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Exotic superconductivity in time-reversal symmetry broken honeycomb systems

Rhombohedral graphene –stacked graphene layers in the ABC configuration –has emerged as an exciting playground for strongly correlated physics and superconductivity. Recent experiments on N-layer rhombohedral graphene reveal signatures of spontaneous time reversal symmetry breaking as well as spin-valley polarised Fermi surfaces. Probes at low temperature reveal several regions of superconductivity, with signs of chiral triplet pairing states [1–3]. To better discern how broken symmetries in the normal state affect underlying many-body states we focus on 2D single-layer honeycomb systems in the presence of various symmetry breaking terms. We employ the truncated-unity functional renormalisation group technique to analyse the leading instabilities of the associated Hubbard model, which takes a microscopic model and interpolates between the bare Hubbard interaction and a low-energy two-particle interaction vertex. We discuss how the different broken symmetries affect the resulting superconductivity, and the implications this has for chiral and/or triplet pairing states. We further characterise the superconducting states in a topological context through calculation of Chern number landscapes, where we find regions of topological superconductivity.

References:
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Field of Condensed Matter

Superconductivity

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