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Many-body Physics of Rydberg Polaritons ALEXANDER EDELMAN, PETER LITTLEWOOD, Univ of Chicago — Electromagnetically induced transparency (EIT) in cold dense atomic gasses with Rydberg states in has attracted considerable interest as a means of realizing strong nonlinear photon-photon interactions. The coherent light-matter coupling provided by the EIT medium combined with interactions between Rydberg states whose strength and shape can be engineered provide a parameter space with rich phenomenology including photon bound states and spatially ordered structures. Past theoretical treatments of these systems have relied on equations of motion to predict dynamics in particular limits. Here we present progress towards a full many-body path integral description that considers interaction effects beyond the Dicke model as well as the intrinsically non-equilibrium nature of the system, and explore a tentative phase diagram.

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