Poster-1-4

Rashba coupling to polar modes in superconducting KTaO$_3$

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The discovery of superconductivity in KTaO$_3$ (KTO) heterostructures and uncapped surfaces has recently triggered significant interest. Remarkably, the T_c shows high sensitivity on the crystallographic orientation, reaching values an order of magnitude larger than that of SrTiO$_3$ (STO) heterostructures [1]. As such, insights into the pairing mechanism are of great interest. We study a pairing mechanism based on spin-orbit assisted coupling between the t$_{2g}$ conduction electrons and the soft ferroelectric (FE) modes present in the material. The theoretical approach was developed for bulk STO and generalized to any incipient FE [2]. By combining ab initio calculations and a microscopic model, we find a strongly anisotropic Rashba-like interaction as well as a strong electron-phonon coupling to the soft transverse FE mode [3,4].

[1] Changjiang Liu et al., Nat. Comm., 14, 951 (2023).

[2] Gastiasoro, M. N., Temperini, M. E., Barone, P., and Lorenzana, J. (2023). Phys. Rev. R., 5(2), 023177 (2023).

[3] Venditti, G., Temperini, M. E., Barone, P., Lorenzana, J., and Gastiasoro, M. N. J. of Phys: Mater., 6(1), 014007 (2023).

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