Announcing the Final Examination of Mr. Alvar Rodriguez Garrigues for the Degree of Doctor of Philosophy in Physics

Date: Wednesday, April 6, 2016
Time: 1:00 p.m.
Room: PSB 248
Dissertation title: Electrostatic Control over Temperature-dependent Tunneling across Single-molecule Junctions

The aim of the present dissertation is to improve the understanding and methodology of temperature-dependent tunnel conduction through individual molecules by single-electron transport spectroscopy. New advances in electrochemistry present individual molecular diodes as a realistic option for the implementation on molecular circuits thanks to their high current rectification ratios. Therefore, a major requisite in this field is to understand and control the conduction behaviors for a large variety of conditions. This work focuses on the electric conduction through ferrocene-based molecules as a function of temperatures within a wide range of bias and gate voltages by means of three-terminal electromigrated-broken single-electron transistors (SETs).

The results show that the temperature dependence of the current (from 80 to 260 K) depends strongly on the bias and gate voltages, with areas in where the current increases exponentially with temperature (at the Coulomb blockade regimes), and others where the increase of the temperature makes the current only to vary slightly (at resonance) or to decrease monotonically (at the charge degeneracy points). These different observed behaviors of the tunneling current with increasing temperatures can be well explained for by a formal single-level coherent tunneling model where the temperature dependence relies on the thermal broadening of the Fermi distributions of the electrons in the leads. The model portraits the molecule as a localized electrostatic level capacitively coupled to the transistor leads, and the electrical conduction through the junction as coherent sequential tunneling.

Outline of Studies:
Major: Physics

Educational Career:
B. S., 2010, University of Science and Arts of Oklahoma
M. S., 2013, University of Central Florida, USA

Committee in Charge:
Dr. Enrique del Barco
Dr. Elena Flitsiyan
Dr. Masahiro Ishigami
Dr. Florencio E. Hernandez

Approved for distribution by Enrique del Barco, Committee Chair, on March 22, 2016.

The public is welcome to attend.