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Quantum Manybody Physics with Rydberg Polaritons JONATHAN SIMON, ALEX GEORGAKOPOULOS, ALBERT RYOU, JIA NINGYUAN, University of Chicago — Hybrid materials are an emerging frontier in condensed matter physics and quantum information science. By coupling two unlike systems, it is possible to leverage the advantages of each. Among the most famous examples are exciton-polariton gases, opto-mechanics, and Rydberg EIT; in each case photons are employed for their fast motional dynamics, in conjunction with a medium that is either nonlinear, or designed to be manipulated and read out optically. Here we describe ongoing work to produce a low-dissipation, strongly-correlated quantum material that arises from hybridizing Rydberg excitations with a 2D photon gas in a high-finesse optical resonator. This platform holds tremendous promise for studies of quantum crystallization dynamics and topological materials under pristinely controlled, easily probed conditions.

Jonathan Simon
University of Chicago

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