

Quantum Statistical Behaviors of Interaction of an Atomic Bose-Einstein Condensate with Laser

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Abstract: We have investigated quantum statistical behaviors of photons and atoms in interaction of an atomic Bose-Einstein condensate with quantized laser field. When the quantized laser field is initially prepared in a superposition state which exhibits holes in its photon-number distribution, while the atomic field is initially in a Fock state, it is found that there is energy exchange between photons and atoms. For the input and output states, the photons and atoms may exhibit the sub-Poissonian distribution. The input and output laser fields may exhibit quadrature squeezing, but for the atomic field, only the output state exhibits quadrature squeezing. It is shown that there exists the violation of the Cauchy-Schwartz inequality, which means that the correlation between photons and atoms is nonclassical.

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Key words: atomic Bose-Einstein condensate, sub-Poissonian distribution, quadrature squeezing, Cauchy-Schwartz inequality

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