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Electron Collisions and Ionization of Argon Gas in the Inductively Coupled Plasma Mass Spectrometer CARSON EVANS, ROSS SPENCER, BYU Department of Physics and Astronomy — The plasma torch of the Inductively Coupled Plasma Mass Spectrometer (ICP) is powered by a 3-turn coil attached to a radio-frequency generator running at 40 MHz. The discharge is started by a Tesla coil that briefly ionizes a small fraction of the argon gas flowing through the coil. After the initial ionization pulse, the RF field produces the electric field that gives the electrons enough energy to either exciting or ionizing the argon atoms. We are modeling the effect of the RF field on the electrons, as well as the effect of collisions between electrons with neutral, excited, and ionized argon and with other electrons. We eventually will also include the possibility of de-excitation and recombination of the argon. Our goal is to see an electron avalanche, a chain reaction as electrons accelerate away from the argon ions and collide with neutral argon atoms, causing them to ionize also, and then to see the resulting plasma come to steady state. We find that normal operating condition of the RF coil does not produce a strong-enough electric field to ionize argon; an initial high-field transient is needed. The details of how the electrons evolve during startup will be presented.

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