

# Synthetic Gauge Potentials for the Dark State Polaritons in Atomic Media

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The quest of utilizing neutral particles to simulate the behaviour of charged particles in a magnetic field makes the generation of the artificial magnetic field of great interest. We put forward an optical scheme to generate effective gauge potentials for stationary-light polaritons in the static laboratory frame. To demonstrate the capabilities of our approach, we present a recipe for having dark-state polaritons in degenerate Landau levels. Our scheme paves a novel way towards a versatile quantum simulator for mimicking different Hamiltonians and the investigation of the bosonic analogue of the fractional quantum Hall effect by electromagnetically induced transparency.

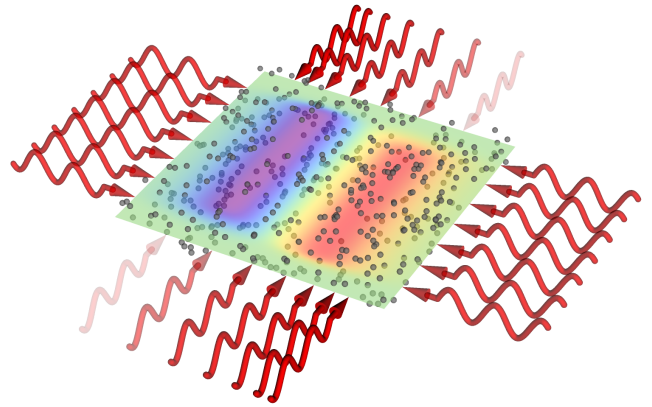


Figure 1: The sketch for the Landau-gauge EIT system. Gray dots represent atoms, and the red-sinusoidal arrows illustrate four control fields. The density and the opacity of arrows reflect the control field strength. The coloured density plot depicts the spatial distribution of the dark-state polarization  $\rho_{21}$