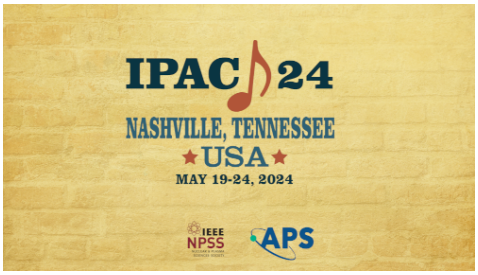

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Temperature, density of states, and thin film optical effects on electron emission from semiconductor photocathodes

Wednesday, 22 May 2024 16:00 (2 hours)

Increasing the brightness of electron beams emitted from photocathodes will allow X-ray Free Electron Lasers (XFELs) to lase at larger photon energies with higher pulse energies. This will enable the development of key new accelerator capabilities. Higher electron beam brightness can be achieved by creating photocathodes with high quantum efficiency (QE) and/or low intrinsic emittance. Results from recent experiments demonstrated that QE can be increased 2 to 5 times by optical interference absorption effects in specifically layered materials compared to conventionally grown photocathodes. We have developed models for electron emission from thin film semiconductor photocathodes that include optical interference effects and show similar increase in QE for alkali-antimonide and cesium-telluride photocathodes. Here, we extend these models to include temperature and density of states effects on electron emission. We present results from these models on both QE and intrinsic emittance and discuss possible ways to increase the brightness of electron beams emitted from thin film semiconductor photocathodes.

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