ELECTRON BERNSTEIN EMISSION DUE TO NONTHERMAL DISTRIBUTIONS IN NSTX

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GENRAY, an all frequencies 3D ray tracing code, calculates electron Bernstein wave emission (EBWE) from thermal or nonthermal distributions[1]. Emission and absorption are calculated at each point along an EBW ray, and the radiation transport equation is back-solved along EBW rays to the detector[2,3,4]. Hot plasma or fully relativistic dispersion is used along with a relativistic calculation of the emission and absorption[2].

The BXO (Bernstein-X-O) mode conversion emission window is found with a shooting algorithm to obtain the central ray angles for a given receiver (antenna) position giving 100% transmission[5]. Alternatively, efficient BX conversion is assumed. Finite receiving antenna aperture is modeled using Mjölhus transmission formula[6] and multiple rays.

We show calculated EBWE radial profiles for an NSTX experimental profile with thermal distributions, and compare to a case with EBWCD nonthermal distributions from a simulated OXB heating and current drive experiment.

It is found that EBWE can give the radial profile of T_e for lower beta thermal NSTX shots through the BXO channel. Also, the EBWE will be sensitive to nonthermal deviations of the electron distribution. The calculations show an intermediate temperature between thermal and tail-nonthermal temperature, for emission based on distributions simulated with 1 MW of EBW power. For EBWE calculated for a high (40%) beta plasma, the BXO channel was only sensitive to the plasma edge (outer 5 cms). However, the BX channel, with smaller n_{ll} can penetrate to the plasma interior and is also sensitive to nonthermal electrons.

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References

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