Abstract Submitted
for the PSF21 Meeting of
The American Physical Society

Analyzing Nanoscale Thermal Transport Using Time-resolved X-ray Diffraction[1] JAMES GRAMMICH[2], Northern Illinois University, ERIC LANDAHL[3], DePaul University — Classical models of thermal transport breakdown at lengthscales below a few microns in many materials. Time-resolved x-ray diffraction has been proposed as one method to investigate this regime of nanoscale thermal transport, especially inside semiconductor materials where other techniques can not penetrate or yield quantitative results. We benchmarked a new, portable, and fast open-source x-ray dynamical diffraction code (*TRXD*) for strained crystals developed by DePaul University against an existing standard server-based closed-source calculation tool (*GID_SL*, Grazing Incidence Diffraction for Superlattices). *TRXD* is also validated against experimental x-ray peak lineshapes by convolving the calculation results with an appropriate instrumentation resolution function. *TRXD* is shown to properly predict the long time-scale classical thermal behavior of a cooling semiconductor, while revealing discrepancies at the short time-scale where new nanoscale thermal transport models are under development. A new high-resolution x-ray diffraction data set is compared to a previously published low-resolution data set, and found to give the same result for delayed thermal transport in ultrafast laser-excited 100 nm metal film on a Gallium Arsenide crystal substrate.

[1]US Department of Energy, Basic Energy Sciences, Office of Science, Under Contract No. DE-AC02-06CH11357
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Date submitted: 05 Oct 2021 Electronic form version 1.4