Using a weak-coupling renormalization group formalism, we study competing ordered phases for repulsively interacting fermions on the models with quadratic band touching. As electrons are added to the system, excitonic order is suppressed, and unconventional superconductivity appears generically in its place. We obtain the phase diagram showing characteristic ordering temperatures for both short- and long-ranged interactions, and identify the most likely superconducting instabilities.

**Introduction**

**Renormalization group calculation and results**

![Diagram showing RG flows to the chiral "d-2d" phase.](image)

**Nature of the superconducting phase**

**Bilayer:** We find that the most likely superconducting instabilities for repulsive interactions are to f-wave, d-wave, and pair density wave (PDW) phases. Because the latter two belong to two-dimensional group representations, these have two-component order parameters. We find which linear combination of order parameter components is realized using two independent methods: by solving the self-consistent mean-field equations, and also by deriving and minimizing the Landau free energy. From both methods, we find that the spatially modulated but non-chiral PDW phase is realized, while the chiral "d-2d" phase is realized for d-wave, as shown below.

**Checkerboard:**

![Diagram showing phase instabilities at various values of angular anisotropy.](image)

**REFERENCES**


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