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Coherent phonon transport in Epitaxial Oxide Heterostructures AJAY YADAV, AARON SWARZ, University of California, Berkeley, CA, RAMEZ CHEAITO, University of Virginia, Charlottesville, VA, JAYAKANTH RAVICHANDRAN, Columbia University, New York, NY, PATRICK HOPKINS, University of Virginia, Charlottesville, VA, ARUN MAJUMDAR, Vice President for Energy, Google Inc., CA, JOEL MOORE, University of California, Berkeley, CA, RAMAMOORTHY RAMESH, Deputy Director for Science and Technology, Oak Ridge National Laboratory, Oak Ridge, TN — Coherent transport of phonons was unambiguously observed [1] in superlattices of complex oxides, $(SrTiO_3)_m/(CaTiO_3)_n$ and $(SrTiO_3)_m/(BaTiO_3)_n$ manifested by a minimum in thermal conductivity as a function of superlattice interface density. To gain further insights into coherent regime of phonon transport, we systematically changed acoustic impedance mismatch between superlattice constituents and studied its effect on the transition from incoherent to coherent regime of heat transport. Further, in an attempt to manipulate transport of a broad range of phonons in the coherent regime, controllable disorder is introduced to attain both short-range and long-range phonon scattering. Quasi-periodic, controllable disorder is introduced by randomly stacking alternating layers of $SrTiO_3$ and $CaTiO_3$, for a given average interface density and volume fraction. In conclusion, our studies elucidate the effect of periodicity and impedance mismatch on both coherent and incoherent phonon scattering in epitaxial oxide heterostructures.

[1] J. Ravichandran, A. Yadav, R. Cheaito et al., accepted in *Nature Materials* (2013).

Ajay Yadav
University of California, Berkeley, CA

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