Abstract Template

A tale of two heavy fermions: periodic Anderson model and twisted bilayer graphene

(Session 2, Oral)

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In this talk, I will discuss various aspects of heavy fermion physics in two different systems. For the first part, I summarize our two recent papers [1,2] on the periodic Anderson model on a cubic lattice, which is the minimal model of many "conventional" heavy-fermion materials. By using two-site cellular dynamical mean-field theory (DMFT) with the numerical renormalization group (NRG) impurity solver, we answer many open questions on the nature of heavy-fermion quantum criticality, including the Fermi surface reconstruction and strange metallicity. For the second part, I present the DMFT+NRG study [3] of the single-valley topological heavy fermion model [4,5] of twisted bilayer graphene, focusing on the origin of correlated gaps and metal-insulator transitions. We find that both electron-electron and electron-phonon interactions are crucial for explaining the gaps at $\nu = \pm 2$.

[1] A. Gleis, S.-S. B. Lee, G. Kotliar, and J. von Delft, "Emergent Properties of the Periodic Anderson Model: a High-Resolution, Real-Frequency Study of Heavy-Fermion Quantum Criticality", arXiv:2310.12672.
[2] A. Gleis, S.-S. B. Lee, G. Kotliar, and J. von Delft, "Dynamical scaling and Planckian dissipation due to heavy-fermion quantum criticality", arXiv:2404.14079.
[3] S. Youn, B. Goh, G.-D. Zhou, Z.-D. Song, and S.-S. B. Lee, "Origin of the correlated gaps in twisted bilayer graphene", in preparation.
[4] Z.-D. Song and B. A. Bernevig, "Magic-Angle Twisted Bilayer Graphene as a Topological Heavy Fermion Problem", Phys. Rev. Lett. **129**, 047601 (2022).
[5] G.-D. Zhou, Y.-J. Wang, N. Tong, and Z.-D. Song, "Kondo phase in twisted bilayer graphene", Phys. Rev. B **109**, 045419 (2024).