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Physics of Electron Beam Generation and Dynamics from a Single Diamond Field Emitter[1] THOMAS KWAN, CHENGKUN HUANG, ANDREI PIRYATINSKI, RYAN BAKER, DONGSUNG KIM, HEATHER ANDREWS, RYAN FLEMING, VITALY PAVLENKO, EVGENJA SIMAKOV, Los Alamos National Laboratory — Many applications such as compact accelerators and electron microscopy demand high brightness electron beams with small beam size and low emittance. Electric-field-assisted diamond emitters manufactured from semiconductor processes are strong candidates for cathodes in such sources. We use the LSP particle-in-cell code to simulate the diamond emitter and obtain the beam size and divergence. ?To account for charge transport/tunneling, a semiclassical Monte Carlo emission method is developed and applied to a model to explain the measured emission characteristics. The beam divergence observed in the simulations is further corroborated with electron trajectories in an empirical field model. The results are compared with experimental observations. An effective mass based model accounting for the conduction band quantization in a high aspect ratio semiconductor nanotip is also developed for electron transport and emission.

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