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Topological preparation of Laughlin and Pfaffian states of photons[1] FABIAN GRUSDT, FABIAN LETSCHER, Dept. of Physics & research center OPTIMAS, University of Kaiserslautern, Germany, MOHAMMAD HAFEZI, Joint Quantum Institute, NIST/University of Maryland, College Park MD, MICHAEL FLEISCHHAUER, Dept. of Physics & research center OPTIMAS, University of Kaiserslautern, Germany — We present a new scheme for the preparation of highly correlated Laughlin and Pfaffian states of photons. In contrast to other proposals we do not start from an N-photon Fock state, but adiabatically introduce photons one by one. As a consequence our scheme only requires a time $T \sim N$ to grow an N-photon Laughlin state. We consider a realistic setup of two-dimensional cavity arrays subject to an effective magnetic field. Moreover we assume strong on-site interactions for photons. Our scheme makes use of the quantization of the Hall current, which is topologically protected, and the ability to manipulate the magnetic flux locally in photonic systems [Hafezi, arXiv:1310.7946]. By adiabatically introducing flux quanta in the center of an N-photon Laughlin state, quasihole excitations can be created. Replenishing the resulting hole with a new photon allows to create an incompressible $N+1$ photon Laughlin state. Photon-losses lead to an increasing number of hole-type excitations at the edge of the Laughlin liquid and thus limit the achievable system-sizes. We present numerical simulations for small systems of interacting photons and for an effective model of non-interacting composite fermions, demonstrating the feasibility of our scheme.

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