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Towards Fermionic Ground State Molecules with Strong Dipolar Interactions SEBASTIAN WILL, JEE WOO PARK, CHENG-HSUN WU, JENNIFER SCHLOSS, QINGYANG WANG, MARTIN ZWIERLEIN, Massachusetts Institute of Technology — A degenerate Fermi gas with strong dipolar interactions should enable the creation of novel states of matter such as quantum crystals, supersolids and topological superfluids. Fermionic ground state molecules are promising candidates for the experimental realization of such a dipolar Fermi gas, as they can have a large electric dipole moment that gives rise to long-range anisotropic interactions. ^{23}Na^{40}K is a fermionic molecule that is especially well suited for this purpose. In its rovibrational ground state, it is chemically stable against molecule-molecule collisions and possesses a large electric dipole moment of 2.72 Debye. We have found that ^{23}Na^{40}K Feshbach molecules have a long lifetime and a significant admixture of the electronic spin singlet state. Therefore, they constitute an ideal starting point to reach the singlet rovibrational ground state in a two-photon STIRAP process. We have spectroscopically explored excited and ground state molecular potentials of ^{23}Na^{40}K and successfully performed STIRAP transfer into a deeply bound vibrational level.

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