Complex oxides exhibit an incredible diversity of properties ranging from ferroelectricity and ferromagnetism to unconventional superconductivity. In addition, they are promising candidates for applications spanning from data storage to battery technology. Controlling the interplay between the microscopic electronic, spin, orbital, and lattice degrees of freedom in oxides by manipulation of their structural and chemical complexity is a central challenge. In this talk, I will show how advanced quantum mechanical computational and theoretical techniques can meet this challenge and enable the understanding, design, and discovery of novel multifunctional materials with targeted properties. As an example, I will discuss new insights into the switching process and domain structure of a recently discovered type of ferroelectric oxide, which may enable electric field control of magnetic, orbital, and electronic states.

Biographical Sketch

Beth Nowadnick is a Postdoctoral Research Associate in the School of Applied and Engineering Physics at Cornell University. Her research uses a combination of quantum mechanical simulations and theoretical approaches to advance our fundamental understanding of the properties and functionality of complex oxides and other quantum materials. Beth obtained both her B.S. in Physics and Mathematics and her Ph.D. in Physics from Stanford University.