

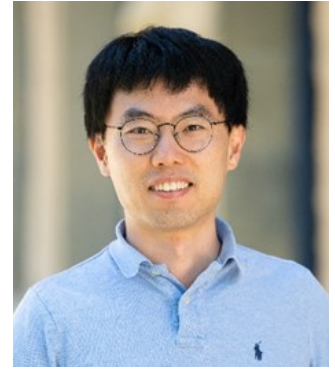
Dr. Jiawei Zhao

Postdoctoral Scholar

Department of Materials Science and Engineering
Stanford University

Seminar: Tuesday, February 27th - 09:30 AM - BRK 1001

<https://purdue-edu.zoom.us/j/93617548649>



Exploring energy transport extremes in materials at microscopic level

Abstract:

As we advance towards a zero-carbon future, the electrification of various sectors stands out as a pivotal step in decarbonizing our energy system, where the fundamental challenge often revolves around the control of charge and heat flow. Despite significant progress in understanding microscopic charge and heat transport processes, finding materials that push the boundaries of energy transport remains a significant hurdle. Recent advancements in materials engineering, however, have started to open up new opportunities for enhancing energy transport properties. In this talk, I will discuss efforts to push the boundaries of energy transport in materials, focusing on two key areas: (1) First, I will discuss strategies to improve electron mobility in semiconductors, which is vital to many energy and information devices. I will present our latest work on first principles methods that analyze electron-phonon and electron-defect interactions, enabling us to quantify and predict electron transport in semiconductors. This research has led to the discovery of a new semiconductor material, boron arsenide, which exhibits simultaneously high electron and hole mobilities, positioning it as a promising candidate for future semiconductor devices. (2) Second, I will discuss strategies to design extreme thermal insulation materials, which play a significant role in energy conservation across various applications, from buildings to industry. We exploited the size effect of heat conduction in air by creating vacuum in a structured cell array, achieving a thermal conductivity that's four times lower than air. This method offers the potential for significant energy saving while maintaining the convenience of traditional insulation materials. These explorations represent steps towards enhancing energy efficiency, which is crucial for building a zero-carbon society.

Biography:

Dr. Jiawei Zhou is currently a postdoctoral scholar in the Department of Materials Science and Engineering at Stanford University. His research leverages the latest advancements in first-principles computation, energy transport physics, and material synthesis to tackle energy and sustainability challenges. Dr. Zhou earned his Ph.D. (2019) in Mechanical Engineering from Massachusetts Institute of Technology, and received Wunsch Foundation Silent Hoist and Crane Award for Outstanding Thesis from MIT for his PhD research. He is also the recipient of the Best Poster Award at the ASME Society-Wide Micro and Nano Technology Forum from IMECE (2019), and has been named in Stanford University's World's Top 2% Scientist list (2023).

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