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SEMINAR: Tunable spin-motion dynamics in a quantum gas of polar molecules

ANNETTE N. CARROLL

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Seminar Room

Quantum gases of polar molecules are a powerful platform for studying emergent exotic phenomena owing to their tunable long-range dipolar interactions. Many body spin-motion models with tunable dipolar interactions can be studied with ultracold molecules when a pseudospin-1/2 is encoded in their two lowest rotational levels. In this talk, I will describe recent observations of spin-motion dynamics of fermionic KRb molecules with systematically tuned Hamiltonian parameters via the combination of dc and microwave fields. We first measured the mean-field Ramsey phase dynamics arising from strong dipolar interactions and demonstrated a large extent of tunability of the dipolar spin Hamiltonian both with dc electric field strength and with Floquet-engineering. Next, Ramsey contrast dynamics driven by a generalized t-J model, a canonical Hamiltonian in condensed matter physics, were observed by systematically introducing motion regulated by optical lattices. Finally, I will present recent success in producing degenerate Fermi gases of molecules in a single or bilayer configuration for future studies of spin-motion models of low-entropy samples where dipolar interactions compete with quantum statistics.

Hosted by: Prof. Dr. Leticia Tarruell