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Expansion to Higher Mode in Electron Density Measurement by Microwave Resonator Probe IJI LIANG, SHU OHTA, KIMITAKA KATO, KEIJI NAKAMURA, HIDEO SUGAI, Department of Electronics & Information Engineering, Chubu University — Microwave resonator probe enables electron density measurement from the observed shift in resonance frequency of U-shape antenna of length L in plasma. The fundamental resonance ($m = 1$) occurs at the frequency where L coincides with a quarter of the wavelength. In this paper, operation of microwave resonator probe is expanded from the fundamental mode resonance to the higher mode resonances. For the given mode m , the electron density can be determined simply by the frequency difference between the resonance frequency f_{pm} in plasma and that f_{vm} in vacuum. The measurable highest density is experimentally found to be given by the plasma cutoff density corresponding to f_{vm} . This is because the u-shape antenna is not efficiently excited in overdense plasma. On the other hand, the lowest electron density depends on the resonance broadening mainly caused by electron- neutral collisions. Use of the higher mode resonance expands a range of measurable electron density by an order of magnitude or more. Examples of the electron density measurement of surface wave plasma with use of the higher mode are presented.

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