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Thermal transport measurements in high-energy-density matter[1]

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Thermal conductivity is one of the most fundamental physical properties of matter. It determines the heat transport rate and has an enormous impact on a variety of mechanical, electrical, chemical, and nuclear systems. Thermal conduction is important in high energy density (HED) matter such as laboratory fusion plasmas, planetary cores, compact stars, and other celestial objects. Examples are in the ablation and instability growth in inertial confinement fusion (ICF) capsules, in energy loss from ICF hot spot, and in the evolution of Earth's core-mantle boundary. Despite the importance of thermal conductivity in HED systems, experimental measurements under relevant conditions are scarce and challenging. We have developed a method of differential heating for thermal conductivity measurements. In this talk, experimental designs will be described for four different platforms: optical laser heating, proton heating, laser-generated x-ray heating and XFEL heating. Data from various facilities will be presented and comparison with models will be discussed.

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