

CED : « Engineering Sciences and Techniques »

THESIS DEFENSE

«SOUMIA ALILOUTE»

CANDIDATE FOR DOCTOR SCIENCES AND TECHNIQUES

« Theoretical Study of the Efficiency of the Proposed
Bidirectional Quantum Teleportation of Superposed Coherent
States Over a Quantum Network»

Date :	Tuesday 25 july 2023
Time :	10 am
Location :	Conference Hall, FST - Al Hoceima

Committe Members

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ABSTRACT

The proposed work is motivated by the interesting and staggering quantum teleportation process, based on the entanglement phenomenon, the most counter-intuitive property in quantum information, which states that a quantum measurement made on one of the entangled particles affects the state of the others remotely. The quantum teleportation is applied to coherent states, a set of quantum states, that do give rise to a sensible classical limit. In this respect, we propose a scheme of teleporting an unknown superposed coherent state between two parts in two directions simultaneously. This proposed scheme is essentially based on optical devices like beam splitters, phase shifters and photon number measurement detectors. The probability of success and the mean fidelity of quantum teleportation in the presence of quantum noise, which describes the interaction of the system with environment, are evaluated in respect on the mean number of photons of the sent state and the environment's noise rate. However, quantum Fisher information (QFI) is studied to estimate some parameters, such as the weight and the phase of sent states.

In addition, a bidirectional quantum teleportation protocol is introduced over a quantum network (QN) consists of more than four members sharing a coherent entangled state, where it is implemented in a perfect or noisy environment. The results show that the amplitude of the coherent state and the decoherence parameter play an important role in maximizing or minimizing this probability. At fixed values of the amplitude and the decoherence parameters, the success probability increases as the number of users increases. The fidelity of the teleported coherent state depends on the type of the encoded information, whether entangled/partial or classical information, namely depending on the weight parameter. The stability of the fidelity is displayed when the users teleport classical information.

Keywords: Bidirectional teleportation, Quantum network, Entanglement, Coherent states, Optical devices.