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Editors
Suzana Petrović, Goran Gligorić and Milutin Stepić

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continuous-wave (CW) and pulsed optical pumping (POP) schemes [2,3]. Using the pulsed technique with Ramsey scheme, high-contrast fringes were observed for our experimental clock setup. Rabi oscillations demonstrate a sufficiently uniform microwave magnetic field distribution inside the cavity. We could observe Ramsey signals with a contrast of up to 35% with a linewidth of 160 Hz and a typical short-term clock stability of $2.1\times10^{-13}\tau^{-1/2}$ [2,3].

Here we report the measurements about 25 mm vapor cell's relaxation time (T1 and T2) which can seriously affect the Rb clock's short-term stability. The traditional Franzen [4] method of evolution in the dark is used to measure population relaxation time T1. Spin echo [5] method is used to measure coherence relaxation time, by creating an atomic spin polarization with a laser pulse and then applying two separated $\pi/2$ and π microwave pulses. This scheme removes the effects of dephasing due to residual inhomogeneities of the magnetic field inside the Rb vapor cell. Extrapolation to zero microwave results in coherence relaxation time T2 ≈ 3 ms which is consistence with the theoretical calculation.

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Composite localized modes in discretized spin-orbit-coupled Bose-Einstein condensates

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The use of ultracold quantum gases, in particular bosonic and fermionic condensates, for simulating fundamental effects originating in condensed-matter physics has drawn much interest [1]. One of these effects is the spin-orbit coupling (SOC). This effect plays a major role in many phenomena and applications, including spin and anomalous Hall effects [2], topological insulators [3], spintronics [4], etc. In contrast to the complex picture found in solids, the experimental and theoretical description of SOC effects in

Bose-Einstein condensate (BEC) is much simpler [5]. This has motivated our study of the impact of SOC on the immiscibility-miscibility transition in the localized complexes in BEC, which can emulate the phase transition between insulating and conducting states in semiconductor. For this purpose, we introduce a discrete model for binary SO-coupled BEC trapped in a deep one-dimensional optical lattice [6]. We consider two different types of coupling, with spatial derivatives acting inside each species, and between the species. Stable localized composite states of miscible and immiscible types are found to exist for both types of coupling. We also study how the transition between miscible and immiscible type of localized complexes depends on the SOC strength. Particularly interesting are the applications of our model to the SOC binary condensates built of infinitely heavy atoms and the binary BEC with effective atomic masses which have opposite signs.

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Electromagnetically induced transparency in four-level Y-type atom with degenerated and quasidegenerated excited levels

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Electromagnetically induced transparency is an effect in which, by using electromagnetic influence, some opaque medium can be made transparent for radiation which is otherwise resonantly absorbed [1,2]. Research in the area of EIT effect was extensively conducted on quantum systems with three levels, however during the last decades, some generalizations to bigger number of energy levels have been made. Although papers concerning these systems show some new effects, only limited number of them take degeneracy of the atomic levels into consideration [3].

We consider four-level Y-type atom, which first excited state contains the manifold of three sublevels, interacting with probe and two control fields. Probe field drives the transition between the ground level and particular sublevel. Control fields couple the given sublevel with closely spaced upper excited levels.

Absorption and dispersion of the probe and coupling fields are investigated (plotted) as the functions of spontaneous emission coefficients, the Rabi frequencies and detunings of the fields. Electromagnetically induced transparency in the fields is achieved (realized)