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Topological Quantum Matter Made of Light LUKAS PALM, CLAIRE BAUM, MATT JAFFE, LOGAN CLARK, University of Chicago, NATHAN SCHINE, University of Colorado Boulder, NINGYUAN JIA, Massachusetts Institute of Technology, JONATHAN SIMON, University of Chicago
— Topological states of matter can be realized using cavity Rydberg polaritons, quasiparticles composed partly of cavity photons and partly of atomic Rydberg excitations. These polaritons interact strongly thanks to the Rydberg excitations and have individual particle behaviors determined by their photonic degree of freedom and shaped through a twisted optical cavity. We recently demonstrated that this hybrid system is a fruitful platform for building strongly correlated quantum states in an artificial gauge field by preparing a synthetic two-particle Laughlin state of photons for the first time. Building on this pioneering work, we describe our recent efforts to enable larger systems by designing a highly degenerate cavity in combination with improved state readout through Rydberg enhanced imaging.

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