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Analysis of higher harmonics on bidirectional heat pulse propagation experiment in helical and tokamak devices

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Recent studies have indicated that the local theory of the electron heat transport cannot model the plasma response against the modulation electron cyclotron resonance heating (MECH) correctly. In this paper we propose a new method to analyze the MECH experiment, aiming to examine the local transport model. The method is applied to the MECH experiments performed in the helical (LHD and TJ-II) and tokamak (KSTAR and DIII-D) devices, having different parameters. The experiments are performed in steady state L-mode plasmas. By changing the MECH deposition location, the outward and inward propagating heat pulses are produced that are measured with Electron Cyclotron Emission (ECE) systems. The thermal diffusivity and the thermal convective velocity are obtained not only at the fundamental MECH frequency but also at its higher harmonics, as well as from both outward and inward propagating pulses, providing different transport coefficients at a radial region. These results clearly show the universality of the violation of the local transport model.

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