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Condensed Matter/HEATER Seminar

Speaker: Ankit Disa,
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Topic: Manipulating electronic structure and transport in correlated oxide heterostructures

Details: January 27, 2016, 12:10 pm
60 St. George St., MP606

In complex transition metal oxides, strong correlations between electrons lead to entangled ground states with many fascinating emergent phenomena, including magnetism and high-temperature superconductivity. Moreover, the interplay between structural, charge, spin, and orbital degrees of freedom in these systems opens up the possibility of inducing and influencing exotic phase behavior using state-of-the-art atomic layering techniques. In this talk, I describe the engineering of electronic structure and transport properties of complex oxides through atomically-precise control of dimensionality and interfacial structure using molecular beam epitaxy. Specifically, I focus on two studies related to the rare-earth nickelates, an archetypal correlated system. The first investigation concerns the thickness-induced metal-insulator transition in $LaNiO_3$, in which we use synchrotron-based x-ray diffraction and magnetotransport to reveal the structural origin of the crossover and demonstrate the realization of two-dimensional conduction in $LaNiO_3$ by surface engineering. The second project focuses on our ability to manipulate the orbital configuration in rare-earth nickelates. A combination of first-principles theory and synchrotron-based x-ray techniques illustrates that unique three-component heterostructuring can be used to effectively change the nickelate orbital structure to emulate that of the high-temperature superconducting cuprates, and, in fact, can tune the orbital configuration between the bulk structures. Both approaches are based on simple physical mechanisms and represent routes to explore and enhance a wide variety of orbitally-dependent phenomena in correlated oxides including metal-insulator transitions, spin switching and superconductivity.

Ankit Disa is a PhD candidate in Applied Physics in the group of Prof. Charles Ahn at Yale University. He received his B.S. in Applied and Engineering Physics from Cornell University in 2010.