Friday, January 22, 2016
4:10pm-5:00pm  **Student AIM Seminar** -- Scott Rich (University of Michigan)  **Utilizing Phase Response Curves to understand the activity of large neuronal networks** -- 1084 East Hall

Friday, February 05, 2016
4:10pm-5:00pm  **Student AIM Seminar** -- Derek Wood (University of Michigan)  **Sensor Array Imaging in Random Media** -- 1084 East Hall

Friday, February 12, 2016
4:10pm-5:00pm  **Student AIM Seminar** -- Michael Newman (University of Michigan)  **Introduction to Quantum Information** -- 1084 East Hall
Utilizing Phase Response Curves to understand the activity of large neuronal networks

Since the era of Hodgkin and Huxley in the 1950s, the neurons in your brain have been modeled with various degrees of accuracy and complexity as systems of differential equations. Since these models typically exhibit oscillatory properties, a common way to analyze their properties is with the Phase Response Curve (PRC). PRCs illustrate how a perturbation delivered at various phases of an oscillation differentially advance or delay the timing of subsequent oscillations. For neurons, the perturbations are synaptic activity and the oscillations are action potential firings.

In this talk, I will first provide a background of the mathematics underlying the PRC and its application to analyzing systems of connected oscillators. I will then provide results from my current research that show how the properties of a neuron's PRC can change the overall behavior of a large neuronal network and briefly discuss the biological importance of these results.

Sensor Array Imaging in Random Media

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On the first day of a complexity theory course, a teacher generally introduces the complexity classes P and NP: the set of tasks that can be done efficiently on a deterministic and nondeterministic computing agent, respectively. These classes are the most important because they represent the boundary between things we can actually do on our computers in a reasonable amount of time, and things we can't.

More recently, quantum mechanics has stretched this computational boundary even further: tasks that are fundamentally impossible using the computers of today might not be for the computers of tomorrow (or at least, maybe a century from now).

The field of quantum information theory explores this question: assuming quantum mechanics is valid, what type of computational power does its view of nature give us? This is the new boundary of things we could actually do on our computers.

In this talk, I will give an abbreviated introduction to the basics of quantum information. I will discuss a few of its applications, and if time permits, I will give a brief overview of my research in the direction of quantum cryptography. I'll assume nothing more than some linear algebra and familiarity with tensor products.