

LMS Seminar

A Mechanical description of Thermal conductivity and its Applications

Anne Tanguy

¹LaMCoS, CNRS, INSA Lyon ²ONERA, University Paris-Saclay ³LMS, Ecole Polytechnique, IP Paris

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Abstract

The heat conductivity characterizes heat transfer which is a phenomenon of energy transport in matter, linking energy flux to temperature gradient. Two types of heat carriers have been already identified in solids: electrons and lattice vibrations, the latter also being described in terms of phonons in quantum mechanics. In this presentation, I will first remind the different descriptions of heat carriers and their connexion to thermal conductivity, within the kinetic theory and its link to quantum theory. We will show that eigenvibrations in solid disordered materials can take different forms, and that the phononic contribution to heat transfer can be simply described in terms of the propagation of mechanical wave packets. This mechanics-based approach not only allows us to obtain the non-trivial dependence of heat conductivity on temperature, also observed experimentally in careful experiments, but also to predict the role of nanostructural design in heat management in solids. Among the applications, we will discuss the possibility of manufacturing integrated circuits for heat management.

About the speaker

Graduated from Ecole Polytechnique, Anne Tanguy began her professional career as an assistant professor of theoretical physics where her work focused on constitutive laws of glasses, then became a professor in mechanical engineering at INSA Lyon in 2015. In 2020, she has been appointed scientific director of the Materials and Structure division at ONERA. After spending a few months in the Ministry of Research as deputy director of the Research and Innovation Strategy department, she joined LMS and M4S as a professor at Ecole Polytechnique and dean of the bachelor.

