Lifetimes of three particles in an isotropic harmonic trap

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We present an analytic calculation of the energy levels and decay rates of particles confined by an isotropic harmonic trap. Using a single adiabatic hyperspherical channel, we derive a transcendental equation whose solutions give the energy levels and decay rates of the trapped states. To gain a more physical interpretation of the results, we examine two regimes: the oscillator length much greater than, and much less than, the two-body $S$-wave scattering length. For the case of a large oscillator length, we find explicit analytic expressions for the decay rate of the trapped states. We find that the decay rate for bosons scales as $|a|^4$ (in agreement with prior work on free-space recombination), with higher-order corrections due to the trap. Moreover, the decay rate shows resonant enhancements due to Efimov physics just as free space rates do. In addition, we show that for a small oscillator length, the decay rate is proportional to the trapping frequency and exhibits log-periodic behavior.

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Quantum information

Temporally multiplexed storage of images in a gradient echo memory

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In this paper we have demonstrated that the optical gradient echo memory is suitable for the coherent storage of images. We experimentally study the effect of atomic diffusion on the quality of an image stored in the long-lived ground state coherence of a warm atomic ensemble. We show that the maximum spatial frequency that can be stored is predetermined by the storage time and the diffusion coefficient of the medium. Additionally, we study the ability of this memory to store multiple images at the same time, allowing temporal and spatial multiplexed storage in an atomic vapor [1]. Finally, we would like to emphasize that this setup is perfectly adapted to be combined with recent experiments on the generation of squeezed states and entangled images [2] with four-wave mixing in a hot rubidium vapor.

References