北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

Quantum Geometry and the Electron-Phonon Coupling

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Abstract

Electron-phonon coupling (EPC) is crucial for various phases of matter, particularly superconductivity. Previous studies of the bulk EPC strength did not consider the electron band geometry or topology. We find that the electron band geometry (like the Fubini-Study metric or its orbital-selective version) contributes to the dimensionless EPC constant in graphene and MgB2. The geometric contributions account for approximately 50% and 90% of the total EPC constant in graphene and MgB2, respectively. The geometric contributions in the two systems are further bounded from below by the topological contributions, which come from the winding numbers of nodal points/lines or the effective Euler number. Given that MgB2 is a phonon-mediated superconductor with a critical temperature of about 39K, our results suggest that the nontrivial electron band geometry/topology might favor superconductivity with a relatively high critical temperature.

About the speaker

Dr. Yu got his Ph.D. from the Pennsylvania State University, University Park in 2020. Then, he spent two years as a postdoctoral fellow at the Condensed Matter Theory Center at the University of Maryland, College Park. He is currently a Moore postdoctoral fellow in the Department of Physics at Princeton University.