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Experimental observation of electron density bifurcation in plasma-metamaterial composites in microwave range OSAMU SAKAI, YOSHIHIRO NAKAMURA, AKINORI IWAI, Kyoto University — Metamaterials, which are composed of designed microstructures and show extraordinary electromagnetic responses, match plasmas so well, and high-power microwaves induce bifurcation phenomena in this plasma-metamaterial composite. Since dielectric constant or permittivity of plasmas varies from positive to negative values at microwave frequencies, the composite with negative permeability becomes a reconfigurable negative refractive index material [1]. Furthermore, as indicated by our recent report [2,3], this composite shows strong nonlinear properties. Bifurcation of permittivity (or electron density) was predicted by a theory [2], and we have verified it in our recent experiments; using double split ring resonators whose array showed negative permeability at 2.45 GHz, clear bifurcation with hysteresis was observed in electron density evolutions with input power <300 W. This result implies that this composite is a nonlinear microwave metamaterial.

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- [3] Y. Nakamura and O. Sakai, Jpn. J. Appl. Phys. 53, 03DB04 (2014).

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