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Interaction Dynamics among Rydberg Polaritons in Multi-Mode Optical cavities HADISEH ALAEIAN, JAN KUMLIN, HANS PETER BUCHLER, TILMAN PFAU, University of Stuttgart — Polaritons are superpositions of matter and photon states, whose effective masses are from the photonic part and their interaction originates from their matter part. While the small mass of the photons allows for observing quantum effects at higher temperatures, even up to the room temperature, the interaction allows creating collective many-body effects. Though being very promising due to the rather weak exciton-exciton interactions observing some of the important many-body effects has remained elusive for exciton-polaritons, so far. In this talk we discuss a new quasi-particle called cavity-Rydberg polariton, a quantum superposition of a Rydberg state and a cavity mode. Benefiting from the large interaction between cavity-Rydberg polaritons, inherited from their strongly-interacting atomic part, these quasi-particles are the best candidates to realize a strongly-correlated system for studying quantum many-body physics with photons.

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