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Driving denaturation: Nanoscale thermal transport as a probe of DNA melting YONATAN DUBI, School of Physics and Astronomy, Tel-Aviv University, Tel-Aviv, Israel, KIRILL VELIZHANIN, CHIH-CHUN CHIEN, MICHAEL ZWOLAK, Los Alamos National Laboratory — The microscopic dynamics of DNA denaturation have long been a subject of intense study but many aspects of this phenomenon remain poorly understood. Experiments typically measure the degree of denaturation versus temperature which, unfortunately, introduces only a relatively weak constraint: Although many existing models reproduce this denaturation transition well, they give, e.g., incorrect time scales for fluctuations in base pair unbinding. Here, we propose a critical test of DNA models based on driving DNA out of thermal equilibrium via two heat reservoirs. Contrary to what might be expected, we find that the preeminent model of denaturation predicts the thermal conductance to increase substantially as DNA melts. Furthermore, we show that different models can possess qualitatively different thermal transport properties. Measuring the thermal conductance of DNA will thus shed new light on the nonlinear physics of this important molecule and may lead to novel thermal technologies, such as a DNA thermal switch.

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