

**Abstract Submitted for the Twelfth Topical Conference
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Theory Experiment

Modeling of 110 GHz Electron Cyclotron Wave Propagation and Absorption on DIII-D,* Y.R. Lin-Liu, S.C. Chiu, T.C. Luce, R.L. Miller, *General Atomics* — It has been well recognized that to model electron cyclotron (EC) wave propagation and absorption in tokamak plasmas of the present-day and future experiments will require a relativistic treatment. A relativistic dielectric tensor and dispersion functions based on small Larmor radius expansion including terms consistently up to the third harmonic have been derived by Matsuda and Hau.¹ Around the fundamental harmonic resonance, their formulation gives the refractive indices for both the O– and X–modes, which agree well with those of existing weakly relativistic models. In this work, we examine predictions of their theory in the parameter regime directly relevant to up-coming experiments using the new DIII–D 110 GHz ECH system. The refractive indices near the second and third harmonic resonances are calculated and compared with those obtained from the exact relativistic dispersion relation using the numerical algorithm proposed by Smithe and Colestock.² The benchmarked theory will be used to describe warm plasma effects on wave propagation and damping including the case of oblique incidence for current drive applications.

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¹K. Mastuda and J.Y. Hsu, *Phys. Fluids* **B3**, 414 (12991).

²D.N. Smithe and P.L. Colestock, *Proc. of 19th Top. Conf. on Radio Frequency power in Plasmas*, (1991) p. 46.

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