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Topological photonics: an observation of Landau levels for optical photons[1] NATHAN SCHINE, Univ of Chicago, ALBERT RYOU, ARIEL SOMMER, JONATHAN SIMON, University of Chicago — Creating photonic materials with nontrivial topological characteristics has seen burgeoning interest in recent years; however, a major route to topology, a magnetic field for continuum photons, has remained elusive. We present the first experimental realization of a bulk magnetic field for optical photons. By using a non-planar ring resonator, we induce an image rotation on each round trip through the resonator. This results in a Coriolis/Lorentz force and a centrifugal anticonfining force, the latter of which is cancelled by mirror curvature. Spatial- and energy- resolved spectroscopy tracks photonic eigenstates as residual trapping is reduced, and we observe photonic Landau levels as the eigenstates become degenerate. We will discuss the conical geometry of the resulting manifold for photon dynamics and present a measurement of the local density of states that is consistent with Landau levels on a cone. While our work already demonstrates an integer quantum Hall material composed of photons, we have ensured compatibility with strong photon-photon interactions, which will allow quantum optical studies of entanglement and correlation in manybody systems including fractional quantum Hall fluids.

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