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ME 280 (AUG) 3:0
Fundamentals of Nanoscale Conduction Heat Transport

Instructor: Navaneetha Krishnan Ravichandran

Course description: General introduction to the basic rules of quantum mechanics; crystal lattice definitions; reciprocal lattice; harmonic and anharmonic potential energy of the crystal; phonons as normal modes/eigenmodes of the crystal lattice vibrations; harmonic properties of the phonons - wavelength, wavevector, dispersions, group velocities and heat capacity; Einstein and Debye models; anharmonic phonon-phonon interactions; Fermi's golden rule and applications to phonons; anharmonic properties of phonons - phonon scattering rates, phonon lifetimes and phonon mean free paths; properties of the phonon-phonon collision matrix; momentum-conserving and momentum-dissipating scattering processes; Boltzmann equation for phonon transport; thermal conductivity; diffusive and non-diffusive heat transport.

Prerequisites:

Resources:
(1) **Electrons and Phonons: The Theory of Transport Phenomena in Solids**, by J. M. Ziman, Oxford University Press.
(2) **Nanoscale Energy Transport and Conversion: A Parallel Treatment of Electrons, Molecules, Phonons, and Photons**, by Gang Chen, Oxford University Press.

Outcomes:

Additional information:

Course website: