Study of Clock Transition in a Bose-Einstein Condensate in Expansion Using Interrogation RF Pulse

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In this work we want to study the quantum analogue of an atomic clock based on cold atoms, where classically, using the Ramsey method, localized atoms are excited in two different zones. The first zone promotes a hyperfine transition in the atoms using a specific RF pulse close to the resonance for the separation between the $F = 3$ and $F = 4$ levels, and in the intermediate region between the pulses, the quantum superposition of states evolves over time. In the second zone, the atoms receive a second RF pulse, identical to the first and evolve again during a free time, when their states are then measured, generating a sinusoidal fringe-shaped interference pattern. The quantum analogue of the situation presented is a Bose-Einstein condensate, where we use Na atoms in a coherent state that interact with two RF pulses close to the 1.77-GHz hyperfine transition to study the Clock transition.