Characterization of the Transition from Collisional to Stochastic Heating in a RF Discharge

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In this work, we have studied the transition from the collisional to stochastic regime occuring in a RF inductively coupled plasma discharge, with the RF antenna placed inside to the chamber, using a Langmuir probe and a Faraday cup techniques for electron and ion current measurements, respectively. The Electron and Ion Energy Distribution Functions were obtained using a method based on the second derivative of the I-V curves and the analysis of its evolution as a function of the working pressure revealed the existence of two distinct discharge regime, where the EEDFs have particular trend in their shape. These regimes are governed by the heating processes occuring in the plasma, namely the stochastic and collisional regime. The stochastic regime, for example, one can assign the presence of a high energy electron tail in de EEDF. For electrons, this high energy tail can be considered an indication of a two population of electrons formation in the plasma sheet. The transition from the collisional to the stochastic regime was also characterized in the analysis of plasma parameters such as electron temperature and density corroborating with the EEDF analysis. We have also shown that the change in the heating regime is also reflected in the energy distribution of the ionic component of the plasmas.