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Thermal transport and surface sensitivity in suspended amorphous silicon nitride thin films[1] R. SULTAN, A.D. AVERY, D. BASSETT, B.L. ZINK, University of Denver, Physics and Astronomy — Thermal transport in disordered materials continues to provide surprising new results, which often have direct consequences for applications ranging from quantum computation to cutting-edge cosmology. For example, some of the most sensitive detectors of radiation currently in use are thermal detectors that use highly sensitive micromachined thermometers to register the temperature rise caused by absorption of incident light or particles. To achieve this sensitivity, the thermometer is commonly thermally isolated using free-standing amorphous silicon-nitride membranes. As a result, the heat flow through this material is often a critical design parameter. In this talk we present recent measurements of thermal conductivity of a large number of suspended silicon-nitride structures. The results show not only deviation from previously reported measurements, but also very clear but somewhat puzzling dependence on the surface preparation of the structures. Such surface-sensitivity is expected at very low temperatures, but is seen in our experiments even near 300 Kelvin, where one normally expects heat flow to be dominated by carriers with very short mean-free-paths. We discuss possible interpretation of our results and compare to other recent surprises in the thermal properties of disordered materials.

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