

Advanced Lower Hybrid current drive modeling

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Lower hybrid (LH) waves have been successfully used for driving non-inductive plasma current in tokamaks via resonant electron Landau damping. Even though collisions and wave-particle interactions are well understood at a microscopic level, several issues remain regarding the modeling of LH current drive (CD). In particular, it is difficult to explain how the spectral gap is filled and to calculate the ray damping consistently with the quasilinear distortion of the distribution function. In this work, a ray-tracing code is coupled to a 3-D bounce-averaged relativistic Fokker-Planck solver in order to model LHCD. It is shown that using a large number of rays, which is computer time-consuming and makes the self-consistent calculation of ray damping very difficult, is not necessary to properly fill the spectral gap. A new scheme involving only a few rays is presented [1]. Besides the numerical advantages, this method gives an interesting insight on the electron distribution build-up and the resulting power and current deposition profiles. Applications to LH simulations for ITER and various existing tokamaks are presented. The non-thermal electron bremsstrahlung emission is calculated and compared with experimental data.

[1] J. Decker and Y. Peysson, 33th EPS Conf. on Plasma Physics and Controlled Fusion – Roma, Italy (2006).