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Manipulating dipolar and spin-exchange interactions in spin-1 Bose-Einstein condensates[1] BO-YUAN NING, Department of Optical Science and Engineering, Fudan University, Shanghai 200433, China, S. YI, Institute of Theoretical Physics, Chinese Academy of Sciences, Beijing 100190, China, JUN ZHUANG, Department of Optical Science and Engineering, Fudan University, Shanghai 200433, China, J.Q. YOU, Department of Physics, Fudan University, Shanghai 200433, China, WENXIAN ZHANG, Department of Optical Science and Engineering, Fudan University, Shanghai 200433, China — For a spin-1 Bose-Einstein condensate (BEC), it has been a challenge to experimentally single out the effects of the magnetic dipolar and the spin-exchange interactions, which are usually entangled together and cooperatively determine the spin dynamics. In this work, we develop a generalized WAHUHA rf pulse sequence to suppress dipolar interaction and employ the periodic dynamical decoupling optical pulse sequence to suppress the spin-exchange interaction through Freshbach resonance, respectively. Our results demonstrate that the two sequences are independent of each other and suppress substantially the spin interaction. With this scheme, it is possible to make one spin interaction overwhelm the other and dominate the spin dynamics, so that one can investigate unambiguously the effects of the corresponding spin interaction. Moreover, the two sequences can be applied together to freeze the spin dynamics, which provides an opportunity to manufacture more sensitive magnetometers based on spin-1 BECs. Our method is easy to implement in experiments and is useful to investigate individually the effects of each spin interaction in spinor BECs.

[1]NFSC, NCET, Shanghai Pujiang Program

Wenxian Zhang
Department of Optical Science and Engineering,
Fudan University, Shanghai 200433, China

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