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Rabi oscillations and Ramsey-type pulses in ultracold bosons: Role of interactions[1] Q. GUAN, Homer L. Dodge Department of Physics and Astronomy and Center for Quantum Research and Technology, The University of Oklahoma, T. M. BERSANO, S. MOSSMAN, P. ENGELS, Department of Physics and Astronomy, Washington State University, D. BLUME, Homer L. Dodge Department of Physics and Astronomy and Center for Quantum Research and Technology, The University of Oklahoma — Double-well systems loaded with one, two or many quantum particles give rise to intriguing dynamics, ranging from Josephson oscillation to self-trapping. This work presents theoretical and experimental results for two distinct double-well systems, both created using dilute rubidium Bose-Einstein condensates. The first is realized by creating an effective two-level system through Raman coupling of hyperfine states. The second is realized by creating an effective two-level system in momentum space through the coupling by an optical lattice. Even though the non-interacting systems can, for a wide parameter range, be described by the same model Hamiltonian, the dynamics for these two realizations differ in the presence of interactions. The difference is attributed to scattering diagrams that contribute in the lattice coupled system but vanish in the spin-orbit coupled system. The internal dynamics of the Bose-Einstein condensates for both coupling scenarios is probed through a Ramsey-type interference pulse sequence. The results have important implications for lattice calibration experiments and momentum space lattices.

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