

# SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

## **Measuring Molecular Orientation and Rotational Mobility Using a Tri-spot Point Spread Function**

MS Dissertation Defense

By

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**Abstract:** Single molecules have become a powerful tool for biophysicists since they were first optically detected 28 years ago. Understanding molecular orientation can not only improve the accuracy of single-molecule localization, but it can also provide insight into biochemical behaviors at the nanoscale. In this thesis, I present a method to measure the molecular orientation and rotational mobility of single-molecule emitters by designing and implementing a tri-spot point spread function. The point spread function is designed so that it is capable of measuring all degrees of freedom related to molecular orientation and rotational mobility. Its design is optimized by maximizing the theoretical limit of measurement precision. Two methods, basis inversion and maximum likelihood, are used to estimate the molecular orientation and rotational mobility. The basis inversion method was demonstrated experimentally with fluorescent beads. The maximum likelihood estimator approaches the theoretical limit of accuracy and precision in simulations, and is used to measure experimentally the orientation of single fluorescent molecules embedded in a polymer matrix.

DATE: Tuesday, April 18, 2017  
TIME: 1:00 p.m.  
PLACE: Green Hall. Room 0120

**Research Advisor:**  
Dr. Matthew Lew

This seminar is in partial fulfillment  
of the Masters Degree