Beyond Entangled Pairs: Quantum Correlations in Networks

Fact Sheet

Project Information

**BEPQCiN**

Grant agreement ID: 101106868

**DOI**

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Marie Skłodowska-Curie Actions (MSCA)

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30 June 2026

**Total cost**

€ 0,00

**EU contribution**

€ 308 746.56

**Coordinated by**

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS

France

Objective

This research proposal concerns the theoretical study of quantum correlations in networks. Given the current wide availability of the preparation and distribution of two-party entangled states, we propose to develop theoretical tools that enable the construction of multipartite quantum correlated networks using two-party states as building blocks. Such interconnected quantum networks would then allow for the implementation of sophisticated and secure quantum information protocols. The project is divided in three work packages (WP) with different questions and goals. The first one focuses on the generation of entanglement. It will tackle the problem of manipulating bipartite quantum states in quantum networks in order to generate genuinely multipartite entangled states. Our goals are to characterise the sets of
states that can be generated in a given network, define entanglement measures that are appropriate for network scenarios, and bound the amount of entanglement a network can produce. The second WP concerns the certification of entanglement in partly trusted star networks. Our goal is to develop a complete framework for entanglement certification with a semi-device-independent approach that is particular to networks, employing techniques from quantum steering. The final WP focuses on the problem of the equivalence between entanglement and Bell nonlocality. Our objective is to investigate whether any bipartite entangled state can lead to nonlocality in a network setting. The investigation of this fundamental, long-standing question will allow us to determine which bipartite states are and are not useful to quantum networks with the highest level of security. This research project shall be undertaken by the applicant, Dr. Jessica Bavaresco, under the mentorship of Prof. Nicolas Brunner at the University of Geneva, Switzerland, during the outgoing phase, and Dr. Cyril Branciard at the French National Centre for Scientific Research, France, during the return phase.

**Keywords**

- Quantum networks
- Quantum internet
- Quantum communication
- Quantum correlations
- Entanglement
- Steering
- Bell nonlocality
- Causal structures
- Causal networks
- Multipartite systems

**Programme(s)**

- HORIZON.1.2 - Marie Skłodowska-Curie Actions (MSCA)

**Topic(s)**

- HORIZON-MSCA-2022-PF-01-01 - MSCA Postdoctoral Fellowships 2022

**Call for proposal**

- HORIZON-MSCA-2022-PF-01

[See other projects for this call](#)
Funding Scheme
HORIZON-TMA-MSCA-PF-GF - HORIZON TMA MSCA Postdoctoral Fellowships - Global Fellowships

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Participation in EU R&I programmes
HORIZON collaboration network
Other funding
€ 0,00

Partners (1)

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Schweiz/Suisse/Svizzera > Région lémanique > Genève
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