

# Physics and Applications of High Brightness Beams



Contribution ID: 63

Type: **Invited talk**

## Advancements in Sub-GV/m X-Band Photocathode Gun at the Argonne Wakefield Accelerator Facility

*Tuesday, June 20, 2023 9:30 AM (25 minutes)*

The Argonne Wakefield Accelerator (AWA) supports an extensive research portfolio along three themes: electron beam production, electron beam manipulation, and electron beam-driven wakefield acceleration. Currently, AWA is developing a sub-GV/m X-band photocathode gun (Xgun) driven by ultra-short radiofrequency (rf) pulses. With a demonstrated gradient of 400 MV/m on the photocathode surface, the Xgun exhibits low dark current and breakdown rates. The Xgun is powered by high-power rf (300 MW) and short rf pulses (9-ns FWHM) from AWA's power and transfer structure based on two-beam acceleration (TBA). This development has several significant applications. In the short term, the Xgun will be employed to investigate photocathode emission physics in ultra-high-field environments (see E. Frame's presentation). In the medium term, it will be utilized as an injector for compact X-ray free electron lasers (X-FELs). Lastly, in the long term, it will serve as AWA's 500 MeV TBA demonstrator. This talk will highlight the recent progress and outline our research and development roadmap for the coming years.

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**Session Classification:** High brightness electron sources