
***DJEYLAN AKTAS***

**Institute of Physics Slovak Academy of Sciences**



**Project number**
**1156/01/01**

**Project duration**
**10/2022 - 9/2025**


## BIOGRAPHY

Dr Djeylan Aktas is head of the experimental photonics quantum communication group at the Institute of Physics of Slovak Academy of Sciences (IPSAS). He received his diploma in fundamental physics from the University of Nice Sophia Antipolis in 2011. He has obtained a PhD in experimental quantum photonics in the same university at the INPHYNI with the QPI team in 2016 gaining a wide knowledge in designing complex photonics experiments and their applications in quantum communication and sensing. After that, he became Senior Research Associate in the quantum communication team at QETLabs leading the work on the development of integrated photonics devices for quantum networks. After his involvement in the first phase of the UK National Quantum Technologies Programme funded by the Engineering and Physical Sciences Research Council, he became co-investigator in the phase 2 and he participated in the international collaborative research program on quantum technologies funded by Innovate UK and the National Sciences and Engineering Research Council of Canada.

## PROJECT SUMMARY

### Backbone of an International Quantum Network


Quantum communication is rapidly gaining popularity due to its high levels of security and technological maturity. Experimental devices have already been taken out of the lab and purpose-built Quantum Key Distribution systems are now an option for real-world communication thus ensuring provably secured point- to-point links. The history of quantum networks is already rich in attempts to stack these links in a telecommunication infrastructure and recently, hundreds of millions of euros of research funding have been allocated to build large-scale quantum communication network. However, most implementations suffer from drawbacks preventing them from being widely adopted. The first difficulty one encounters with a trusted-node approach is the resource overhead of a fully connected mesh, and second while trying to deploy these QKD systems, is their limited range of operation. They are quite efficient at a metropolitan scale but the drastic decreasing rate with losses and the nature of quantum information, disallowing amplification, make inter-city links a challenge. Entanglement-based QKD is key to build a scalable trusted-node free and fully connected quantum network. Amongst those protocols, Flood Light QKD is a prime candidate to solve bottleneck issues in connecting clusters of metropolitan networks with a single link. This protocol is not constrained by the fundamental limits of repeaterless quantum communications like standard QKD schemes and can reach gigabits rates of unconditionally secure communication. The challenge resting on the fact that it employs a phase-stable interferometric system deployed over a long optical fibre. This project aims at combining various QKD protocols for establishing full connectivity of multiple nodes over short distances and some specific entanglement-based protocols for reaching long distance of quantum communication. Hence, creating the backbone of a first international quantum communication network.


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# PUBLICATIONS

**- Scalable authentication and optimal flooding in a quantum network**
Naomi R. Solomons, Alasdair I. Fletcher, **Djeylan Aktas**, Natarajan Venkatachalam, Sören Wengerowsky, Martin Lončarić, Sebastian P. Neumann, Bo Liu, Željko Samec, Mario Stipčević, Rupert Ursin, Stefano Pirandola, John G. Rarity, Siddarth Koduru Joshi. PRX Quantum, 3, 020311, 2021.

**- A trusted-node-free eight-user metropolitan quantum communication network**
S. K. Joshi, **D. Aktas,** S Wengerowsky, M. Loncāric , S. P. Neumann, B. Liu, T Scheidl, G. C. Lorenzo, Ž. Samec, L. Kling, A. Qiu, M. Razavi, M. Stipcēvic , J. G. Rarity, R. Ursin. Science Advances, Vol. 6, no. 36., 2020.

**This publication has been highlighted with many news outlets and is in the top 5% of all research scored by Altmetric with 1123.**

**- Quantum enhancement of accuracy and precision in optical interferometry**
F. Kaiser, P. Vergyris, **D. Aktas**, C. Babin, L. Labonté, S. Tanzilli
Light: Science & Applications, Nature,7, 17163, 2018.

- Entanglement distribution over 150 km in wavelength division multiplexed channels for quantum cryptography
**Djeylan Aktas,** Bruno Fedrici, Florian Kaiser, Tommaso Lunghi, Laurent Labonté, Sébastien Tanzilli.
Laser and Photonics Reviews, 10 (3), pp.451-457, 2016.

- Demonstration of Quantum Nonlocality in presence of Measurement Dependence
**Djeylan Aktas**, Sébastien Tanzilli, Anthony Martin, Gilles Pütz, Rob Thew, Nicolas Gisin. Physical Review Letters, American Physical Society, 114, 220404, 2015


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S A S P R O 2

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