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Motional resonance enhanced artificial atomic spin-orbit coupling[1] LINGNA WU, XINYU LUO, State Key Laboratory of Low Dimensional Quantum Physics, Department of Physics, Tsinghua University, Beijing 100084, China, ZHI-FANG XU, Department of Physics, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan. Department of Physics and Astronomy, University of Pittsbur, MASAHITO UEDA, Department of Physics, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan, RUQUAN WANG, Institute of Physics, Chinese Academy of Sciences, Beijing 100080, People's Republic of China, LI YOU, State Key Laboratory of Low Dimensional Quantum Physics, Department of Physics, Tsinghua University, Beijing 100084, China. Collaborative Innovation C
— Atomic spin-orbit coupling (SOC) represents an important type of synthetic gauge fields actively pursued in quantum simulation studies. Recently, different schemes based on pulsed or periodic modulating gradient magnetic field (GMF) are proposed and implemented to synthesize one dimensional (1D) SOC in a spinor atomic Bose-Einstein condensate (BEC). This study provides theoretical understanding and experimental confirmation that the strength of SOC is enhanced making use of motional resonance associated with atomic center of mass in a harmonic trap. In addition to enable extra tunability and flexibility of gradient magnetic field based schemes for synthesizing atomic SOC, the findings we present also shed light on experimental efforts towards synthesizing two-dimensional (2D) atomic SOC.

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