



Dept. of Physics & Engineering Physics  
Fall 2021 Physics Colloquium Series

Lindy Boggs Energy Center, Rm. 240  
Monday, October 25, 03:00-04:30 pm

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***Drawing atomic-level insights from molecular machines,  
active battery materials, fuel cell components, and  
optically active materials using NMR spectroscopy***

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Solid-state NMR (SSNMR) spectroscopy is ideally suited for studying specific local properties, such as modes of disorder, bonding (both intra- and intermolecular), local dynamics, and proximity between components in complex heterogeneous mixtures. Since these exact characteristics provide the source of functional behavior in many important materials, SSNMR is ideally suited to understanding and optimizing functional materials. A series of studies developing SSNMR methods to tie local properties to the functional properties of a range of inorganic materials will be presented.

There are many classes of inorganic material that display valuable functionalities. Often, these arise from interplay between the components of a complex and heterogeneous material; furthermore, disorder, intermolecular bonds, and specific local dynamics may play a vital role in the material's function. The key to understanding and controlling behavior is therefore likely to be found in successfully quantifying these characteristics. Solids NMR spectroscopy is ideally suited to studying this exact class of properties, and therefore occupies a central role in the seminar, though an array of other valuable tools will also be discussed where warranted. The chief focus of the seminar will be the local structures and dynamics in materials for lithium-ion batteries, but the discussion will also include a collection of other inorganic systems selected to explore the effects of intermolecular interactions, optical properties, atomistic dynamics, and the relationship of physical properties to molecular orbitals.

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