Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Orbital engineering of nickelates in three-component heterostructures ANKIT DISA, DIVINE KUMAH, ANDREI MALASHEVICH, HANGHUI CHEN, SOHRAB ISMAIL-BEIGI, FRED WALKER, CHARLES AHN, Center for Research on Interface Structures and Phenomena and Department of Applied Physics, Yale University, ELIOT SPECHT, Materials Science and Technology Division, Oak Ridge National Laboratory, DARIO ARENA, National Synchrotron Light Source, Brookhaven National Laboratory — The orbital configuration of complex oxides dictates the emergence of a wide range of properties, including metal-insulator transitions, interfacial magnetism, and high-temperature superconductivity. In this work, we experimentally demonstrate a novel method for achieving large and tunable orbital polarizations in nickelates. The technique is based on leveraging three-component, atomically layered superlattices to yield a combination of inversion symmetry breaking, charge transfer, and polar distortions. In the system we studied, composed of $LaTiO_3/LaNiO_3/LaAlO_3$, we use synchrotron x-ray diffraction and spectroscopy to characterize these properties and show that they lead to fully broken orbital degeneracy in the nickelate layer consistent with a single-band Fermi surface. Furthermore, we show that this system is widely tunable and enables quasi-continuous orbital control unachievable by conventional strain and confinement-based approaches. This technique provides an experimentally realizable route for accessing and studying novel orbitally dependent quantum phenomena.

Ankit Disa
Center for Research on Interface Structures and Phenomena and
Department of Applied Physics, Yale University

Date submitted: 14 Nov 2014 Electronic form version 1.4