DEPARTMENT OF CHEMISTRY
Seminar Series

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Ultrafast meets ultrasmall: carrier dynamics in nanostructured semiconductors

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Understanding ultrafast carrier photophysics including photogeneration, recombination, transport, and energy transfer is the foundation of nanostructured material electronic and optoelectronic applications. Nanocrystals constitute a major class of nanostructured material. They have unique physics property due to strong quantum confinement effect that leads to multiple exciton generation (MEG) effect, where more than two pairs of exciton generated by absorbing one photon, and strong multiple exciton interactions that lead to Auger recombination. While the majority research groups rely on all optical spectroscopies to understand novel photophysics, I use a unique ultrafast photocurrent spectroscopy (sub-40 ps) by directly collecting photocurrent *in situ* devices. In this talk, I will demonstrate this unique ultrafast photocurrent spectroscopy (which can be developed to sub-1ps) to bridge the gap between fundamental photophysics and applied devices research. In addition to nanocrystals, I will demonstrate carrier transport dynamics study in 2D materials of black phosphorus.

Dr. Gao currently is an assistant professor in the Department of Physics and Astronomy at Clemson University, South Carolina, USA. Dr. Gao received his M.Sc. and PhD from the University of Alberta, Canada. He has been a postdoctoral fellow at the National Renewable Energy Laboratory (Advisor: Art Nozik), Los Alamos National Laboratory (Advisor: Victor Klimov), and Department of Chemistry at University of California, Berkeley. (Advisor: Paul Alivisatos)

BIO

His research interests include A) fundamental understanding of ultrafast carrier dynamics with a novel approach of ultrafast photocurrent spectroscopy; B) next generation optoelectronics including semi-transparent LEDs, ultra-sensitive IR photodetectors, and solution-processed solar cells; C) nanomaterials synthesis. His research are highly interdisciplinary and at the interface of Physics, Chemistry, Materials Sciences and Engineering, and Electrical Engineering.

Research Area: Ultrafast photocurrent spectroscopy, nanomaterials synthesis, nanostructured optoelectronics