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Dissipative self-assembly of fractional quantum Hall states of light

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The generation of a fractional quantum Hall state of bosons has been an important goal in both atomic and optical physics, but due to a number of difficult experimental challenges, these states have yet to be realized in the many-body limit. In this talk, I discuss a simple mechanism which answers one of the outstanding questions in quantum optical systems: how can we stabilize a strongly correlated, many-body photon state against particle losses? I will show that by using parametric amplifiers to couple the fractional quantum Hall state to an auxiliary, intentionally lossy system, fractional quantum Hall states of light can be passively generated and stabilized in arbitrarily large systems. This mechanism could be implemented in any strongly interacting photonic system, such as Rydberg polaritions, or mobile excitations in arrays of trapped ions or superconducting qubits.