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The Effect of Decoherence on Microwave Scattering from a Small Expanding Laser-Generated Plasma[1] CHRISTOPHER GALEA, MIKHAIL SHNEIDER, ARTHUR DOGARIU, Princeton University, RICHARD MILES, Texas A&M University — The scattering of microwaves with wavelength λ by a plasma of size L_p that is small compared to the wavelength ($L_p \ll \lambda$, so that the scattering is considered coherent) has been studied extensively in the literature and has resulted in many useful diagnostics, including Radar Resonance-Enhanced Multiphoton Ionization (Radar REMPI) and Rayleigh Microwave Scattering (RMS). Recent Radar REMPI experiments conducted at pressures below 1 Torr show that changing from 12 GHz to 94 GHz microwaves results in a faster decay rate of the scattering signal. Assuming the microwave scattering is coherent, we would expect little change between the two normalized frequency cases. However, if we consider the expansion of the plasma (e.g., due to ambipolar diffusion), at some point the spatial phases will differ enough to destructively interfere and our measured signal will drop drastically – we will call this decoherence. We expect stronger decoherence for the 94 GHz case because the plasma size will become comparable to the shorter wavelength (94 GHz) first, which explains why there is faster decay in the 94 GHz signal. In this talk, we present a model of the decoherence effect and show how it explains this measurement discrepancy for a xenon-helium cell at 152 mTorr.

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