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Observation of Universal Efimov's Ratios across an Intermediate-Strength Feshbach Resonance in ^{39}K MICHAEL VAN DE GRAAFF, XIN XIE, ROMAN CHAPURIN, JILA, NIST and the University of Colorado, MATTHEW FRYE, JEREMY HUTSON, Joint Quantum Centre (JQC) Durham-Newcastle, Durham Univ, JOSE D'INCAO, PAUL JULIENNE, JUN YE, ERIC CORNELL, JILA, NIST and the University of Colorado, DURHAM TEAM, JQI TEAM, JILA TEAM — Efimov's original scenario is featured by an infinite number of three-body bound states (trimers) accumulating at unitarity where $E = 1/a = 0$. The binding energies of these trimers have a self-similar structure with a fixed scaling factor between adjacent branches. This scheme is valid in the zero-range limit and in real systems only applies to highly-excited trimers with finite-range interactions. In this work, we unambiguously measured the benchmarks associated with the Efimov spectrum in ^{39}K, denoted as $a_-^{(n=0)}$, $a_*^{(n=1)}$ and $a_+^{(n=0)}$, with n indexing the parentage of trimer. $a_-^{(n)}$ are tri-atomic resonances at $a < 0$, $a_*^{(n)}$ are scattering resonances between atoms and Feshbach molecules at $a > 0$, $a_+^{(n)}$ are interference minima in three-atom recombination at $a > 0$. We report a universal ratio $a_*^{(1)}/a_-^{(0)}$ on the two lowest-lying trimers. The within-ten-percent consistency between this ratio and zero-range result implies that finite range perturbations are suppressed as expected for Feshbach resonances with intermediate strength. We introduce multi-channel van der Waals three-body model that can reproduce all three benchmarks.

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