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Nanoscale thermal transport measurements: Bridging ultrafast and steady-state BRIAN G. GREEN, MARK E. SIEMENS, University of Denver — Macroscale thermal transport is explained by classical thermal diffusion, but as nanostructure length scales are reduced towards the order of the phonon mean free path, transport of thermal energy takes on a fundamentally different character and manifests ballistic effects. We investigate nanoscale thermal transport by comparing results from two different techniques applied to a thermally isolated suspended bridge structure. One technique uses the transient thermoreflectance method to measure sub-nanosecond cooling dynamics following ultrafast laser heating in a micron-sized region of a metallic film deposited on the bridge; the second is a DC technique measuring transport driven by a thermal gradient across the bridge, through the full, far larger volume of the film. These very different methods give similar results of reduced thermal conductivity relative to macroscale values, and in combination they are a powerful tool for investigating and understanding thermal transport at the nanoscale.

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