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Analytical and Numerical Study of Lower Hybrid Wave Propagation in Plasma ALESSANDRO CARDINALI, VALERIA FUSCO, ENEA-EURATOM — Lower hybrid current drive (LHCD) is an effective technique for non-inductively sustaining and for current profile modification of tokamak plasmas. Experiments have indicated that the bootstrap current alone is not sufficient to develop and sustain advanced scenario for reactor relevant experiments like ITER and DEMO, and LHCD may be particularly well suited for efficiently driving current off-axis ($r/a > 0.8$) in reactor grade plasmas. In order to study the plasma-wave interaction, an equations system has been derived from the Vlasov-Maxwell model, with the help of appropriate simplifying hypothesis. The solution can be obtained not only by considering the full wave equation but also by using methods based on asymptotic techniques like the WKB. While the full wave solution is a knotty problem both numerically and analytically, due to the 3D involved in the tokamak geometry, the asymptotic technique based on the WKB approximation leads to an amazing simplification, reducing the problem to an integration of a system of ordinary differential equations (ray tracing) for both the phase integral and the amplitude of the electric field. Particular care is requested in the solution of the wave equation when dealing with singular points like cut-offs and mode-conversion, which are easily met at the plasma periphery. To test the reliability of the aforesaid methods, a strict comparison between the full wave solution and the WKB approximation is performed in a paradigmatic situation (1D cylindrical geometry).

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