

Pair-density-wave and high-temperature superconductivity: the role of electron-phonon coupling

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Abstract: Electron-phonon coupling (EPC) and electron-electron interaction are ubiquitous and typically strong in strongly-correlated quantum materials. Moreover, increasing studies have reported evidences that EPC could be crucial in understanding various quantum phases of matter such as Fe-based and cuprate high-temperature superconductivity. In this talk, I will show that EPC, often in collaboration with electron-electron interactions, could play an important (sometimes dominant) role in inducing exotic quantum phases of matter such as pair-density-wave superconductivity [1], antiferromagnetic long-range order [2], and d-wave superconductivity [3]. Our results might shed new light to understanding the role of EPC in strongly-correlated quantum materials.

[1] Zhaoyu Han, Steven Kivelson, and Hong Yao, Phys. Rev. Lett. 125, 167001 (2020).

[2] Xun Cai, Zi-Xiang Li, and Hong Yao, Phys. Rev. Lett. 127, 247203 (2021).

[3] Hao-Xin Wang, Yi-Fan Jiang, and Hong Yao, arXiv:2211.09143 (2022).

Bio: Hong Yao is currently a professor at Tsinghua University and an APS Fellow. He received his Ph.D. degree from Stanford University in 2009. In 2009-2012, he did his postdoctoral research first in University of California at Berkeley and then in Stanford University. He joined the Institute for Advanced Study at Tsinghua University in 2012 and became a full professor there in 2017. Prof. Yao has made fundamental contributions to the theory of quantum phases of matter, novel quantum critical phenomena, and their realization in quantum materials (citation of APS Fellow). He has published more than 110 papers, including 2 in Science, 4 in Nature Physics, and 30 in PRL, with more than 9800 citations (Google Scholar). Prof. Yao was awarded the National Science Fund for Distinguished Young Scholars in 2018, the Daniel Tsui Fellowship by the University of Hong Kong in 2021, and the Ye Qisun Prize by the Chinese Physical Society in 2022.

