

Diploma thesis abstract

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The quantum theory of four-mode light field generation was developed. We studied the quantum properties of coupled parametric process consisted of four parametric down-conversions, which can be produced at nonlinear wave interactions with quasi-phase-matching in aperiodically-poled nonlinear crystal. It was shown, that this type of interaction can be the source of four-mode entangled states. Statistical properties of particular modes were studied: the mean photon numbers, the variances of the mean photon numbers, the Glauber correlations functions of the second, third and fourth orders were calculated. It is shown that photon number correlations have nonclassical character at small interaction length. We also calculated the covariance matrix for continuous quantum variables of the generated modes and made use the criterion of separability based on the partial scaling transform to reveal the entanglement between these variables. It is established that cluster entangled states are produced in the coupled parametric processes. The novel method of forming four-mode entangled states in one aperiodically-poled nonlinear crystal was studied in this work. We analysed the possibility of using the generated four-mode entangled state in quantum teleportation of an unknown two-mode entangled state. The fidelity of such teleportation was computed.