Topological interplay between photons and electrons

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A seminal gedankenexperiment by Laughlin describes the charge transport in quantum Hall systems via the pumping of flux. An optical excitation could probe and manipulate quantum Hall systems in a similar way: When light containing orbital angular momentum interacts with electronic Landau levels, it acts as a flux pump that radially moves the electrons through the sample, as a radial photocurrent. We experimentally investigate this effect for a graphene system in a Corbino geometry and discuss potential theoretical explanations. The key insight is the violation of dipole approximation for itinerant electrons. This approach could open new avenues for direct measurement of the spatial and spectral coherence of an electron's wavefunction, with fundamental and practical implications in coherent light-matter interaction.