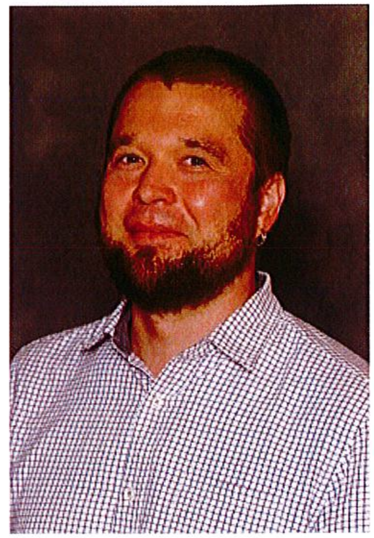
Center for
BRIGHT BEAMS
A National Science Foundation Science & Technology Center



Prof. Sergey Baryshev

Electrical Engineering,
Michigan State University

Quantum Effects in Electron Emission from Nanodiamond

Synthetic granular ultra-nano-crystalline diamond with a high *n*-type conductivity via nitrogen doping ((N)UNCD) has emerged as a high efficiency field- or photo-emission source. It is widely anticipated that graphitic grain boundaries (surrounding diamond grains) are behind the high efficiency of (N)UNCD. Grain boundary effect hypotheses rest upon the fact that (N)UNCD efficiency can be largely "tuned" through the diamond-to-graphite ratio typically quantified by optical and X-ray spectroscopy techniques.

In this talk, some unconventional effects that assist electron emission from (N)UNCD will be outlined: 1) output current saturation and 2) light emission during field emission, and 3) intrinsic emittance independent of the excess photon energy during photoemission. Our recent experimental and theoretical works, which further corroborate the crucial role of defect grain boundary states on electron emission from (N)UNCD, will be summarized. We will outline the critical role of density of grain boundary states induced inside the diamond fundamental band gap, charge carrier mobility and effective mass, as well as grain boundary spatial effects on electron emission. It will be discussed how the models, implying quantum effects associated with the graphitic grain-boundary-promoted electron emission, can simultaneously and self-consistently account for high efficiency and unconventional behavior of (N)UNCD.

Monday, June 3, 2019

3:10 pm

Hosting Institution: University of Chicago, PRC 201

Simulcast: https://cornell.zoom.us/j/373862927

CBB research is conducted with major support from the National Science Foundation under Grant No. PHY-1549132.