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Multichannel effects and universality in three-body physics of strongly interacting Lithium-7

We study the apparent disagreement between experimental measurement of three-body observables in ultracold lithium-7 and the predictions of universal theory, which has shown to be generally accurate in describing the other alkali-metals. For this purpose, we apply a sophisticated numerical approach based on an expansion and subsequent diagonalisation of the full three-body Hamiltonian in momentum space. With this method, we are able to take into account both realistic molecular interactions with many low-lying dimer states, and the complete three-body hyperfine basis that underpins the multichannel nature of the problem. Our results show that multichannel effects in lithium-7 shift the three-body parameter away from the universal prediction and towards the current experimental data. By analysing partial recombination losses, we find that this sensitivity can be attributed to a strong coupling to specific three-body hyperfine channels, which have often been neglected in earlier studies. In addition, we apply our methods to the computation of the Efimov binding energy, and compare directly with state-of-the-art experiments.

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