



DEPARTMENT OF  
MATHEMATICS  
*Illinois State University*

## Undergraduate Colloquium

**Title:** A Quantum Mechanics Paradigm: Bridging the Multiscale Divide in Single Species Population Dynamics

**Speaker:** Professor Leon Arriola (University of Wisconsin—Whitewater)

**Location:** STV 350A

**Time:** 1:00 pm - 1:50 pm on Thursday (03/05/2020)

**Abstract:**

A quantum mechanics formal framework is utilized in order to describe how the probabilities of having exactly  $n$  single species objects evolve in time. A Hamiltonian operator is constructed by appropriately defining creation and annihilation operators. The dynamical description of the population is found via a Markov generating function (GF). This GF is a solution of an associated Schrödinger equation. This quantum viewpoint, via the expected value of the GF yields the standard macroscopic ordinary differential equations (ODE) such as the decay, growth and logistic models, etc. In multiple interactions within a single species, unexpected effects such as quantum tunneling occurs in the probabilities of population. These tunneling effects gives specific predictions of the uncertainty in the population at the macroscopic level. This framework depicts emerging behaviors that are not seen in the current macroscopic models such as ordinary/partial differential equation ODE/PDEs.