Good Afternoon,
You are invited to attend our weekly ECE Graduate Seminar.

Old Dominion University
College of Engineering and Technology
Department of Electrical and Computer Engineering

All lectures to be held at 3:00pm on Fridays online at
https://vs.prod.odu.edu/kvs/zoom/?cid=202120_ECE731831GraduateSeminarSpring2022VS_96353
For more information, contact Dr. Chung Hao Chen at (757) 683-3475 or email cxchen@odu.edu.

Friday, January 14, 2022 Seminar Topic:

Study of Quantum Efficiency Enhancement in Different Mie-type Nanostructured NEA GaAs Photocathodes

by Md. Aziz Ar Rahman, Ph.D. Candidate from the Department of Physics at Old Dominion University

Abstract:

The interaction of 500-800 nm radiation with Mie-type nanostructured GaAs of different shapes (truncated nanocone, nanopyramid and nano-square columns) has been studied using the Lumerical's Finite Difference Time Domain (FDTD) and CHARGE tool. The motivation is to design an optimized structure for Negative Electron Affinity (NEA) GaAs photocathode which supports Mie-type resonance to maximize the quantum efficiency (QE) in 700-800 nm wavebands for generation of polarized electrons. At resonance wavelengths these reported structures present a very small reflectance as low as 1%, resulting in much higher QE. The simulated QE around 780 nm shows much strong enhancement up to 27% due to the shifting of resonance towards the longer wavelength compared with the results from previously reported Mie-type NEA nanopillar array GaAs (< 15%) and flat NEA GaAs wafer (~13%) photocathodes. The field profile distribution shows that most of the photoelectrons are generated within the nanostructures at a location ~100 nm away from the top and side emission surfaces, where the transport of most of the photoexcited electrons to the emission surface occur and contribute to the emitted electrons. The field profile distribution along with the field lines also shows the excitation of dipole and quadrupole modes within the nanostructures at resonant frequency. The significant increase in the QE of the studied structures around 780 nm indicates that this type of photocathodes could be a very promising candidate needed by high current accelerators such as CEBAF at Jefferson Lab and the future Electron Ion Collider.

Bio:
Research area: Quantum efficiency and spin polarization enhancement of photocathode electron source for applications in electron ion collider at Jefferson Lab.