Pulsed discharges in hydrogen and its isotopes play critical roles in several applications\textsuperscript{1,2}: pre-ionization plasmas in field-reversed configuration, plasma lens for focusing heavy-ion beams, and gas-puff Z-pinches. However, the initial phase of these discharges is still poorly understood.

We have developed a particle-in-cell / Monte Carlo (PIC/MC) model to study the initial phase of these discharges. In our model, we have adopted the energy conserving and direct implicit schemes with adjustable damping\textsuperscript{3}. The collisions between the charged particles and the neutrals are described by Monte Carlo method, including all the process of Coulomb, elastic, excitation, ionization and recombination collisions. With this model, we study the effects of several parameters on the properties of the discharges: the amplitude and pulse duration of the voltage, the magnetic field strength, the dimensions and the initial neutral gas density and temperature profiles. Strong effects of the magnetic field magnitude and the gas pressure on the discharge properties have been shown.


* This work was supported by the National Natural Science Foundation of China (No. 11105057).