Can we build a large-scale quantum network with deterministic quantum light sources?

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Hundreds and thousands of fireflies synchronize their dazzling light in summer nights – one of nature's most beautiful demonstrations on the importance of synchronization and scalability in a network. Inspired by this, we can ask such a question: is it possible to synchronize many devices in a future quantum internet? This is one of the "biggest" fundamental questions that has just emerged during the development of quantum information science in the past decades.

Recently we have successfully realized the first entanglement swapping experiment with a deterministic quantum light source based on semiconductor quantum dots. It opens the possibility of connecting quantum devices in a scalable way. Now we aim to test this type of sources in a real-world quantum optical network. In the short term, the idea is to demonstrate a time and frequency synchronized quantum communication link by using only one segment of the fiber network. In the middle term, the two-nodes link shall be extended to multipartite links by using (hybrid) quantum repeaters. Thus, large-scale multipartite entanglement can be created on this link, which forms the experimental testbeds for several exciting experiments.

Short Bio:

Fei Ding received Ph.D. in 2009 through the joint doctoral promotion program of the Max Planck Society in Germany and the Chinese Academy of Sciences. Then he joined the IBM Zurich Research Laboratory from 2010 to 2012, as a Marie Curie fellow. Continuing his academic journey, Fei assumed the role of a group leader at IFW Dresden, Germany, from 2012 to 2016. In 2016, he received a tenured full professorship (W3 Chair) at Leibniz University Hannover. He received the prestigious ERC grant for two times.