ABSTRACT

The ability to create materials in two-dimensional (2D) form has repeatedly had a transformative impact on science and technology. In parallel with the exfoliation of layered crystals, atomic-scale thin film growth of complex materials has enabled the creation of artificial 2D heterostructures with emergent phenomena, as seen in perovskite oxide heterostructures. By releasing the oxide thin films from substrates, I want to grant more freedom in the design, manipulation, and characterization of the artificial material.

In this talk, I will present the early harvests in the research of oxide membranes. The first topic is the ultrathin limit of oxide membranes, wherein the freestanding layer faces an inherent 2D limit of the crystalline lattices described by a 2D topological phase transition. In the second part, I will discuss how to use the freestanding geometry of the oxide membranes, particularly in terms of controlling the lattice of 2D quantum materials. In the example of magnetic oxides, an extreme degree of strains was induced to control electromagnetic ground states, revealing a new phase diagram inaccessible in bulk crystals and thin films.