

Superfluidity in bilayers of dipolar fermions

In recent years there has been an immense theoretical and experimental interest in ultracold dipolar systems such as heteronuclear polar molecules, magnetic and Rydberg atoms. Long-range and anisotropic interaction between dipoles, and its tunability through external fields, make dipolar systems very rich playgrounds for the realization of interesting phenomena such as BCS-BEC crossover, density wave instabilities, topological states and quantum magnetism. Moreover, imbalanced dipolar systems may also pave the way for the observation of exotic superfluid phases. Engineering layered structures of dipolar fermions holds a great promise to study interlayer superfluidity, thanks to the attractive component of the interlayer interactions. I first discuss BCS-BEC crossover in symmetric bilayers of ultracold dipolar fermions. In particular, I elaborate the interplay between many-body screening and interlayer pairing and much-speculated density wave instability. I then show how population imbalance in a bilayer system of dipolar fermions affects the pairing between two layers, and what exotic quantum phases appear in the zero temperature phase diagram of this system.