Interactions of phospholipid membranes in the presence of ATP

Thursday,
August 31, 2017* 3:30pm,
LD 010
402 N. Blackford Street

Refreshments at 3:00 pm in the Physics Conference Room LD 154B
For additional information call 274-6900

Abstract:

One interesting class of soft matter systems are multilamellar stacks of phospholipid bilayers. Phospholipids (lipids in short) are found in biological membranes but are also of significant interest in material research due to their distinctive properties. In water or buffer solutions, lipids spontaneously form membrane structures called lipid bilayers with thicknesses on the order of 4-5 nm. In addition, the van der Waals attraction between membranes causes them to form regular stacks of many layers with repeat lattice spacings (D-spacings) on the order of ten to hundreds nanometers. The D-spacing depends not only on lipid type but also on the composition of the water or buffer solution in which membranes are formed. Adenosine triphosphate (ATP) is a molecule involved in energy transfer in biological processes and is therefore of interest in bio-inspired material research. Using three complementary experimental methods, namely small-angle x-ray scattering (SAXS), NMR spectroscopy, and dynamic light scattering (DLS), we investigate lipid interactions in the presence of ATP. We find that ATP not only binds to membranes but also greatly increases the D-spacing to such an extent that an unbinding transition occurs as ATP concentration increases. We follow this unbinding transition for various conditions and explore the balance of electrostatic and van der Waals forces that govern this transition. These findings can help construct a physical basis for van der Waals interactions of membranes in the presence of polarizable organic solutes with possible applications in nanotechnology.

*Physics colloquium is scheduled for 2016-17 academic year for every Thursday, 3:30 PM in LD 010. Changes to the schedule will be posted at www.physics.iupui.edu