Announcing the Final Examination of William Ernest Richardson for the degree of Doctor of Philosophy in Physics

Date: April 4, 2024
Time: 2:00 p.m.
Room: PSB 160
Dissertation title: An Atomistic Approach to Large Scale Transport: An Investigation of the Resistivity-Size Effect in Thin Films with Realistic Disorder.

Abstract:
The resistivity-size effect has emerged as an obstacle in our pursuit of ever shrinking electronic devices. Interconnects and vias are the nanoscale copper conductors connecting within and between layers of a CPU, respectively. New materials and methods are required to address this problem. In particular, there is a critical need for a theoretical framework which can evaluate the properties of new materials in a way that reflects real world performance.

To this end, a computational methodology is developed by introducing an ab initio parameterized tight-binding model to accurately calculate electronic structure and simulating electronic transport via the calculation of the Kubo-Greenwood conductivity tensor. Transport properties are computed using the kernel polynomial method, a highly scalable approach wherein physical quantities can be represented as a weighted sum of Chebyshev polynomials. Using this combined approach, it is possible to simulate mesoscale electronic transport for systems with over 10^6 sites containing various forms of realistic disorder. Through the use of ensemble calculations, an examination of resistivity due to surface disorder and disorder due to realistic phonon fields is presented.

Outline of Studies:
Major: Physics

Educational Career:
M. S. Materials Science, University of Central Florida, Florida, 2017
B. S. Physics, University of Central Florida, Florida, 2014
B. S. Mathematics, University of Central Florida, Florida, 2014

Committee in Charge:
Dr. Eduardo Mucciolo (Chair)
Dr. Patrick Schelling (Co-Chair)
Dr. Enrique del Barco
Dr. Volodymyr Turkowski
Dr. Kevin Coffey (External Committee Member)

Approved for distribution by Dr. Eduardo Mucciolo, Committee Chair, on March 17, 2024.

The public is welcome to attend.