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Quantum spin relaxation in mixtures of spinor cold atoms YI-YA TIAN, PO-CHUNG CHEN, DAW-WEI WANG, National Tsing-Hau University — Recently spin relaxation becomes an extensively studied subject in the field of spintronics. One of the most important mechanism of electron spin relaxation in a semiconductor quantum qubit results from the hyperfine interaction with nuclei spins. Due to limitations in solid state experiments, the effects of nuclei spins to the electron spin relaxation is still not fully understood yet. Here we propose that such electron-nuclei system can be modeled by a mixture of two species of spinor cold atoms (say ^{7}Li and ^{87}Rb), loaded in a bi-frequency optical lattices of large wavelength difference. We use exactly diagonalization method to study how an initially spin polarized "electron" atom relaxs in a spin bath of "nuclei" atoms. Our calculation shows that the spin relaxation are strongly sensitive to the polarization of "nuclei" atoms, while for the fully unpolarized case the relaxation is mainly determined by the density of states. Our theoretical results can be also applied in studying the electron spin relaxation dynamics in the solid state quantum qubit.

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