Fachgruppe Physik und Astronomie Universität Bonn

Physikalisches Kolloquium
Fachgruppe Physik/Astronomie der Universität Bonn

UNIVERSITÄT BONN

Friday, 19.06.2026, 1:15 p.m.
in Lecture Hall ROT (0.056)

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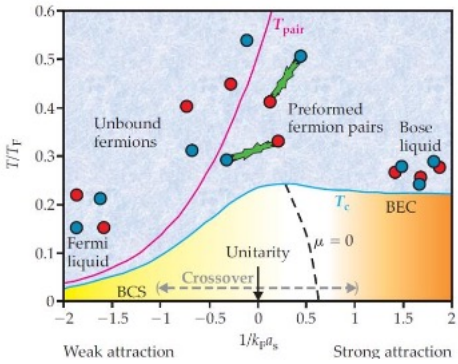
„The Evolution from BCS to BEC in Superfluids and Superconductors: Crossovers versus Quantum Phase Transitions“

Superfluidity and superconductivity are interesting many-body phenomena that have been found in metals, neutron stars, nuclei and more recently in ultracold atoms. For a given metal, neutron star, or nuclei the tunability of particle density or interaction strength is either very limited or impossible, and thus many density- or interactiondependent superfluid/superconducting properties cannot be controlled at the turn of a knob. However, in ultracold Fermi atoms, the interaction strength can be tuned experimentally to change qualitatively and quantitatively superfluid properties. This tunability allows for the study of the evolution of superfluidity from Bardeen-CopperSchrieffer (BCS, weak coupling) of large Cooper pairs to Bose-Einstein condensation (BEC, strong coupling) of tightly bound molecules. I discuss the BCS to BEC evolution in s-wave and p-wave angular momentum channels and conclude that this evolution is just a crossover phenomenon for s-wave, while it corresponds to a quantum phase transition for p-wave pairing. Lastly, I consider condensed matter systems (Li-doped nitrates and magic angle twisted trilayered graphene), where particle density or chemical potential may be tuned experimentally, potentially allowing for studies of the BCS (higher density) to BEC (lower density) evolution in superconductors.



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Everybody is welcome, especially students of all semester

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