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**Coherent Microwave Rayleigh Scattering from Resonance Enhanced Multiphoton ionization in argon**[1] ZHILI ZHANG, MIKHAIL SHNEIDER, RICHARD MILES, Princeton University, APPLIED PHYSICS GROUP, MECHANICAL AND AEROSPACE ENGINEERING TEAM — Microwave scattering from a resonance enhanced multi-photon ionization (REMPI) produced plasma provides a new means for the direct, time accurate observation of the free electrons and thus a new method for high sensitivity REMPI spectroscopy of a gas and a new method for the measurement of electron formation and loss processes. The REMPI plasma acts as a coherent microwave scatterer, with the scattering electric field amplitude proportional to the number of electrons. Since the size of the REMPI plasma is small compared to the microwave wavelength, the scattering falls into the Rayleigh regime. Multiphoton ionization and electron recombination processes are studied in argon using this method. A time dependent one dimensional plasma dynamic model is developed to predict the time evolution of the microwave scattering from the plasma. Experimental results of the argon ionization spectrum and electron recombination rates are in good agreement with the model predictions.

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Zhili Zhang
Princeton University

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