

Abstract Submitted
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High-Energy

Ballistic

Electrons in Low-Pressure Radio-Frequency Plasmas.¹ YANGYANG FU, BOCONG ZHENG, DE-QI WEN, PENG ZHANG, QI HUA FAN, JOHN P. VERBONCOEUR, Michigan State University — This work demonstrates the presence of a small number of high-energy ballistic electrons (HEBEs) that originate from secondary electrons in low-pressure radio-frequency (rf) plasmas. The kinetic behaviors of the HEBEs are illustrated through electron energy probability functions from the fully kinetic particle-in-cell simulations, showing two wavy high-energy tails and two bifurcations during one rf cycle. Test-particle simulations and a semi-analytical method associated with nonlocal electron kinetics are performed to characterize the HEBE trajectories, which reveal the ballistic nature of the HEBEs and their typical bouncing features between the rf sheaths. Parameter dependence of the HEBEs on the discharge conditions (e.g., gas pressure, gap distance, and rf frequency) are identified, which is relevant to the plasma collisionality. With a pronounced presence of HEBEs, the overall impacts of the secondary electron emission on discharge parameters, such as electron power absorption and ionization rate, are also illustrated.

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Yangyang Fu
Michigan State University

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