Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

A New Optical Method to Measure Electron Impact Excitation Cross Sections of Atoms in a Metastable State PEEYUSH SAHAY, SUSAN T. SCHERRER, CHUJI WANG, Mississippi State University — We report a new method, based on plasma-cavity ringdown spectroscopy (P-CRDS), to measure electron impact excitation cross-sections (EIECS) of atoms. Measurements of EIECS of mercury atoms in two regular and one metastable states, 6s6p $^3P_1$, 6s7s $^3S_1$, and 6s6p $^3P_0$, respectively, have been conducted. The measured EIECS values of these energy levels, $(9.0 \pm 2) \times 10^{-17}$ cm^2, $(2.5 \pm 0.6) \times 10^{-18}$ cm^2, and $(1.7 \pm 0.4) \times 10^{-17}$cm^2, are in agreement with the reported literature values. As a part of the measurements, the highly sensitive CRDS technique is employed to determine the absolute population density of Hg atoms, with an atmospheric plasma acting as the atomization and excitation sources. This new approach can be an alternative technique to the optical emission spectroscopy (OES) and electron energy loss techniques to measure EIECS. The method can extend EIECS measurements to both high and low pressure conditions.

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Date submitted: 19 Jul 2011 Electronic form version 1.4