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Electron beam formation and resonance phenomena in low pressure capacitive rf plasmas SEBASTIAN WILCZEK, JAN TRIESCHMANN, RALF PETER BRINKMANN, THOMAS MUSSENBROCK, Ruhr University Bochum, EDMUND SCHÜNGEL, JULIAN SCHULZE, West Virginia University, Morgantown, ARANKA DERZSI, IHOR KOROLOV, ZOLTÁN DONKÓ, Wigner Research Center for Physics, Budapest — In capacitively coupled radio frequency discharges the expansion of the modulated plasma sheaths accelerates a fraction of electrons. This consequently leads to various kinds of electron beam formations; one or likely multiple beams are triggered and start propagating. Especially at low pressures, these electrons traverse through the plasma bulk with high kinetic energy and ionize the neutral background gas to sustain the plasma. Under distinct discharge conditions a violation of the quasi-neutrality of the plasma bulk is indicated by a local accumulation of charge density. Consequently, strong electric fields exist even in the center of the discharge. In this work, the electron beam formations are investigated in conjunction with resonance behavior of the discharge by means of 1d3v Particle-In-Cell simulations. It is shown that the driving frequency or higher harmonics of the driving frequency match the local electron plasma frequency, particularly in the bulk region. This is an indication of local resonance phenomena in conjunction with the establishing of distinct electron beam modes being formed. Moreover, this is connected to a change of the local electric field.

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