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A method for measuring optical cross sections for electron impact excitation from metastable states[1] C.A. DEJOSEPH, JR., Air Force Research Laboratory, Wright-Patterson AFB, OH, V.I. DEMIDOV, UES, Inc., Dayton, OH — We present a method for determining optical cross sections of states which are excited by electron impact from metastable levels. The method utilizes the afterglow of a low pressure, pulsed (100% modulated) rf-driven plasma. Following termination of the rf power, the average electron energy decreases rapidly to a few tenths of an eV, which, for the rare gases, is well below the inelastic threshold for excitation from the ground and metastable states. At the same time, metastable atoms can react to create fast electrons through pooling reactions, which produce ionization, and collisions of the second kind with slow electrons. The energy of these fast electrons depends on the specific production mechanism. These fast electrons can, in tern, collide with metastables leading to excitation and subsequent optical emission from higher lying states. At the low pressures of this experiment ($\sim$20 mTorr) emission from three body recombination is negligible. We demonstrate the method using a pulsed ICP in argon over the pressure range of 10-20 mTorr. Specifically, we present relative data for a number of lines from the Ar $3p^5 4p$ manifold, where optical cross sections have been measured, and from the $3p^5 5p$ manifold, such as the 420.1 and 419.8 nm lines where measurements are unavailable.

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