熱輸送のスペクトル学的理解と機能的制御
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§１. 研究成果の概要

This year, I focused my efforts on the theoretical part of the project and performed simulations to study the fundamentals of the ray-phononic concept as well as some devices possible within this paradigm. My simulations demonstrates the formation of directional thermal fluxes in phononic crystals due to the stochastic phonon motion in phononic crystals. I illustrated possible applications of such directional fluxes for emitting directional heat rays, filtering the phonon spectrum, and even protecting a specific region from a thermal gradient. Finally, the simulations showed that this concept is not bound to only low temperatures, and ray-phononic nanostructures can control heat fluxes even at room temperature using modern materials like boron arsenide. Moreover, my simulations suggested that ray phononics is free from limitations of the traditional thermal phononics and enables creating and guiding thermal fluxes in realistic nanostructures regardless of their surface roughness. Thus, my work this year established theoretical grounds for this project, and demonstrated possible devices and application of the proposed concept.

In addition to the theoretical work, I started building the experimental setup and the Labview software required for the setup.

【代表的な原著論文情報】

1) "Ray phononics: Thermal guides, emitters, filters, and shields powered by ballistic phonon transport", Materials Today Physics, vol. 15, p./100272 vol. 1, 2020