drive. Finally, we present initial numerical results from a recently developed code which consistently compares the steady driven nonlinear Hall currents and steady fields, corresponding to different configurations in terms of the Ohmic dissipation in the helical coils and discuss future perspectives.

ACKNOWLEDGMENTS

One of the authors, V.N.D., thanks Brazilian funding agencies FAPESP (Grants 2009/11835-0 and 2012/22830-2) and CNPq (Grant 141136/2012-0) for financial support, Centro Atómico Bariloche (Argentina) for the hospitality during part of this work, V. L. Quito and P. L. S. Lopes for fruitful discussions concerning the structure of magnetic fields, and

Universidad de Cuyo for partial financial support. The authors are indebted to Ms. Luiza Coury for her kind assistance with Fig. 1.