Momentum Correlations in Few-Body Systems

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Few-body states of ultracold atoms are highly controlled systems where correlated quantum states can be prepared deterministically. While position-space imaging of such systems can reveal spin and charge correlations, interesting properties related to condensation and superfluidity are only accessible via momentum space measurements.

In this talk I will show how single-particle sensitive detection of atomic momenta can be used to probe the coherence properties of fermionic few-body systems. Using fluorescence imaging in free space, we are able to detect momenta of individual lithium atoms and measure spin-resolved momentum correlation functions. This technique reveals the entanglement properties of a Fermi-Hubbard dimer and enables high-contrast interference in fermionic Hanbury Brown-Twiss experiments.

In the future, single-particle resolved momentum correlations may be used to measure superfluid order parameters in small two-dimensional clouds.