Soutenance de thèse

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Entanglement in High Dimensional Quantum Systems

Entanglement detection is crucial in the context of quantum information and quantum computation. This important task has proved to be quite hard for quantum systems of dimensions higher than 2×3, in which case, there exists well established necessary and sufficient conditions. To tackle this challenge for bipartite systems, we introduce a mathematical framework to reduce the problem to entanglement in a two qubit system. This is done by mapping each subsystem locally into a qubit preserving the separability . Our main use of this formalism is as a gate way to derive entanglement criteria for bipartite or multi-partite systemes based on existing ones derived for qubit systems. For the multi-partite case, we focus on spin squeezing inequalities for qubits to derive entanglement criteria for general systems. We derive generalized form of Sørensen-Mølmer's criterion and of spin squeezing inequalities for fluctuating particle number in terms of arbitrary collective operators. We applied our results to study entanglement in a system of ultra-cold Chromium atoms trapped in a bi-dimensional optical lattice in collaboration with Quantum Dipolar Gazes team in Laboratoire de Physique de Laser at Paris Nord 13 University. We showed, in a numerical simulation, that our generalized inequalities are able to detect entanglement in their system using collective operators. Moreover, we show that such observables can be measured using available techniques.

Jeudi 11 juillet 2019 à 14 h
Amphithéâtre du bât 520 (3ème étage)
Université Paris-Sud, 91405 Orsay Cedex

La soutenance sera suivie d'un pot auquel vous êtes chaleureusement conviés.