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(G*) POS-B8 – Measurements of a DC Gas Discharge

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The DC gas discharge is a non-thermal laboratory plasma that is initiated by an applied electric field. It serves as a useful apparatus for studying fundamental phenomena in plasma physics and has found several applications in materials science and engineering. In contrast to thermally ionized plasma, the distribution function of a gas discharge deviates from Maxwellian at low pressures. It is affected by a high-energy tail due to accelerated electrons and is truncated by inelastic collisions. To have a good understanding of particle kinetics within the plasma, measurements of the distribution function are important. Fortunately, this is made possible with the Langmuir probe diagnostic. In addition to measurement of the distribution function, Langmuir probes can also directly measure several important plasma properties including the electron temperature and plasma density. Furthermore, spatially separated probes can measure gradients in potential that can be used to infer an electric field. To investigate properties of gas discharges and to evaluate the design and implementation of a Langmuir probe diagnostic, an array of several probes was designed and inserted into an intermediate pressure DC gas discharge. Before the Langmuir probe experiments, measurements of the discharge were performed including obtaining IV characteristics and determining breakdown voltages for several gases. Images of the discharges were recorded using a USB camera and emission spectra were obtained using a visible light spectrometer. Langmuir probe measurements were then taken of the electric field in the cathode region and IV characteristics were obtained to determine plasma properties: both by a graphical method and by the calculation of the electron energy distribution function (EEDF) from the second derivative.

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