**Title:** Manipulating Time with Entropy

**Abstract:** Glass transition, the process of falling out of equilibrium for a supercooled liquid, has long been a topic of intense theoretical work. A key factor in this process is rapidly increasing relaxation times in supercooled liquids, which is related to the rapid loss of configurational entropy. However, structure/property relationships are difficult to directly predict in glassy systems as controlling entropy is non-trivial. In most existing studies, intermolecular interactions are used to control the local glass structure and dynamics. Here we demonstrate that configurational entropy can be strongly varied under extreme nanoconfinement. In these conditions, both entropic (intra-molecular) and enthalpic (interactions with interfaces) degrees of freedom for a supercooled liquid can be controlled, leading to a better understanding of the effect of entropy on relaxation times. Extreme nanoconfinement is achieved through confining polymers or molecular glasses in densely packed nanoparticle films of various sizes. These composite materials also have interesting functional properties such as resistance to thermal and UV degradation and better mechanical properties, which can all be achieved through manipulation of entropy.

Bio: Zahra Fakhraai received her B.Sc. and M.Sc. degrees in physics from Sharif University of Technology in Iran. She then joined Jamie Forrest’s group at the University of Waterloo from 2003 to 2007, to study the dynamics of polymers in thin films and on their surfaces. She received the 2007 American Physical Society’s Padden Award for her work towards her Ph.D. Zahra worked in the Gilbert Walker’s group at the University of Toronto from 2008 until 2009, performing near-field infrared imaging of the structure and chemical composition of protein aggregates. Zahra received NSERC post-doctoral fellowship in 2009 and moved to Mark Ediger’s lab at the University of Wisconsin-Madison to study properties of stable glasses until 2011, when she joined the Department of Chemistry at the University of Pennsylvania where she is currently an Associate Professor and the Graduate Chair with a secondary appointment at the Department of Chemical and Biomolecular Engineering. Her group at Penn combines experiments and modeling to explore structure, dynamics, and optical properties of amorphous materials at nanometer length scale. Zahra is a member of the American Physical Society, American Chemical Society, Materials Research Society, and the American Association for the Advancement of Science. She is the recipient of the NSF Career award (2014), Sloan fellowship in Chemistry (2015), the Journal of Physical Chemistry JPC-PHYS lectureship award (2017), and the APS Dillon Medal (2019).

