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P2.4012 Experimental investigation of the ordinary wave anomalous absorption in the plasma filament

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A number of effects, such as anomalous backscattering and anomalously ion acceleration, observed in experiments on electron-cyclotron resonant heating (ECRH) in magnetic fusion toroidal devices [1-2] are not explained within the conventional linear theory. The theoretical model proposed in [3] explains the anomalous backscattering as a result of the two upperhybrid (UH) plasmon parametric decay (TUHPD) instability possessing very low threshold due to trapping of excited plasmons in the vicinity of the density maximum. Model experiments [4] have shown that the anomalous absorption in a plasma filament related to the TUHPD instability can reach 80%. A similar situation, which can occur in the case of ordinary pump wave polarization, is under investigation in the present paper. A plasma filament is created by RF power (~ 100 W, frequency ~ 27 MHz) in a quartz tube (inner diameter 2.2 cm) filled with argon at a pressure of about 1-2 Pa and placed in magnetic field of up to 45 mT. The maximal average plasma density in the filament is slightly exceeding 2×1010 cm-3 and electron temperature is about 1 eV. The tube with plasma passes through a waveguide with a cross section of 7.2×3.4 cm2 perpendicular to the wide wall. Microwave pulses (power up to 200 W) at a frequency of 2.35 GHz significantly exceeding the ECR and UH frequencies are incident along the waveguide onto the plasma in ordinary polarization. At the pump power exceeding a threshold of about 30 W the strong (30-35%) anomalous absorption of the incident power in a plasma filament is observed leading to decrease of the transmitted and reflected microwave power and to the growth of plasma luminosity. Dependence of the effect on the magnetic field, plasma density and microwave power as well as the microwave plasma emission is investigated. The observed effect is explained by decay of the pump wave into two electron plasma waves possessing frequencies smaller than electron cyclotron one.
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