Thermal conductivity of lower mantle minerals from \textit{ab initio} anharmonic lattice dynamics

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Determination of lattice thermal conductivity ($\kappa$) of lower mantle minerals is a key to understanding the dynamics of the Earth's interior. Although determination of $\kappa$ was impractical in the deep Earth $P$, $T$ condition for a long time, recent experimental and computational developments have been extending the accessible $P$ and $T$ ranges (e.g. H. Dekura, T. Tsuchiya and J. Tsuchiya, Phys. Rev. Lett. 110, 025904, 2013). \textit{Ab initio} prediction of $\kappa$ requires understanding of the phonon-phonon interaction associated with the lattice anharmonicity. We recently succeeded in developing an efficient method to calculate it based on the density-functional perturbation theory combined with anharmonic lattice dynamics theory, and applying to MgSiO$_3$ perovskite in the whole lower mantle $P$, $T$ range for the first time. Next we extend our techniques to other lower mantle minerals such as MgSiO$_3$ post-perovskite, and now calculations of more realistic Fe-bearing systems are also started. In this presentation, we introduce the current situation of our research on $\kappa$.

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