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Optical optimization of Cs2Te photocathodes

Tuesday, 9 May 2023 16:30 (2 hours)

This poster will report the progress on optical optimization of Cs2Te photocathodes using simulations and preliminary experimental results. Thin film semiconductor photocathodes are often used in high brightness electron sources. These sources are particularly bright when the cathodes are operated "near threshold", i.e., with a laser energy close to the sum of the band gap and electron affinity. However, doing so results in very low quantum efficiency, in part due to inefficient light absorption. Most photocathodes that use visible or IR lasers (e.g., alkali antimonides, GaAs, etc.) benefit from optically optimizing the substrate to take advantage of optical interferences. This improves light absorption in the photoemissive thin film to enhance quantum efficiency (QE) and brightness. For example, QE enhancement of over 4x has been shown for Cs3Sb cathodes near threshold. Cs2Te is a commonly used UV photocathode that is more robust than the alkali antimonides and is also a candidate photocathode for the new CARIE injector at LANL. We describe simulations and preliminary experimental data showing optical enhancement of Cs2Te photocathodes. We also describe how the techniques for optically optimizing Cs2Te and other UV photocathodes differs from similar techniques for photocathodes that use visible or IR light, considering, in particular, the lack of reflective materials and the reduced variation in optical constants.

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Footnotes

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Primary author: ALEXANDER, Anna (Los Alamos National Laboratory)

Co-authors: SIMAKOV, Evgenya (Los Alamos National Laboratory); HOFFBAUER, Mark (Los Alamos National Laboratory); PAVLENKO, Vitaly (Los Alamos National Laboratory)

Presenter: ALEXANDER, Anna (Los Alamos National Laboratory)

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