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Department of Electronic Engineering

SEMINAR

Quantum storage of entangled photons at telecom wavelengths in a crystal

By

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Abstract:

The quantum internet -- in synergy with the internet that we use today -- promises an enabling platform for next-generation information processing, including exponentially speed-up distributed computation, secure communication, and high-precision metrology. The key ingredients for realizing such a global network are the distribution and storage of quantum entanglement. As ground-based quantum networks are likely to be based on existing fiber networks, telecom-wavelength entangled photons and corresponding quantum memories are of central interest. Recently, $^{167}\text{Er}^{3+}$ ions have been identified as a promising candidate for an efficient, broadband quantum memory at telecom wavelength. However, to date, no storage of entangled photons, the crucial step of quantum memory using these promising ions, $^{167}\text{Er}^{3+}$, has been reported. Here, we demonstrate the storage and recall of the entangled state of two telecom photons generated from an integrated photonic chip based on a silicon nitride micro-ring resonator. Combining the natural narrow linewidth of the entangled photons and long storage time of $^{167}\text{Er}^{3+}$ ions, we achieve storage time of $1.936\ \mu\text{s}$, more than 387 times longer than in previous works. Successful storage of entanglement in the crystal is certified by a violation of an entanglement witness with more than 23 standard deviations (-0.234 ± 0.010) at $1.936\ \mu\text{s}$ storage time. These results pave the way for realizing quantum networks based on solid-state devices.

Reference:

Ming-Hao Jiang, Wenyi Xue, Qian He, Yu-Yang An, Xiaodong Zheng, Wen-Jie Xu, Wenjun Wen, Yu-Bo Xie, Yanqing Lu, Shining Zhu, Xiao-song Ma. Quantum storage of entangled photons at telecom wavelengths in a crystal. *Nat. Comm.* 14, 6995 (2023).

Biography:



Professor Xiao-Song Ma joined School of Physics at Nanjing University in 2015. He obtained his B.S. from Nanjing University in 2003, M.S. from Leiden University in 2005 and Ph.D. in Physics at University of Vienna in 2010. He was a postdoc fellow in the Institute of Quantum Optics and Quantum Information in Vienna from 2010 to 2012, and a Marie Curie fellow at Yale University from 2012 to 2015. His research area covers long-distance quantum communication, experimental investigations on the foundation of quantum physics and integrated photonics for quantum-enhanced technology.

ALL ARE WELCOME

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