Abstract Submitted
for the GEC09 Meeting of
The American Physical Society

Development of a portable greenhouse gas analyzer based on Penning ionization electron spectroscopy (PIES) in a pulsed glow discharge plasma[1] C. MARK DENNING, VADIM STEPANIUK, VALERY SHEVEREV, Lenterra, Inc., LENTERRA, INC. TEAM — A greenhouse gas (GHG) analyzer currently under development at Lenterra, Inc. is described which utilizes Penning ionization electron spectroscopy (PIES) in a glow discharge plasma. A population of helium metastable atoms (2^3S, 19.8 eV) is produced in a pulsed (50 μs duration, 5 kHz rep rate) glow discharge in helium/analyte gas mixtures. In the afterglow electrons are produced due to Penning ionization of GHG analyte molecules (including carbon dioxide and methane) by the helium metastables. These electrons possess energies equal to the energy stored in the helium metastable minus the ionization potential of the analyte molecule. Electron energy spectra are measured using the current-voltage characteristic obtained during the afterglow with a swept-voltage collector electrode. These spectra exhibit peaks that allow for the determination of the ionization potential of each analyte, and therefore selective gas detection. Experimental results are presented and components of the portable PIES device are described, including the glow discharge apparatus, as well as a carbon nanotube gas micro-concentrator and a micro gas chromatography column.

[1]Work Supported by DOE SBIR Grant No. DE-FG02-07ER84894.

C. Mark Denning
Lenterra, Inc.

Date submitted: 08 Jun 2009 Electronic form version 1.4