Condensed Matter Theory Center Seminar

Thursday, September 29
11:00 am – 12:00 pm
2205 John S. Toll Physics Building

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"Strongly-correlated SU(N)-fermionic mixtures in one-dimensional harmonic traps"

Abstract: We consider a repulsively interacting multicomponent Fermi gas under harmonic confinement, as recently realized in the experiment of Pagano et al. [Nat. Phys. 10, 198 (2014)]. This setup realizes a gas with tunable $SU(N)$ symmetry. In this talk, we concentrate on the density- and momentum-distributions of particles in such a setup, and present results both for the strongly-interacting limit and for finite interactions.

A particular focus will be on the so-called Tan's contact - the weight of a $k^{-4}-scaling which is observed in the tails of momentum distributions of general contact-interacting systems. We exploit an exact solution at infinite repulsion to show a direct correspondence between the value of the Tan's contact for each of the N components of the gas and the Young tableaux for the S_N permutation symmetry group identifying the magnetic structure of the ground-state. This opens an alternative route for the experimental determination of magnetic configurations in cold atomic gases, employing only standard (spin-resolved) time-of-flight techniques.

Departing from the exact solution in the infinitely-interacting regime, we then present an analytical scaling prediction for the Tan's contact at finite interactions with respect to the number of fermions, the number of components and the interaction strength and show its qualitative agreement with recent experiments. Along the way, we introduce the analytical (low density approximation, Bethe-ansatz) and numerical techniques (MPS/DMRG) used in the investigation.

J. Decamp, J. Jünemann, M. Albert, M. Rizzi, A. Minguzzi, and P. Vignolo,
"High-momentum tails as magnetic structure probes for strongly-correlated SU(k) fermionic mixtures in one-dimensional traps", arXiv:1607.08744.

Host: Jed Pixley

Web: http://www.physics.umd.edu/cmtc/seminars.html