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Low-Threshold Two-UH-Plasmon Decay as a Reason for Anomalous Backscattering and Absorption in Second Harmonic ECRH Experiments

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A model interpreting generation of the anomalous backscattering signal in the second harmonic X-mode ECRH experiments at TEXTOR as a secondary non-linear process, which accompanies a primary low –threshold parametric decay instability (PDI) leading to excitation of two–upper hybrid (UH)–plasmon trapped in plasma is introduced. The primary absolute PDI enhancing the UH wave fluctuations from the thermal noise level is supposed to be saturated due cascade of secondary low-threshold decays of the daughter UH waves leading to excitation of the secondary UH waves down-shifted in frequency and the ion Bernstein waves. A set of equations describing the cascade is derived and solved numerically. The results of numerical modelling are shown to be in agreement with analytical estimations of the growth rates of the initial and secondary parametric decays and the saturation level. The generation of backscattering signal is explained by coupling of daughter UH waves. The fine details of the frequency spectrum of the anomalously reflected X-wave and the absolute value of the observed backscattering signal in 2nd harmonic X-mode ECRH experiments at TEXTOR are reproduced. The level of anomalous absorption due to the PDI is estimated as 25%. The mechanism as well explains the anomalous ion heating at TCV and TJ-II by the generation of the secondary IB waves which directly transfer the pump power to the ion component.

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