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2P36 - Electron Temperature and Density Measurements of Plasma Generated at the Focus of a CW Microwave Beam

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An experimental setup to study plasma generated at the focus of a continuous-wave (CW) microwave beam was designed and constructed at the Air Force Research Laboratory at Kirtland AFB, NM. Experimental studies of free space plasma are of interest because they can help validate and improve theoretical models, such as the Improved Concurrent Electromagnetic Particle-In-Cell (ICEPIC) code. Free space plasma does not interact with bounding wall surfaces, which help prevent non-ideal effects, such as contamination and secondary electron emissions, from influencing the experimental results. In our experimental setup, free space plasma is generated by a multi-kW, 4.7 GHz CW microwave system at pressures ranging from 100 to 200 mTorr. A precision mass flow system controls the composition of the gas used to generate the plasma. Gas pressure, gas composition (a mixture of Ar, N2, and O2), and the power of the microwave beam are varied to study their effects on the stability, uniformity, and parameters of the plasma. Invasive and non-invasive plasma diagnostic methods were implemented to measure the electron temperature and density of the plasma. In addition, simulations of the plasma generated in our experiment were conducted with GlobalKin, a zero-dimensional global-kinetics model, using estimates of the total power absorbed by the plasma generated under different conditions. The results from the experiments and simulations conducted to date will be presented.

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