Contribution ID: **2067** Contribution code: **SUPC058** Type: **Student Poster Presentation**

# Monte Carlo modeling of spin-polarized photoemission from NEA GaAs with low-temperature and strained-lattice effects

*Sunday, 19 May 2024 14:00 (4 hours)*

GaAs-based photocathodes activated to negative electron affinity (NEA) is the only existing technology that can deliver intense and highly spin-polarized electron beams for the forthcoming Electron-Ion Collider as well as enable spin-polarized scanning tunneling microscopy, ultrafast spin-polarized low-energy electron diffraction, and other cutting-edge experiments. The degree of spin-polarization of electrons photoemitted from unstrained GaAs is usually considerably less than the theoretical maximum of 50%. However, it has been experimentally observed that the degree of electron spin polarization can be increased and even exceed the theoretical maximum when the sample is cooled to low temperatures. Additionally, in strained lattice samples, the theoretical maximum of spin polarization increases to 100%. The previously developed Monte Carlo approach to spin-polarized photoemission from unstrained, room temperature NEA GaAs provides excellent agreement with experimental data in a wide range of doping densities and photoexcitation energies. This study aims to extend the model's capabilities by incorporating both low-temperature and strained-lattice effects into the band structure and exploring their impact on spin and momentum relaxation mechanisms. Modeling of both low-temperature and strained NEA GaAs will provide a foundation for modeling photoemission from novel spin-polarized materials and complex layered structures.

## Footnotes

## Funding Agency

NIU's CAST Program

## Paper preparation format

Word

## Region represented

North America

**Primary author:** CALLAHAN, John (Northern Illinois University)

**Co-authors:** RODRIGUEZ ALICEA, Ambar (University of Puerto Rico); CULTRERA, Luca (Brookhaven National Laboratory); CHUBENKO, Oksana (Arizona State University); KARKARE, Siddharth (Arizona State University)

**Presenter:** CALLAHAN, John (Northern Illinois University)

**Session Classification:** Student Poster Session

**Track Classification:** MC2: Photon Sources and Electron Accelerators: MC2.T02 Electron Sources