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Building Topological Materials of Light in Degenerate Multimode Cavities CLAIRE BAUM, LUKAS PALM, MATT JAFFE, LOGAN CLARK, University of Chicago, NATHAN SCHINE, University of Colorado Boulder, NINGYUAN JIA, Massachusetts Institute of Technology, JONATHAN SIMON, University of Chicago — Strongly interacting optical photons hold great promise for exploring the exotic properties of topologically ordered materials. We make photons interact strongly by turning them into cavity Rydberg polaritons, quasiparticles hybridizing an optical cavity photon with an interacting atomic Rydberg excitation. We recently used these polaritons to create the first Laughlin states of light. However, the maximum size of such quantum materials in our system scales with the number of degenerate modes of the optical cavity. Thus, we describe our efforts to create a highly degenerate multimode twisted cavity compatible with the Rydberg gas, enabling us to explore bigger and more robust topologically-ordered Laughlin states with multiple polaritons.

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