Abstract Submitted
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Point-to-Point Coulomb Effects in High Brightness Photoelectron Beamlines for Ultrafast Electron Diffraction[1] MATTHEW GORDON, University of Chicago, S.B. VAN DER GEER, Pulsar Physics, JARED MAXSON, Cornell University, YOUNG-KEE KIM, University of Chicago — Spatial and temporal resolution of electron diffraction and microscopy techniques can typically not exceed the quality of the electron source. For this reason, ultra-high brightness photocathodes have been actively sought, and found, over the past decades. This however poses a new challenge: Maintaining the increased phase-space density throughout the entire device. Most beam dynamics simulation codes approximate detrimental Coulomb interaction with a mean-field space charge approach. While this approximation is sufficient in traditional beams with large temperature, it fails to capture the more subtle stochastic effects that arise due to the point-like nature of electrons. In this contribution we introduce two numerical methods implemented in the General Particle Tracer (GPT) code to calculate the effects of the photocathode image charge when using a point-to-point interaction model. With these methods we simulate the effects of stochastic Coulomb interactions on two high brightness photoemission beamlines designed for single-shot ultrafast electron diffraction: one using a 200 keV gun, and the other using a 5 MeV gun.

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