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# TRANSMITTING QUANTUM ENTANGLEMENT IN SCARCE SATELLITE NETWORKS

**Abstract**

Quantum computing has growing importance not only in the field of cryptography but in material science, medicine, and many more thanks to the advancements in quantum algorithms. Quantum communication provides several solutions including secret key exchange. With the use of satellite, we can achieve a higher level of coverage than using optical fibers where the distances are limited due to the properties of the fiber. In recent years most works that coined satellite networks as a medium for quantum communication had two things in common. First the satellites should be in Low Earth Orbit, increasing the maximal optical throughput of the earth-satellite links, second the system should provide a continuous communication channel between the end nodes. Not considering the cost of technology development which needed for high reliability satellite-based quantum system, one of the highest drivers of cost for these networks is the cost of launching and maintaining satellites. By decreasing the number of satellites needed for a functioning network, one can decrease the cost of that system. However, reducing the number of satellites in the network lowers the time intervals where there is a direct connection between end nodes.

In our research, we created a routing protocol for scarce quantum optical satellite systems, which maximizes the optical transmittance of the possible routes. The main idea behind our algorithm was the utilization of entanglement swapping and the growing time capacity of quantum memories. By utilizing quantum entanglement swapping, we eliminated the need for the resulting routes to be time consecutive.

Our main goal was to create an algorithm that would enable scarce quantum satellite networks. To test our algorithm, we modeled two types of satellite architectures along with four satellite systems. In our preliminary testing, where we used a satellite system where classical continuous communications were sub-optimal, we could achieve a high level of quantum entanglement transmission between our end nodes.