Abstract Submitted
for the GEC19 Meeting of
The American Physical Society

The characterization of reactive plasmas using frequency-domain terahertz spectroscopy. MARK CAPPELLI, FABIO RIGHETTI, Stanford University, KARIM OUARAS, University of Cambridge — Terahertz (THz) spectroscopy (TS) to probe plasma chemistry is advantageous as it accesses ground state molecular transitions. Early studies were based on time-domain methods (TDTS) generating spectrally-broad pulses ranging from 0.1 – 5 THz [1]. Experiments as early as 2003 [2] reported the use of TDTS to study dust-forming plasmas. The broad spectra makes measurements of plasma cut-off straightforward, but it is difficult to de-convolve the fine structure of molecular absorption spectra. The recent availability of continuous-wave frequency-domain (FD) THz sources with much higher spectral resolution has afforded the probing of molecular absorption features but have not yet been exploited in studies of plasma chemistry. One major benefit of FD THz spectroscopy (FDTS) compared to infrared methods is its ability to characterize both plasma chemistry as well as electron density and collision frequency. In this presentation, we provide insights into the use of FDTS as a diagnostic and demonstrate the opportunities and challenges by example measurements in a low-pressure argon-methanol RF inductively coupled plasma. [1] J. Neu and C.A. Schmuttenmeer, J. of Appl. Physics 124, 231101 (2018). [2] S. P. Jamison et al., J. Appl. Phys., vol. 93, no. 7, pp. 4334–4336 (2003).

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Date submitted: 30 May 2019 Electronic form version 1.4