

Superconductivity in multi-Weyl semimetals: Conditions for the coexistence of topological and conventional phases

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Abstract

In this work [1], we explore the possible emergence of superconducting phases in a multi-Weyl semimetal. In particular, we show that the presence of a pair of Weyl nodes with chirality $|\nu| \geq 1$ leads to an effective description of the intranodal pairings in terms of monopole harmonics[1,2,3], in contrast to internodal pairings that preserve the angular dependence of conventional spherical harmonics. Therefore, we explore the conditions for the competition and/or coexistence between both types of superconducting phases, and we identify the presence of the so-called topological repulsion mechanism, which was previously reported in the context of simple Weyl semimetals[2,3]. We identified the critical temperatures corresponding to the monopole and conventional superconducting phases, and calculated the specific heat as a function of temperature, thus showing that this thermodynamical parameter may provide an experimental probe to determine the chirality index ν in the material[1].

References

- [1] A. Tapia and E. Muñoz, Physical Review B 113, 024501 (2026)
- [2] E. Muñoz, J. Esparza, J. Braun, and R. Soto-Garrido, Superconductivity 12, 100132 (2024)

- [3] E. Muñoz, R. Soto-Garrido, and V. Juricic, Physical Review B 102, 195121 (2020)

Figures

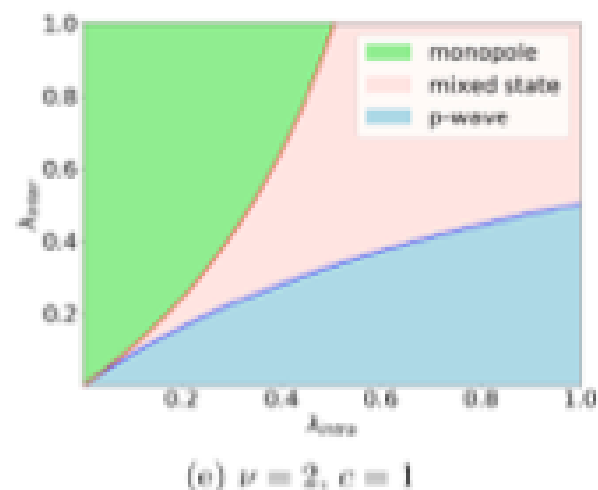


Figure 1: Phase diagram displaying the competition between monopole superconducting and a conventional p-wave phase, with an intermediate coexistence region.

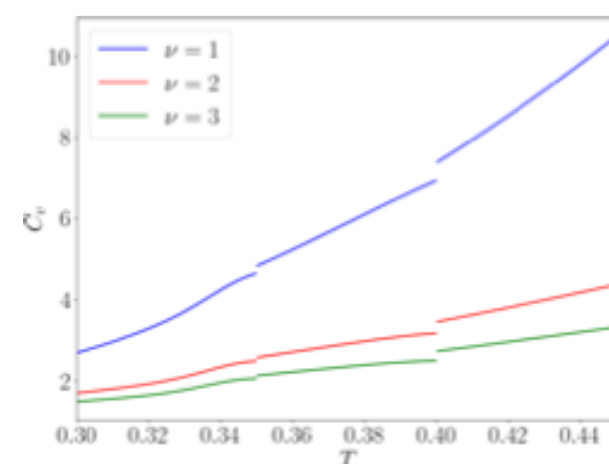


Figure 2: Total specific heat (in dimensionless units [1]) as a function of temperature T (also in dimensionless units [1]), for different topological charges ν .

