# Quantum Information Seminar Series

## Quantum Information Seminar Series 2026

**Friday, December 11** | 12:00pm - 1:00pm, IRCB Room 1030
Questions? Contact: Wei Guo

# Link-Free Multi-Node Timing Synchronization for Scalable Quantum Networking

**Abstract:** Precise timing synchronization is essential for quantum networking, especially when we need to identify photon correlations between geographically separated nodes for applications such as entanglement distribution, quantum teleportation, and entanglement swapping. Traditionally, this is achieved using dedicated timing-distribution systems, such as White Rabbit. While these systems work very well, they require additional infrastructure, which can limit scalability and flexibility, particularly for free-space and satellite-based quantum networks. In this talk, I will present our recent work on link-free timing synchronization, where we use independent miniature rubidium atomic clocks at each network node, combined with computational post-processing, to synchronize photon detection events without dedicated timing links. Our approach uses a two-stage coincidence search algorithm to recover photon correlations even when the initial timing offsets exceed one second. We then apply a drift-compensation technique to correct the relative clock drift over extended measurement periods. We demonstrate this approach on a deployed metropolitan-scale fiber network connecting 3 geographically separated nodes. After drift correction, we achieve timing performance approaching that of White Rabbit, with stable operation over 8 hours. More importantly, we demonstrate Hong–Ou–Mandel interference between remote nodes with visibility exceeding 70%, statistically equivalent to what we obtain using White Rabbit synchronization.



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