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Generation arbitrary permutation symmetric state with projection FANGWEN SUN, Optical Nanostructures Laboratory, Columbia University, New York, NY 10027, CHEE WEI WONG, OPTICAL NANOSTRUCTURES LABORATORY, COLUMBIA UNIVERSITY, NEW YORK, NY 10027 TEAM — We proposed a scheme to generate arbitrary permutation symmetric multi-partite state. The system contains N equally single quantum particles (We use atoms for these particles) which may interact with single photon to generate entanglement between them. This entanglement can be obtained by the transition from three-level Λ atom's exited state to different low levels and emitting corresponding polarized photon, or by inputting a single-photon to a trapped atom to gain different phase shift . After preparing N photon-atom entangled states, the N photons are coupled into same path mode to erase the *Welcher-Weg* information. By postselection $(\frac{N}{2}+k)$ photons in one polarization state and $(\frac{N}{2}-k)$ photons in its orthogonal polarization state with N-fold coincidence counts, we can generate the atom Dicke state $\left|\frac{N}{2},k\right\rangle$. Moreover, the arbitrary superposition of these Dicke states can be generated by constructing corresponding projection measurements, which includes multi-atom GHZ state. Based on the discussion on the entanglement between different degrees of freedom, we will show that the projection measurement can also be constructed in the far- field region without combining all photons in one path mode.

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