CALCULATION OF EMISSION IN GENRAY CODE

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Electron cyclotron emission can be a sensitive indicator of nonthermal electron distributions. The GENRAY ray tracing code calculates the emission following the model proposed in [1]. In the WKB approximation, the radiation transport equation[2] is solved along rf rays using a fully relativistic calculation of the emission and absorption from the electron distribution function.

The radiation temperature is calculated using the obtained radiation at the plasma edge. The relativistic distribution functions used for the absorption and emission coefficient calculations are generated from either a set of analytically parametrized distributions (bi-Maxwellian, shifted Gaussian beam of particles, etc), or they can be obtained from the CQL3D bounce-averaged Fokker-Plank code[3]. This enables the study of nonthermal effects. Collisional absorption due to electron-ion Coulomb collisions is included in the radiation transport equation. The ray trajectories used in the emission calculation can be calculated using various dispersion relations: cold, non-relativistic hot, and fully relativistic plasma. The code can solve the radiation transport equation for different wave modes including O-mode, X-mode, and Electron Bernstein mode. It also has a facility to solve the radiation transport equation including effects of EBW-X-O mode conversion[4].

The GENRAY emission calculations have been applied for modeling of several cases: non-thermal electron cyclotron emission due to lower hybrid current drive on Alcator C-Mod [5], ECE radiation temperature in DIII-D[6], nonthermal EBW emission in NSTX[7].

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