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Dynamics of Ar metastables in RF CCP discharge: PIC/MCC/DSMC simulation LU-JING HOU, MIKHAIL PUSTYLNIK, ALEXEI IVLEV, H.M. THOMAS, G.E. MORFILL, Max Planck Institute for Extraterrestrial Physics — Metastables have long been expected to play an important role in determining properties of an argon (Ar) RF plasma discharge. In the past two decades, extensive experimental, theoretical and numerical research had been conducted to reveal their importance in RF discharge. However, obvious contradictions, which cannot be easily accommodated for different discharge conditions, are found between experiments and theories/simulations and between simulations using different models as well. This clearly indicates an insufficient understanding of physical processes involving metastables in RF discharge. To shed new light on the role of metastables on RF discharge, the present work employs combined PIC/MCC and Direct Simulation Monte Carlo (DSMC) methods to study the dynamics of metastables in RF discharge. Both plasmas (ions and electrons) and metastables are treated as particles in the simulation and are coupled though various collision processes, such as metastable excitation, pooling, electron quenching, step ionization, metastable-wall secondary electron emission, neutral-metastable elastic collisions, in addition to those included in typical PIC/MCC simulation, such as direct ionization and excitation.

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