Kohn-Luttinger superconductivity and the effective Hubbard-Kanamori model in monolayer TMDCs

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Soon after the formulation of the BCS theory of superconductivity Kohn and Luttinger proposed that in some materials overscreening of the Coulomb interaction could lead to an effective attraction for some distance ranges. This mechanism can be imagined as a mobile Friedel oscillation attached to each electron and influencing their interaction. Although this idea didn't work for elemental 3D superconductors, it was revived with the advent of new 2D materials, such as few-layer graphene or metallic TMDCs.

In this talk I will explain how the multiorbital nature of the metallic band, the shape of the lattice and the reduced screening in two dimensions combine to screen the Coulomb interactions in a way that results in superconducting pairing, with the dominant gap of the exotic chiral p+ip symmetry [1]. I will also discuss how such a gap would show up in the STM measurements, and how this universal mechanism would nevertheless yield different experimental signatures in two similar materials, $NbSe_2$ and TaS_2 [2]. Finally, I will outline the construction of an effective Hubbard-Kanamori model based on the calculated screened Coulomb potential.

References

[1] J.Siegl *et al*., Nature Communications 16, 8228 (2025).
[2] L. Gibelli *et al*,. Phys. Rev. B 112, L220505 (2025).