

Towards global Quantum Networks: the role of Space

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ABSTRACT

The development of global quantum networks is emerging as a critical enabler for secure communications, high-precision metrology, distributed sensing, and scalable quantum computing.

While terrestrial fibre infrastructures underpin early quantum communication deployments, their intrinsic attenuation limits long-distance performance. Space-based links, offering significantly lower transmission losses, provide an appealing route toward global quantum connectivity.

This paper outlines motivations for integrating space segments into quantum networks, covering applications spanning quantum cryptography, distributed and blind quantum computing, advanced time distribution, and quantum-enabled sensing for scientific and Earth-observation purposes.

Emerging concepts for space-enabled quantum networking are presented within the broader context of Europe's future quantum ecosystem. From these identified needs, the idea of QUASAR proposal was proposed to create an in-orbit demonstration of space-based entanglement distribution to support the transition towards operational entanglement-enabled services. Additionally, the talk will highlight the key technical challenges in developing QUASAR mission and the corresponding ground infrastructure.