Observation of Fast Evolution in PT-Symmetry System

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The question to find and realize the minimal time of evolution between two quantum states is significant both in theory and application. In quantum mechanics, the minimal evolution is bound by the gap between the largest and smallest eigenvalues. In the parity-time-symmetric hamiltonian theory [1], it was predicted that the optimized evolution time can be reduced drastically comparing to the lower bound in the Hermitian case, and can become even zero [2]. In this Letter, we report the experimental realization of the evolution of PT-symmetric Hamiltonian theory in an nuclear magnetic resonance (NMR) quantum information processor. The experiment is carried out in a Hilbert space that admits non-unitary evolution [3]. The experimental results demonstrate that the PT-symmetric hamiltonian can indeed evolve much faster than that in a quantum mechanics system, and time it takes can be arbitrary close to zero.

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