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3P10 - Gas Temperature Determination of Nonthermal Plasma Through Boltzmann Plot Method

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Nonthermal plasma (NTP) causes delayed melanoma cell death which is indicative of apoptosis. The NTP is produced by applying a high voltage signal to helium gas, causing ionization of a combination composing neutral gas molecules and ambient air. By exploring the plasma's physical temperature, the energy exchanged during the plasma-cell interaction can be further understood. The NTP discharge contains radical species including ions, electrons, and neutrals. The temperature of the electrons exceeds the temperature of the gas due to high energy collisions which suggest that the NTP is not in a state of Local Thermodynamic Equilibrium (LTE). The gas temperature can be understood as the physical temperature the test sample undergoes during the application of the plasma discharge. In order to determine the temperature of the gas, the Boltzmann Plot Method (BPM) has been instituted. This diagnostic has been proven to approximate the physical temperature of the gas using spectroscopic measurements of the OH radical present in the NTP discharge. For the application of the BPM, it is assumed the upper state of at least two spectral lines in the OH spectrum can be distinguished, the transition probabilities are accurately identified, and the plasma under study is in LTE. Even though the NTP is not in LTE, the temperature can still be resolved if the uncertainties of these assumptions are factored in to calculations. The comparison of spectral standards to experimentally measured spectra under high resolution provides a model of NTP temperature.

Author: Mr ASHFORD, Marcus (Primary Contributor)

Co-authors: Mr ALLEN, James (Secondary Contributor);   Dr ZIRNHELD, Jennifer (Faculty Supervisor);   Dr BURKE, Kevin (Faculty Supervisor)

Presenter: Mr ASHFORD, Marcus (Primary Contributor)

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