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Collective many-body effects in ultracold gases in an optical cavity MARK LEE, JANNE RUOSTEKOSKI, University of Southampton, UK — In free space atoms in dense or degenerate gases exhibit a cooperative response to light scattering, resulting in collective linewidths and shifts which depend not only upon the properties of the individual atoms but also the quantum statistical properties of the gas. For ultra-cold gases trapped within optical cavities the picture is substantially altered by the discrete nature of the cavity mode to which the atoms couple, and by the scattered light mediating long range atom-atom interactions. We derive a formalism to describe many-body collective effects on light scattering in the cavity, and compare the results of simple models to stochastic calculations. The results include both spatial variation of the atom density due to light induced potentials and quantum correlation properties.

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