Dissipation effects on the electrical conductivity on solids with anharmonicities

C.I. Vallejos, and J.O. Sofo

Our research group has derived an expression for the electrical conductivity of solids that includes relaxation, dissipation, and quantum coherence. The approach consists of combining linear response theory with the Mori-Zwanzig formulation. Within this formalism, irrelevant system variables (noise) are encoded into a memory function, allowing us to incorporate dissipation effects at all orders in the relaxation interaction. In this pursuit, we investigated the energy dissipation of an infinitely large system of quantum harmonic oscillators, considering the influence of anharmonic contributions. This system serves as a simplified model applicable to the study of phononic interactions in solids, providing valuable insights into their behavior. Our goal is to derive an analytical expression for energy dissipation as heat following an initial perturbation. We initially focused on analyzing the case with cubic anharmonic contributions and explored how these corrections impact the system's dynamics. Subsequently, after removing the perturbation, we study the system's evolution as it returns to its equilibrium state.