

Emulation of Magneto-Optical Effects Using Ultracold Atoms

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Emulation of quantum condensed-matter systems using ultracold atoms has been attracting considerable attention. As is well known, magneto-optical (MO) effects are generated when the lights pass through certain kinds of magnetic medium though the effects may be quite weak for experimental detection sometimes. In this talk, we will address an arresting theoretical scheme for emulating the famous MO Faraday effect in ultracold atomic gases. We will elaborate that an artificial MO Faraday effect is readily signalled by the spin imbalance of atoms, with the setup of laser fields offering a high controllability for quantum manipulation. In addition, with the underlying polarization state being extracted in the synthetic dimension, the artificial MO effect emerges under an entirely different mechanism from the conventional picture. In particular, the MO rotation is related to the bulk topology in synthetic dimensions, and thus provides an unambiguous evidence for the desired topological MO effect, which has not been developed hitherto in ultracold atoms.