

## **Announcing the Final Examination of Cameron Nickle for the degree of Doctor of Philosophy in Physics**

**Date:** November 16, 2020

**Time:** 12:00 p.m.

**Room:** Zoom Meeting: <https://ucf.zoom.us/j/92929394593>

**Dissertation title:** Theoretical Analysis Of The Conduction Properties Of Self-Assembled Molecular Tunnel Junctions

### **Abstract:**

As the size scale of electrical devices approach the atomic scale. Moore's law is predicted to be over for semiconductor devices. Studies into the replacement of semiconductor technology with organic devices was first predicted by Avriam and Ratner[1] in 1974. Since then significant research into molecular based organic devices has been conducted. The work presented in this dissertation explores the theoretical frameworks used to model transport through molecular junctions. We present studies which seek to garner a better understanding of the charge transport through molecular junctions and how the conduction properties can be optimized. We show that a single atom can change a molecule from an insulator to a conductor. We also study the effects of sigma and pi bridges on molecular rectification. We will then show molecular devices that act as viable electrical static and dynamic switches. The studies presented here help to demonstrate the viability of organic devices in the forms of rectifiers and switches with applications ranging from the replacement of traditional semiconductor devices to neuromorphic computing.

### **Outline of Studies:**

Major: Physics

### **Educational Career:**

B. S. University of South Carolina, South Carolina, 2014

### **Committee in Charge:**

Dr. Enrique Del Barco (Chair)

Dr. Eduardo Mucciolo

Dr. Masahiro Ishigami

Dr. Florencio Eloy Hernández (External Committee Member)

Approved for distribution by Dr. Enrique Del Barco, Committee Chair, on November 9, 2020.

The public is welcome to attend remotely.