НАУЧНЫЙ СЕМИНАР ИНСТИТУТА СПЕКТРОСКОПИИ РАН

Ultracold fermions with resonant interactions: Superfluids, quasiparticles, and more

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The experimental realization of ultracold fermionic quantum gases with tunable interactions has opened an entrance gate into the quantum world of strongly interacting matter. Such systems allow us to realize exotic many-body states, which challenge our understanding of matter governed by the rules of quantum mechanics.

After giving a brief historical review, I will talk about three experiments conducted in Innsbruck. In a resonant spin mixture of ^{6}Li atoms, we have observed second sound as a manifestation of superfluidity and found behavior in accordance with Landau's two-fluid theory. In a second experiment, with ^{40}K atoms immersed in a Fermi sea of ^{6}Li, we study the physics of quantum impurities strongly interacting with a fermionic bath. With new spectroscopic tools at hand, we investigate the properties of quasiparticles and their formation dynamics in real time. Finally, I will report on progress in our new experiment that combines ^{161}Dy with ^{40}K atoms with the goal to realize novel superfluid regimes in mass-imbalanced fermion mixtures.

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