Announcing the Final Examination of Mr. Daniel Bonior for the degree of Doctor of Philosophy

Date: October 26, 2018
Time: 4:30 p.m.
Room: PSB 445
Dissertation title: Mathematical Foundations of Adaptive Quantum Processing

Quantum information has the potential to revolutionize the way we store, process, transfer and acquire information. In particular, it offers exciting new approaches to secure communication, computation and sensing. However, in order to realize such technologies, we must first understand the effects that environmental noise has on a quantum system.

This dissertation explores the underlying structure of quantum information. Specifically, we use the Bloch representation of a qubit to construct the error functions associated with a qubit communication protocol. Through the use of a previously developed process named Adaptive Quantum Information Processing, we explicitly obtain the possible improvement for the error rate when communicating with qubits.

Lastly, we study our set of error functions through the lens of domain theory. Domain theory is a subset of mathematics that was developed in order to rigorously formalize computations. We order the error functions by the values of their images. With this order we are able to show that the set of error functions, as well as the symmetric unital channels, form a continuous directed-complete partially order set, i.e. a domain. Furthermore, we construct a particular function on our domain, referred to as a measurement, that quantifies the information content for the error functions.

Outline of Studies:
Major: Physics

Educational Career:
B.S., 2013, Middle Tennessee State University

Committee in Charge:
Dr. Eduardo R. Mucciolo
Dr. Keye Martin
Dr. Luca Argenti
Dr. Bhimsen K. Shivamoogi
Dr. Dan C. Marinescu

Approved for distribution by Eduardo Mucciolo, Committee Chair, on October 11, 2018. The public is welcome to attend.