

UNIVERSITY OF RHODE ISLAND
Department of Chemistry
SEMINAR

Room 105 Beaupre
3:00 P.M., Monday, Feb. 10, 2020

Prof. Keith A. Nelson
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**“Light, molecules, and matter:
New opportunities for
discovery and control”**

HOST

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Light, molecules, and matter: New opportunities for discovery and control

Keith A. Nelson

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Whenever we see peaks in a spectrum, we see that light has found some degrees of freedom – for example, electronic, vibrational, or spin transitions – and driven them, inducing some responses in the sample and carrying information about those responses to a detector and, behind that, a spectroscopist hoping to understand what it means. With increasing control over the light fields, we gain increasing control over the responses they can induce and increasing insight into the molecular or material sample. I'll present a brief review of progress in control over wide-ranging degrees of freedom, from collective vibrations in solids to molecular rotations and spins. Then I'll present several recent examples of insights gained through improved control. I'll show how optical excitation of shock waves and observations of responses to them have revealed key steps in “mechanochemistry” of energetic materials. Next I'll illustrate how terahertz-frequency light fields have enabled coherent control over collective material structure and behavior. Finally I'll discuss new methods for spectroscopy and control of electron spins and the prospects for new insights they might provide. In every spectral range, from microwaves to x-rays and beyond, broad new capabilities are increasing spectroscopic access to the degrees of freedom along which molecules and materials move and transform.