Quantum information protocols based on multiparty entanglement

Mots clés :
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- Unité de recherche : Laboratoire Traitement et Communication de l’Information
- Ecole doctorale : École Doctorale Informatique, Télécommunications, Électronique de Paris
- Domaine scientifique principal: Divers

Résumé du projet de recherche (Langue 1)
Quantum information has revolutionized our understanding of information processing and the foundations of quantum mechanics. The major insight has been that the laws of information processing depend on the physical laws of the underlying systems - and so one can be used to understand the other. Two main directions have shown the incredible benefits enabled by this insight. In quantum computation it is possible to factor large numbers into primes exponentially faster than classically, and in quantum key distribution two parties can share absolute secure communications impossible classically. However, we have only touched on the full subtleties allowed by multipartite quantum entanglement. In the same way that the internet is more powerful than any one computer and one two parties protocol, we can expect revolutions in what is possible with quantum networks. The proposed PhD project will focus on developing both theoretically and experimentally novel multiparty entangled quantum information protocols to exploit the full potential of quantum mechanics. It is for instance interesting to investigate the relation between non-locality and permutation symmetry of n-qubit states or to go further into entanglement verification methods. In particular, we will pursue the generation and manipulation of multiparty entangled photon states, such as the so called GHZ and cluster states, which are at the heart of several algorithms developed for performing computation tasks securely over quantum networks (secret sharing between members of a group for instance). Experimental tools will include quantum and nonlinear optics while from a theoretical point of view, we will rely on entanglement and quantum information theory. This work will be supervised by Damian Markham, Eleni Diamanti and Isabelle Zaquine.

Informations complémentaires (Langue 1)
There will be several possibilities for joint work in the context of our team's international collaborations, in particular with the university of Vienna and Imperial College in London.

Informations complémentaires (Langue 2)
The candidate is expected to have knowledge of quantum mechanics and optics, while basic notions of information theory and quantum optics could also be helpful.