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Efimov Resonances in a Mixture with Extreme Mass Imbalance

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We present the observation of two consecutive heteronuclear Efimov resonances in an ultracold Fermi-Bose mixture of Li-Cs by measuring magnetic field dependent three-body loss coefficients and atom loss spectra near a broad Feshbach resonance. The first Efimov resonance is found at a scattering length of $a(0) = -320(10)a_0$, corresponding to approximately 7(3) times the Li-Cs (Cs-Cs) van der Waals range. The second resonance appears at $a(1) = -1870(390)a_0$, close to the unitarity-limited regime at the sample temperature of 450 nK. Indication of a third resonance is found in the atom loss spectra. The scaling factor of the resonance positions of 5.8(1.0) is close to the predicted universal value of 4.9 for zero temperature mixtures. The refined Feshbach resonance position agrees excellently with an extensive interpretation of the recently observed interspecies Li-Cs Feshbach resonances by three different theoretical models: coupled channels calculation, asymptotic bound state model, and multi-channel quantum defect theory.

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