Contribution ID: **44** Type: **Poster**

Quantum entanglement in neutrino oscillations

Monday, 10 August 2020 12:25 (15 minutes)

We quantify bipartite and tripartite entanglement for two and three flavor neutrino oscillations in terms of two and three-qubit states (known as W states) used in quantum information theory. We calculate the concurrence , negativity and three tangle and show genuine tripartite entanglement in terms of a residual entanglement that satisfies a monogamy inequality. We use this analogy to outline the simulation of a neutrino oscillation on a quantum computer. We suggest the implementation of entanglement in neutrino systems on a IBM quantum processor.

Summary

As per our understanding, in quantum mechanics, flavor neutrino states are single-particle states possessing multi-mode flavor entanglement. In my poster entitled "Quantum entanglement in neutrino oscillations", by exploiting essential tools of distributed entanglement theory, the aim is to quantify various measures of entanglement like concurrence, three- tangle, negativity, linear entropy etc. in terms of neutrino transition probabilities between different flavor modes of two- and three- flavor neutrino oscillations, which corresponds to the similar analysis of a single photon in quantum optics, in which entanglement between different modes of two- and three- qubit states in class of W-state has been studied under Stochastic local operations and classical communication (SLOCC). The class of W-state has interesting property that if one of the three qubits is lost the state of the remaining two-qubit system is still entangled and therefore this state have given a stimulus to quantum technology by recognizing its various applications in quantum information processing. We show that the three neutrino state shows the remarkable property of having genuine tripartite entanglement. In addition to this, the two-flavor mode (bipartite) entanglement is analogous to the entanglement swapping resulting from a beam splitter in quantum optics. We conjecture that we can construct a quantum optical system using a collection of beam splitters to mimic the three neutrino states. Such an analogy will enable us to study further neutrino entanglement and understand new phenomena in quantum information theory. Since quantum optical systems can be manipulated, unlike neutrino oscillations experiments, the work done by us is of interest to explore the characteristics of neutrino oscillation quantum entanglement further. Work on simulation of such systems on a IBMQ processor is in progress.

Primary authors: Mr JHA, Abhishek (University of Hyderabad); Mr CHATLA, Akshay (University of Hyderabad); Prof. BAMBAH, Bindu A. (University of Hyderabad)

Presenter: Mr JHA, Abhishek (University of Hyderabad)

Session Classification: Poster session