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Universality in Three- and Four-Body Bound States of Ultracold Atoms[1] S. E. POLLACK, D. DRIES, R. G. HULET, Rice Quantum Institute and Department of Physics and Astronomy, Rice University — The universal regime of Efimov few-body physics occurs when the strength of the interparticle interaction is much larger than the effective range of the two-body potential. By exploiting a broad Feshbach resonance in the $|1,1\rangle$ hyperfine state of ^{7}Li, we can tune the interactions well into the universal regime. The rate of atom loss from our optical trap increases by 9 orders of magnitude from the weakly interacting regime to the strongly interacting regime, allowing unprecedented access to universal physics. We find evidence for two universally connected Efimov trimers in addition to their associated four-body bound states. Intimately related to the Efimov trimers, two tetramer states exist for each trimer, and no additional parameters are required to describe their binding energies. A total of eleven features in the three- and four-body inelastic loss spectra are discovered. The relative locations of these features on either side of the Feshbach resonance agree with universal theory, whereas a systematic deviation from universality is found when comparing features across the resonance. Science.1182840 (2009).

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