

Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Modeling of Diamond Field-Emitter-Arrays for high brightness photocathode applications¹ THOMAS KWAN, CHENGKUN HUANG, ANDREI PIRYATINSKI, JOHN LEWELLEN, KIMBERLY NICHOLS, BO CHOI, VITALY PAVLENKO, DMITRY SHCHEGOLKOV, DINH NGUYEN, HEATHER ANDREWS, EVGENYA SIMAKOV, Los Alamos Natl Lab — We propose to employ Diamond Field-Emitter-Arrays (DFEAs) as high-current-density ultra-low-emittance photocathodes for compact laser-driven dielectric accelerators capable of generating ultra-high brightness electron beams for advanced applications. We develop a semi-classical Monte-Carlo photoemission model for DFEAs that includes carriers' transport to the emitter surface and tunneling through the surface under external fields. The model accounts for the electronic structure size quantization affecting the transport and tunneling process within the sharp diamond tips. We compare this first principle model with other field emission models, such as the Child-Langmuir and Murphy-Good models. By further including effects of carrier photoexcitation, we perform simulations of the DFEAs' photoemission quantum yield and the emitted electron beam. Details of the theoretical model and validation against preliminary experimental data will be presented.

¹Work supported by LDRD program at LANL

Thomas Kwan
Los Alamos Natl Lab

Date submitted: 13 Jul 2017

Electronic form version 1.4