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Generation of super-thermal electrons by intense electron beam in a dc discharge D. SYDORENKO, University of Alberta, Edmonton, Alberta, Canada, I.D. KAGANOVICH, A.V. KHRABROV, Princeton Plasma Physics Laboratory, Princeton, NJ, P.L.G. VENTZEK, L. CHEN, Tokyo Electron America, Austin, TX — Experimental measurements of electron energy distribution function in a rf dc discharge with 800 V dc voltage reveal the presence of a peak of super-thermal electrons with energy in the range of 40-400 eV [1]. The cathode in the experimental device could emit electrons thus producing an electron beam. We used a particle-in-cell code [2] to investigate acceleration of plasma electrons by an electron beam in a dc discharge with parameters close to those of Ref. [1]. The beam excites electron plasma waves via the two-stream instability. Simulations show that the two-stream instability is intermittent, with quiet and active periods. During the quiet periods, the beam propagates through the plasma with minimal perturbations. During the periods of activity of the two-stream instability, the beam interacts with the plasma most intensively at locations where the global frequency of instability matches the local electron plasma frequency. There may be two resonance areas with intense oscillations usually near the edges of the plasma. These intense localized plasma oscillations produce peaks in the velocity distribution function similar to the ones measured in the experiment.

[1] L. Xu et al., Appl. Phys. Lett. 93, 261502 (2008).
[2] D. Sydorenko et al., Phys. Plasmas 13, 014501 (2006).

Dmytro Sydorenko
University of Alberta, Edmonton, Alberta, Canada

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