2009 - 2010

MATHEMATICS COLLOQUIUM SERIES
UNIVERSITY OF CENTRAL FLORIDA

Dr. Jason Swanson
Department of Mathematics
University of Central Florida

will speak on

"Brownian motion, the diffusion equation, and colliding particle models"

ABSTRACT: The well-known diffusion equation describes how the density of a diffusing substance, such as a cloud of dust particles in the air, evolves over time. The changes in the density are the result of each individual particle performing a Brownian motion, which is a continuous analogue of a random walk. Despite the fact that each particle is moving randomly, the diffusion equation itself describes a deterministic evolution. In this talk, I will begin by illustrating how the diffusion equation can be derived from the stochastic model as a first-order limiting approximation, as the number of particles tends to infinity. I will then discuss the second-order approximation, which is not deterministic. Rather, it is described by a stochastic partial differential equation. Such models have applications in studying smaller molecular systems, where the number of particles is not large enough to justify using the classical diffusion equation.

In the above models, the individual particles behave independently, and without interaction. In many applications, however, such models are insufficient. We frequently wish to describe systems of particles that include some kind of interaction potential. I will discuss the case in which particles interact through elastic collisions. Preliminary results are proven only in one dimension. In this case, the ensemble behavior of the system is exactly the same as the previous models, although the individual particles no longer perform Brownian motions. Instead, their motions will depend on the number of particles in the system. I will discuss the deterministic, first-order limiting approximation of their motion, as well as the second-order stochastic approximation.

DATE: **Thursday, October 22, 2009**

TIME: **11:00am – 12:00pm**

PLACE: **MAP 318**

Everyone is cordially requested to attend.