Spécialité de Master « Optique, Matière, Paris »

Stage de recherche (4 mois minimum, à partir de début mars)

Proposition de stage

Date de la proposition : 14 octobre 2015

Responsable du stage

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Code d'identification : UMR 8552 Organisme : UPMC/ENS/CNRS/Collège de France
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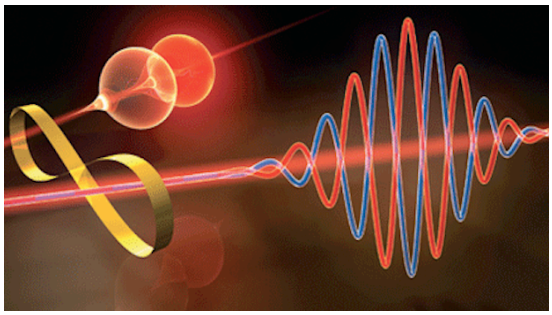
Lieu du stage : UPMC Campus

Hybrid Entanglement of Light: Towards Heterogenous Quantum Information Networks



The wave–particle duality of light has led to two different encodings for optical quantum information processing. Several approaches have emerged based either on particle-like discrete-variable states or on wave-like continuous-variable states. Discrete and continuous-variable approaches rely on different physical states for their implementations. The first usually involves single-photons. In the continuous alternative, qubits can be implemented as superpositions of two distinguishable 'classical' objects, i.e. Schrödinger cat states. Optically, this can be realized by superpositions of two phase-opposite light waves. Both encodings have their own advantages and drawbacks when it comes to sophisticated protocols, and combining the two may offer serious advantages for information processing. Some operations might better take advantage of the continuous-variable toolbox, while others might be more efficient within the discrete variable framework. Transferring information from one encoding to the other is thus a crucial requirement. This is a strong analogy to what has happened with the standard digital (discrete) and analog (continuous) encoding and processing of classical signals.

The research project aims now at demonstrating such a transfer by quantum teleportation based on a novel optical resource, the so-called optical hybrid entanglement between particle-like and wave-like qubits recently demonstrated for the first time in the LKB team. After demonstrating such information transfer between encodings, another step of the research will target the generation of enhanced hybrid entanglement. This effort will first include an increase in the dimensionality of such hybrid entangled states, realizing hybrid qutrits. The team will then target the generation of hybrid entanglement where the discrete part is encoding in polarization and not in the number of photons. This state will facilitate the connexion to the well-developed protocols based on polarization encodings.

Ce stage pourra-t-il se prolonger en thèse ? OUI

Si oui, financement de thèse envisagé: EDPIF

Lumière, Matière, Interactions	**X**	Lasers, Optique, Matière	**X**