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Interference Signatures of Abelian and Non-Abelian Aharonov-Bohm effect on Neutral Atoms in Optical Lattices MING-XIA HUO, NIE WEI, Centre for Quantum Technologies, National University of Singapore, DAVID A.W. HUTCHINSON, CQT, National University of Singapore; Centre for Quantum Technology, Department of Physics, University of Otago, New Zealand, LEONG CHUAN KWEK, Centre for Quantum Technologies, National University of Singapore; IAS and NIE, Nanyang Technological University — We propose a scheme to generate an effective Abelian U(1) or non-Abelian SU(2) gauge field for cold neutral atoms in a ring- or square-shaped optical lattice by using Laguerre-Gauss lasers. The synthetic field produced is strongly localized, which allows us to study the Aharonov-Bohm effect on the neutral atoms. By preparing a coherent state of atoms initially and allowing them to evolve along two different paths enclosing the generated magnetic field, we obtain interference signatures of the Aharonov-Bohm effect with distinctly different patterns in the detection area for systems exposed to a zero, an Abelian U(1) or a non-Abelian SU(2) gauge field.

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