



Canadian Association
of Physicists

Association canadienne
des physiciens et physiciennes

Contribution ID: 2395 Type: **Poster Competition (Graduate Student) / Compétition affiches (Étudiant(e) 2e ou 3e cycle)**

6 - Experimental Detection of Qubit-Ququart Pseudo-Bound Entanglement using Three Nuclear Spins

Tuesday, 4 June 2019 16:55 (2 minutes)

In this work, we experimentally created and characterized a class of qubit-ququart PPT (positive under partial transpose) entangled states using three nuclear spins on a nuclear magnetic resonance (NMR) quantum information processor. Entanglement detection and characterization for systems with a Hilbert space dimension $\geq 2 \otimes 3$ are nontrivial since there are states in such systems which are both PPT as well as entangled. The experimental detection scheme that we devised for the detection of qubit-ququart PPT entanglement was based on the measurement of three Pauli operators with high precision and is a key ingredient of the protocol in detecting entanglement. The family of PPT-entangled states considered in the current study are incoherent mixtures of five pure states. All the five states were prepared with high fidelities and the resulting PPT entangled states were prepared with mean fidelity ≥ 0.95 . The entanglement thus detected was validated by carrying out full quantum state tomography (QST).

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Session Classification: DAPI Poster Session & Student Poster Competition Finals (8) | Session d'affiches DPIA et finales du concours d'affiches étudiantes (8)

Track Classification: Applied Physics and Instrumentation / Physique appliquée et de l'instrumentation (DAPI / DPAI)