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Flatband, magnetism and superconductivity in twisted trilayer graphene

When layers of graphene are rotationally misaligned by the magic angle, the moiré superlattice induces an extremely flat energy band structure. In such a system, the most prominent Coulomb-driven instability occurs at integer filling and are therefore commonly attributed to spontaneous polarization of the moiré unit cell's `flavor' degrees of freedom---spin, valley, and the flat-band degeneracy. Flavor polarization at integer filling is thought to crucially determine further instabilities at lower energy scales, such as superconductivity and weaker incompressible states at fractional filling. In this talk, I will examine the unique role of flavor polarization in twisted trilayer graphene and its influence on the interplay between moiré flatband, Coulomb interaction, superconductivity, and ferromagnetism. I will show that such interplay can be modified by tuning experimental knobs including twist angle and proximity effect [1-5]. Our findings shed new light on a variety of quantum phenomena such as superconductivity at low temperature and the strange metal phase at high temperature.

References

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