Multi-particle entanglement in superradiance

Mehmet Emre Tasgin

Hacettepe University, Institute of Nuclear Sciences 06800, Ankara, Turkey

I show that (i) two-mode entanglement, (ii) many-particle entanglement and (iii) single-mode nonclassicality criteria are intimately connected to each other. For instance, quadrature squeezing (a single-mode nonclassicality) criterion can be obtained from the spin-squeezing (a many-particle entanglement) criterion. Next, I show that one can obtain a new many-particle entanglement criterion from the photon number-squeezing (Mandel’s Q parameter, or sub-Poissonian) single-mode criterion. I show that this criterion can witness entanglement in states, where spin-squeezing and other criteria fail.

- It can witness the onset of many-particle entanglement in some phase transitions.
- It can predict the onset of coherence in a condensate, induced by collisions, as observed in the experiments.
- It can distinguish between different subradiant states in single-photon superradiance.
- It can detect entanglement of many emitters induced by a single-plasmon source.


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