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Photons in synthetic gauge fields

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Electronic transport is localized in low-dimensional disordered media. The addition of gauge fields to disordered media leads to fundamental changes in the transport properties. We implement a synthetic gauge field for photons using silicon-on-insulator technology. By determining the distribution of transport properties, we confirm that waves are localized in the bulk and localization is suppressed in edge states. Furthermore, we measure corresponding topological invariants and investigate the chiral gauge anomaly in the context of Chern-Simon theory. Our system provides a new platform for investigating the transport properties of photons in the presence of synthetic gauge fields.