Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Uncovering the Role of Surfaces in Cross-Plane Thermal Transport in Superlattices ABHINAV MALHOTRA, MARTIN MALDOVAN, Georgia Inst of Tech — Progress towards a deep fundamental understanding of nanoscale thermal transport shall remain elusive if the physical mechanisms behind phonon surface scattering are not completely uncovered. In semiconductor superlattices, the existence of multiple interfaces in the cross-plane direction makes the surface scattering phenomena a critical aspect of thermal transport. Heat conduction in superlattices is a vital transport phenomena which if controlled effectively can lead to significant improvements in existing technologies such as quantum cascade lasers, thermoelectrics, and electronics. In this talk, we will discuss the physical mechanisms that control the cross-plane thermal transport in Si/Ge and $Si_{1-x}Ge_x/Si_{1-y}Ge_y$ superlattices based on our recently developed rigorous quasi-classical treatment of phonon scattering mechanisms at rough interfaces [1,2]. The dependence of phonon surface scattering on incident phonon momentum, angle of incidence and surface properties including roughness and correlation length is established. This developed understanding will be used to fundamentally analyze the modifications in heat spectra in superlattices with the aim of moving towards a paradigm of rational design of thermal materials via the use of energy distributions among phonons with different frequencies and mean free paths. [1] Malhotra, A. and Maldovan, M. *Sci Rep* **6**, 25818 (2016) [2] Malhotra, A. and Maldovan, M. *J Appl Phys* **120** (2016)

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Date submitted: 11 Nov 2016 Electronic form version 1.4