

Abstract Submitted  
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**Creation of Ultracold Dipolar Ground State Molecules of  $^{23}\text{Na}^{40}\text{K}$**   
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QIAN LOH, MARTIN ZWIERLEIN, Massachusetts Institute of Technology — Over  
the past decade ultracold atomic quantum gases have successfully been employed  
as quantum simulators to gain a better understanding of strongly correlated many-  
body systems. However, the dominant interactions between atoms are typically  
short-range in character, limiting the spectrum of quantum phenomena to be ex-  
plored. Quantum particles with long-range dipolar interactions will open new routes  
for quantum simulation and promise the creation of novel states of matter, such as  
quantum crystals, topological superfluids and supersolids. Ultracold heteronuclear  
molecules offer a unique path to realize a strongly dipolar quantum gas. Among  
several choices, NaK stands out as an exceptional molecule due to its chemical sta-  
bility and a large electric dipole moment in its absolute ground state. We report  
on recent progress that led us to the creation of the first ultracold, strongly dipolar  
molecules of NaK. Using a two-photon STIRAP process we have efficiently trans-  
ferred NaK from the Feshbach state to the rovibrational ground state. By applying  
an external electric field, we have aligned the molecular dipoles, inducing long-range  
dipolar interactions. These advances bring the creation of novel states of matter in  
a strongly dipolar quantum gas of NaK into experimental reach.

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