# An elementary 158 km long quantum network connecting room temperature quantum memories

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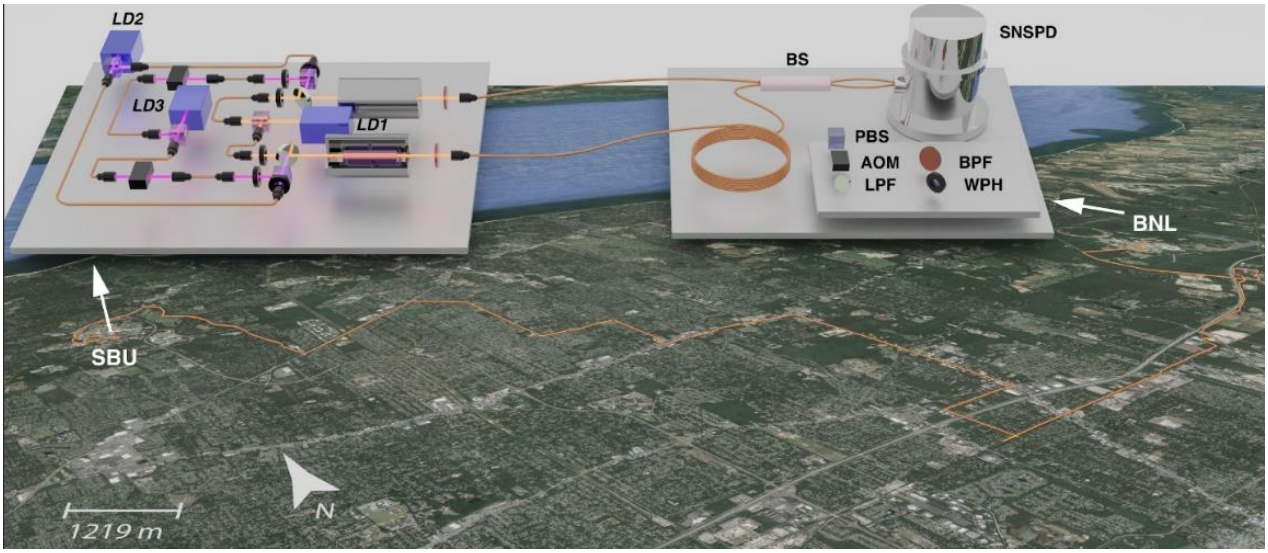
First-generation quantum repeater networks require quantum memories capable of interfacing with telecom photons to perform quantum-interference mediated entanglement generation operations. The ability to demonstrate these interconnections using real-life fiber connections in a long-distance setting is paramount to realize a scalable quantum internet. Additionally, performing these experiments with room temperature atomic vapor systems, opens a plethora of possibilities for scalability and field deployment. Here we report first experimental results obtained in the quantum network prototype connecting quantum laboratories in Stony Brook University and Brookhaven National Laboratory. We have observed Hong-Ou-Mandel (HOM) interference between indistinguishable telecom photons produced in two independent room temperature quantum memories, separated by a distance of 158 km. We obtained interference visibilities after long-distance propagation of V = (38 ± 2)%, for single-photon-level experimental inputs [1]. This first-of-its-kind quantum network is envisioned to evolve into a large-scale memory-assisted entanglement distribution quantum network, the basis for inter-city quantum communication.




Overview of the quantum network testbed on Long Island, New York. It consists of 4 commercially available fibers connecting the Quantum Internet Laboratory (QIT) in the Physics Building in Stony Brook to the Quantum Information Science and Technology Laboratory (QIST) in the Instrumentation Building in BNL. Two quantum memories (Alice and Bob) are located in the SBU QIT laboratory and are connected independently to the network. The interference setup and telecom compatible single photon nano-wire detectors (Charlie station) are located in the QIST laboratory in BNL. The other two fibers are used to transport classical timing triggers and sequencing information.

[1] https://arxiv.org/abs/2101.12742