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Selective Phases in a Multi-Component Correlated Fermions in Optical Lattice

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Abstract:

We study a three-component fermionic fluid in an optical lattice in a regime of intermediate-to-strong interactions allowing for Raman processes connecting the different components, similar to those used to create artificial gauge fields (AGF). Using Dynamical Mean-Field Theory we show that the combined effect of interactions and AGFs induces a variety of anomalous phases in which different components of the fermionic fluid display qualitative differences, i.e., the physics is flavor-selective. Remarkably, the different components can display huge differences in the correlation effects, measured by their effective masses and non-monotonic behavior of their occupation number as a function of the chemical potential, signaling a sort of selective instability of the overall stable quantum fluid.

We, also lately addressed a study about the influence of correlation effects to the topological properties of this system, that supports edge states in the sharp boundaries given by the synthetic dimension.