Non-equilibrium quantum Hall physics with photons

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In this talk, I describe our efforts on the theoretical and the experimental realization of synthetic magnetic fields for infrared photons at room temperature. Our implementation corresponds to a spin-orbit Hamiltonian, uses linear optics and does not break time reversal symmetry. I discuss the observation of edge states for light in a two-dimensional system, its robustness against intrinsic and introduced disorders, as proof of topological order, and the role nonlinearity in such chiral systems. Furthermore, I will consider the strong photon-photon interactions regime, which enables the potential realization of fractional quantum Hall states such as Laughlin states, in the non-equilibrium pumped regime, relevant for the photonic systems.