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Simulating dense QCD matter with ultracold atomic boson-fermion mixtures[1]

KENJI MAEDA, University of Tokyo

We delineate, as an analog of two-flavor dense quark matter, the phase structure of a many-body mixture of ultracold atomic bosons and fermions in two internal states with a tunable boson- fermion attraction. The bosons (b) correspond to diquarks, and the fermions (f) to unpaired quarks. For weak b-f attraction, the system is a mixture of a Bose-Einstein condensate and degenerate fermions, while for strong attraction composite b-f fermions (N), analogs of the nucleon, are formed, which are superfluid due to the N-N attraction in the spin-singlet channel. We determine the symmetry breaking patterns at finite temperature as a function of the b-f coupling strength, and relate the phase diagram to that of dense QCD.

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