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Experimental Analysis of Gas Ionization Mechanics for Standoff Isotope Identification BENJAMIN GRABER, DONG HO WU, US. Naval Research Laboratory — Our previous work has established that gas ionization rate by gamma rays is strongly dependent on the type of gas and gamma radiation energies. We exploit such phenomena for the standoff detection and identification of radioactive materials using a set of gas cells, each containing a particular type of gas and a pair of ion counters. Recently we performed new experiments to investigate how ion production rate is affected by gas cell pressure, shielding constant of the gas cell, the detection distance, gas cell cross section, and the electric field of the ion counters. Optimizing these parameters allows us detection and identification of weak radioactive (<75 uCi) isotopes, such as Am-241, Ba-133, Co-60, Cs-137, and Na-22 at distances over 10m. We attempted to combine some theoretical models of gas ionization and molecule models with our experimental data to form a complete picture of the mechanisms of gas ionization. We find ionization of argon gas is, in particular, interesting because the gas exhibits a significantly higher ionization rate when exposed to low energy gamma rays than higher energy gamma rays.

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