Nanospectroscopy and Imaging of Biological and Layered Structures

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M2 Lecture Hall

Department of Mathematics

University of Sri Jayewardenepura

3.30 pm – 4.30 pm

Speaker

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Organized by Section E1- SLAAS

Abstract:

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Deeper understanding and technological progress in materials physics demand exploration of soft and hard matter at their relevant length scales. This research focuses on the nanometer length scale investigation of structural changes required for membrane fusion in virus nanoparticles and nano-spectroscopic investigation of layered material surfaces implementing scattering type scanning near-field optical microscopy (s-SNOM).

Spectroscopy and imaging experiments were deployed to investigate the chemical and structural modifications of the viral protein and lipid bilayer under various environmental pH variations. It has been shown that breakage of viral membrane could occur even without the presence of a targeting membrane, if the environment pH is lowered. This is in contrary to the current viral fusion model, which requires virus binding to a host cell membrane for forming the fusion pore to release the viral genome. The fusion inhibitor compound 136 can effectively prevent the membrane breakage induced by low pH.

The chemical surface stability and degradation of black phosphorus (BP) under ambient conditions have been studied using s-SNOM. We found that the degraded area and volume on the surface of black phosphorus increase with time slowly at the start of degradation and enlarge rapidly (roughly exponentially) afterward and reach saturation growth following S-shaped growth curve (sigmoid growth curve). The theoretical model presented suggests that the degraded sites in the adjacent surrounding causes the experimentally observed exponential growth of degraded area at the initial stage.

Infrared nano-spectroscopy on muscovite mica exfoliated on silicon and silicon dioxide substrates has also been performed. We show that the near-field profile in s-SNOM can penetrate down to several hundreds of nanometers and enable spectroscopy of buried structures.