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Effect of Interatomic Separation in Ensembles in Determining the Fidelity of Collective Excitation RESHAM SARKAR, MAY KIM, YANFEI TU, RENPENG FANG, SELIM SHAHRIAR, Northwestern University — An ensemble of N independent non-interacting two-level atoms gets excited to $2N$ states on interaction with a classical laser. Of these, only $N + 1$ are symmetric. In the regime where the interatomic separation, Δz, is much smaller than the wavelength of radiation, λ_L, and the atoms do not overlap, the asymmetric states disappear and the cluster is reduced to a manifold of symmetric states. However, when $\Delta z \gg \lambda_L$, the asymmetric states remain coupled to the ensemble. In this talk, we will describe a technique to determine the dependence of the symmetric and asymmetric states on Δz. We will show the algorithm for determining the asymmetric states corresponding to any n of N atoms in the excited state. The number of atoms in the excited state and the size of the cluster govern the dependence of the ensemble on Δz. An understanding of the evolution of these states is imperative for the realization of a collective state atom interferometer, where the Compton frequency is N times higher than that of a single atom. The scale factor, defined as phase shift for a given rate of rotation, for such an interferometer increases linearly as $\sqrt{N}$ for a given area.

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