

Announcing the Final Examination of Christopher Arose for the degree of Doctor of Philosophy in Physics

Date: December 14th

Time: 2:00 p.m.

Location: https://teams.microsoft.com/l/meetup-join/19%3ameeting_ZjdjZjAwMDUtODdkMS00ZjZjLWI0MDEtNDkzYmU4NTM2M2RI%40thread.v2/0?context=%7b%22Tid%22%3a%22bb932f15-ef38-42ba-91fc-f3c59d5dd1f1%22%2c%22Oid%22%3a%228b1fa0a0-36eb-4ab1-9ef6-43dff319e2e3%22%7d

Dissertation Title: Spectrally Selective Pyroelectric Detectors for THz Sensing

Abstract:

Spectrally-selective room temperature pyroelectric detectors have many applications in defense and industry settings for THz detection, such as chemical detection and imaging. In this work, a pyroelectric detector was fabricated with an integrated wavelength-selective absorber based on plasmonic grating absorbers for the purpose of detecting synthetic opioids, such as fentanyl. The aim of this project was to produce a tool for reliable detection while preventing human contact with these compounds. Multiple pyroelectric materials were considered, and commercial lithium tantalate (LT) wafers of varying thickness were used as the pyroelectric element in the final detectors. A novel absorber design with multiple absorption features in the THz regime was investigated and compared to designs already discussed in the literature. The absorber was investigated as a function of the three unique parameters of the absorber's geometry, as well as the metals comprising the absorber layer and the pyroelectric material used. Finally, the manufactured detectors were characterized for responsivity and D^* . The absorber was also tested for its use in electromagnetic filtering and found to be an effective band-stop filter when paired with a passive dielectric with no distinct absorption features in the frequency range of interest. Unlike previous efforts, this absorber utilizes no exotic materials and requires only a single lithography step to achieve selectivity in this frequency range. Preliminary steps have been taken into investigation of integrating the absorber design into a multichannel detector for use in standoff detection equipment.

Outline of Studies:

Major: Physics

Educational Career:

M. S. University of Central Florida (2021)

B. S. University of Central Florida (2018)

Committee in Charge:

Dr. Subith Vasu (Chair)

Dr. Robert Peale (Co-Chair)

Dr. Elena Flitsiyan

Dr. Anthony Terracciano

Dr. Reza Abdolvand (External Committee Member)

Approved for distribution by Dr. Subith Vasu, Committee Chair, on November 23, 2022

The public is welcome to attend.