A new Hamiltonian code for the simulation of ICRF waves propagation and absorption in tokamaks

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Ion Cyclotron Range of Frequency (ICRF) waves are commonly used in tokamaks for heating and non-inductive current-drive. A distinctive feature is their capacity to transfer energy to various plasma species in a selective fashion: absorption of the wave power at ion cyclotron resonance frequencies and their harmonics makes significant ion heating possible, while Landau/TTMP (Transit Time Magnetic Pumping) damping of the magnetosonic wave or of a mode-converted Ion Bernstein wave allows to heat preferentially the electrons. This intrinsic complexity provides an incentive to continually improve the understanding and modeling of the ICRF physics. Recently, by resorting to large-scale computations, Full-Wave codes incorporating multi-dimensional and kinetic effects have made important advances toward a unified description of different ICRF scenarios. We present here the progress made in the development of a new two-dimensional Full-Wave code, EVE, aimed at simulating the ICRF waves propagation and absorption in tokamak plasmas. Based on the same basic principles as ALCYON[1, 2], one of its most original features is the Hamiltonian formalism employed to describe the wave-particle interaction. This should allow for a natural integration in a more ambitious future package for self-consistent calculations of the wave propagation and the kinetics of absorbing plasma species. We discuss the formalism of EVE, the numerical aspects, as well as the state of development of the code. The first Fast Wave Electron Heating simulations will be shown and short-term prospects will be outlined.

References

[1] D. J. Gambier, and A. Samain, Nucl. Fusion **25** (1985) 283.

[2] A. Bécoulet, D. J. Gambier, and A. Samain, Phys. Fluids B **3** (1991) 137.