Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

**Precise Characterization of a Nonuniversal Efimov State and Few-body Interactions in $^{39}$K** XIN XIE, MICHAEL VAN DE GRAAFF, ROMAN CHAPURIN, NOAH SCHLOSSBERGER, JARED POPOWSKI, JOSE D'INCAO, University of Colorado, Boulder, PAUL JULIENNE, Joint Quantum Institute, NIST and University of Maryland, JUN YE, ERIC CORNELL, University of Colorado, Boulder — We perform precise studies of two- and three-body interactions near an intermediate-strength Feshbach resonance in $^{39}$K. We determine, with unprecedented accuracy, the location of the resonance to be 33.5821(13) Gauss. Measurement of dimer binding energies, spanning three orders of magnitude, enables the construction of a coupled-channel model for the determination of scattering lengths with low uncertainty. With the derived scattering length map, we discover that this ground Efimov resonance is located at $|a_-|/r_{vdW} = 14.19(16)$ ($r_{vdW}$ is the van der Waals length), significantly deviating from the van der Waals universal value 9.73. A three-body model is introduced to explain the origin of this anomaly. To enrich our understanding of this Efimov spectrum, we extend our study to positive scattering lengths where atom-dimer interactions give rise to additional complexities in scattering processes.

Xin Xie
University of Colorado, Boulder

Date submitted: 23 Jan 2019 Electronic form version 1.4