Mathematics of Nanoscience

The requirement for specialized materials for applications in energy, medicine, electronics, and aeronautics has lead researchers to develop means to manipulate matter at the atomic and molecular scale of approximately one to one hundred nanometers. Materials at this scale can have radically different properties than at larger scales. Manipulation of materials at the nanometer scale requires new techniques than at larger scales. Understanding the scientific principles of these materials mandates the creation of mathematical models of nanomaterials that reflect these properties.

Graduate students in mathematics at UCF have the opportunity to play a key role in establishing the models that will clarify the behavior of materials at this scale. Working with scientists at the Nanoscience Technology Center at UCF and other researchers in nanoscience at UCF, mathematicians can work on formulating models of the kinetics of nanostructure formation, percolation of nanoproperties, materials characterization, chemical reaction kinetics, the dynamics and topology of polymers, and quantum computing. Skills in understanding these phenomena are in high demand in both industrial and academic research settings.

This is interdisciplinary mathematical research in a rapidly evolving area of interest to many researchers around the world. Students that are interested in this area of research should consult with Professor Brennan to consider the mathematical skills that should be developed for the problems currently under investigation. These skills can include algebraic geometry, algebraic statistics, stochastic differential equations, group representation theory, and dynamical systems. Some experience in chemistry, materials engineering, or materials physics would be useful but not essential.

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