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Long Hyperfine Coherence Time of Ultracold Fermionic ^{23}Na^{40}K Molecules JEE WOO PARK, ZOE YAN, HUANQIAN LOH, SEBASTIAN WILL, MARTIN ZWIERLEIN, Massachusetts Institute of Technology — Ultracold molecules created and trapped at sub uK temperatures allow the full control of the molecules external and internal degrees of freedom down to a single hyperfine state. In particular, an ensemble of molecules all initialized in a single rotational and hyperfine state can be prepared and be coherently addressed using microwave fields. In this talk, we report on the observation of long coherence time between two hyperfine states of fermionic ^{23}Na^{40}K molecules in the ro-vibronic ground state (v=0, J=0). A direct two-photon microwave transition via the J=1 state is used to prepare a superposition of two lowest hyperfine states of J=0, and we perform Ramsey spectroscopy as a direct probe of phase coherence between these states. The fermionic nature of the molecules and the lack of electronic angular momentum in the ro-vibronic ground state heavily suppress the decoherence from collisions and external fields, respectively, and we observe long coherence times upto 0.5 sec for this hyperfine superposition state. The observed long coherence time is a crucial step for applications of trapped dipolar molecules in quantum information processing schemes.

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