

## Playing Hide-and-Seek with Neutrons

Rana Ashkar, Virginia Tech, Blacksburg, VA

Neutron scattering is a powerful technique for exploring the structure and dynamics of matter on the nanoscale. During scattering events, neutrons interact with atomic nuclei of matter and are thus uniquely sensitive to atomic isotopes. In this talk, I will focus on the implementation of neutron isotope sensitivity in studies of soft materials which are fundamental to our lives, from materials that will shape the future of human technology; e.g. polymer composites and actuators, to those responsible for our basic existence; e.g. the membranes of our very cells. These and many other soft materials constitute a fascinating class of matter characterized by flexible molecular assemblies and fast molecular motions on the nanoscale. The dynamic nature of soft materials and their ability to reconfigure their local assemblies under different conditions results in a plethora of exciting material properties that can be tuned using smart molecular engineering and a deep understanding of the underlying physics. Neutron scattering provides us with an exquisite approach to probe these physical properties, from atomic to collective phenomena, and to gain insights into the emergent functions of collective assemblies of the material building blocks. Taking advantage of neutron sensitivity and the high Hydrogen content in soft materials, we can control which moieties to highlight and which to make completely invisible to neutrons by simply replacing Hydrogen with its heavier Deuterium isotope in select parts of the material. These contrast scenarios enable selective investigations of certain components in a material and, in turn, provide a more holistic picture of the many parts that are responsible for the intricate functions of soft matter, from nano-engineered materials to the complex machinery of life.



**Bio:** Rana Ashkar is an assistant professor of Physics at Virginia Tech. Prior to her current appointment, she held a Clifford G. Shull Fellowship at Oak Ridge National Laboratory, preceded by a joint postdoctoral scholarship at NIST and the University of Maryland at College Park. Prof. Ashkar completed her graduate studies at Indiana University and was the recipient of the 2014 Esther L. Kinsley doctoral dissertation award. Her research focuses on nanoscale structures and dynamics in soft matter, with specific emphasis on polymeric systems and biomimetic lipid membranes. Among the many approaches that she uses in her research, she is particularly interested in the applications of x-ray and neutron scattering techniques to resolve collective molecular structures/motions that are critical to the technological and biological applications of soft materials. Beside her scholarly achievements, Prof. Ashkar is committed to diversity and inclusion in STEM fields. She was the founder and first chairperson of the "Women in Neutrons Sciences" committee at ORNL, was an active member on several committees including the Advisory Board of the "Women In Science Program" at Indiana University, and is currently a member of the APS Committee on the Status of Women in Physics.