Diploma thesis abstract

# Quantum cloning by type-I entangled parametric amplification

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*Keywords:* spontaneous parametric-down conversion, entangled states, optical parametric amplification, quantum injection, quantum cloning, entanglement swapping, GHZ states.

In this paper it is described in detail the quantum cloning of $\pi$-states in type-I OPA. It is analyzed a statistical properties of the electromagnetic field for $n$-photon quantum injection in type-I OPA using evolution equations of annihilation operators. Full and abridged form of the output state, generated in type-I one- and two-crystal entangled OPA, as well as an efficiency of the one-photon cloning via "Fidelity" criterion are obtained.

A new method of classical and modified 4-photon Greenberger-Horne-Zeilinger (GHZ) states generation and a new scheme of entanglement swapping via one-mode cloning are elaborated. A use of the entanglement swapping scheme in quantum repeaters for the time-based quantum key distribution protocol is proposed. Additionally, two new methods of the cloning detection, correlative (via one-detector measurement of time correlation function) and interferometric (via polarisation-dependent measurements in coincidence circuit on Brown-Twiss interferometer), are proposed and described.

For experimental illustration the Wootters-Zurek cloning machine with the two-crystal type-I entangled OPA is created. The fact of the cloning is confirmed using original interferometric method of the cloning detection.