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Tentative topic of the invited talk

A generalized heat transport equation for solids at nanoscale

Abstract of the invited talk

Fourier's law accurately estimates heat transport for macroscopic systems based on the continuum hypothesis. However, it breaks down for systems with small characteristic lengths and short timescales where atomic interactions dominate. Thus, the equation is invalid for applications such as semiconductor modeling, bioheat transport, and ultrafast laser manufacturing. Hence, various alternate non-Fourier heat conduction models have been proposed; however, most of the available models are ad hoc and inaccurate.

In this context, I will discuss our novel approach of employing distribution function consistent with Onsager's reciprocity principle to capture non-equilibrium thermodynamics effects, and present the new equation derived in our group. This approach has proven its accuracy for several fluid flow problems; and we extend the equation to solid materials. Our equation includes nonlinear, nonlocal, and relaxation terms, something not available together in any other equation. I will highlight the attractive features of these newly derived SO13 equations and some novel solutions of these equations.