“Energy Funneling and Excited State Dynamics”

Light-harvesting and intramolecular energy funneling are fundamental processes in natural photosynthetic systems, biosensors, and a large variety of organic photovoltaic devices. Dendrimeric macromolecules are artificial light-harvesting molecules possessing unique architectures that allow the efficient energy funneling through the molecular system. To understand the gradient-driven energy transfer we combine experiments -to determine the nature of the electronic excitation and energy transfer process- with computational results – to unravel the kinetics and intramolecular energy redistribution mechanism-. Through this joint effort, we find that the energy-transfer mechanism involves the ultrafast collapse of the photoexcited wavefunction due to non-adiabatic electronic transitions. Efficient coupling to high-frequency vibrational modes leads to ultrafast excited state dynamics and unidirectional efficient energy funneling. To advance beyond this fundamental understanding, we explore new dendritic molecules that can further expand the applications of dendrimers in photoactive devices.

Conjugated Polyelectrolyte Dendrimers are macromolecules with weakly coupled π-conjugated segments surrounded by ionic groups. A combination of chemical substitution and conjugation length yields dendrimers with energy gradients that biased the vectorial energy transfer towards their core. Time-resolved fluorescence characterizes the efficient energy transfer showing a reduction on the quantum yield with faster rates for energy transfer in the ionic macromolecules. These faster rates combined with lower quantum yield are attributed to smaller contribution to this process from the outer phenylene-ethynylene units of the dendrimers.

Bio
Valeria D. Kleiman received her Licenciatura (BSc, MSc) in Chemistry from the University of Buenos Aires, Argentina, and earned her Ph.D. in Physical Chemistry from the University of Illinois @ Chicago. Her graduate work was in the field of quantum control where she showed the control of gas phase processes in the frequency domain. Her current research interests at the University of Florida focus on the understanding of energy flow and excited state dynamics in macromolecular systems. Most of her research efforts use ultrafast spectroscopy to investigate light-harvesting and energy transfer in synthetic materials, including dendrimers and conjugated polymers; energy and electron transfer in multi-metal centered oligomers; and multidimensional and coherent spectroscopies. Kleiman’s honors and awards include an NSF Career award, a Research Innovation award (ResCorp), Ralph E. Powe Junior Faculty Enhancement award, CLAS-Teacher of the year award, AGAUR visiting scholar, visiting professor ICFO, and visiting professor at the University of Buenos Aires.

Valeria Kleiman
Associate Professor of Chemistry
Department of Chemistry
University of Florida

Friday, April 08, 2016
SEH B1220
2:00 – 3:00 p.m
Refreshments will be served at 1:45 p.m.