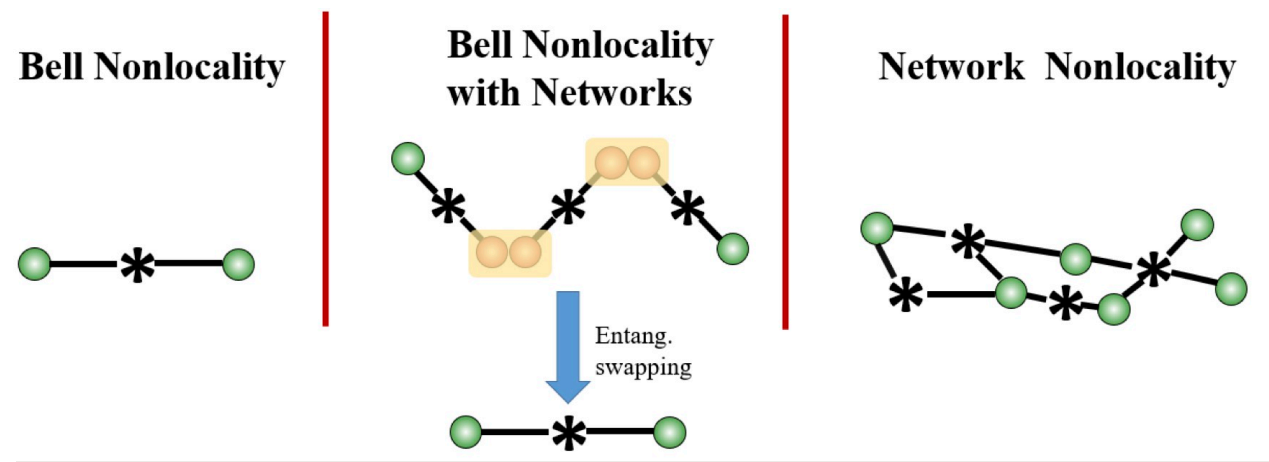# COMPUTE

nonCommutative polynOMial oPtimisation for qUanTum nEtworks

QUANTERA

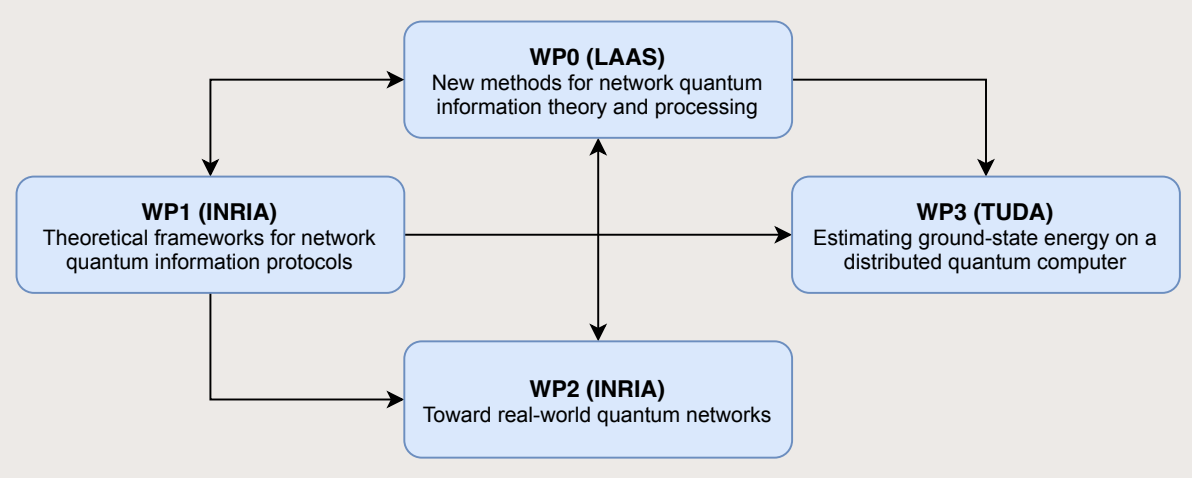## Realizing the potential of quantum networks

The quantum internet will drastically change the way we process information, communicate and compute. The last decade saw the development of the first small-medium size quantum networks, prototypes of this ambitious long-term goal. These already existing real-world quantum networks open new possibilities for quantum information processing. New recent protocols show that they offer a radically new range of application of quantum technologies, e.g., for certification tasks based on Bell nonlocality of quantum correlations, cryptography, or fault-tolerant quantum computation. However, the potentialities they offer are primarily ignored: in nowadays experiments, quantum networks are mainly used to simulate single quantum states, e.g., the standard Alice and Bob scenario. Genuine quantum network protocols remain mostly experimentally infeasible due to their unrealistic theoretical requirements, e.g., in terms of noise.

Objectives:

▸ *Establish Coherent Framework*: Guide both theoretical and practical development of quantum networks.

▸ *Enable Quantum Protocols*: Implement practical quantum network protocols.

▸ *Advance Quantum Computing*: Develop distributed quantum computing to surpass current quantum computer capabilities.

▸ *Bridge Communities*: Integrate polynomial optimisation and quantum information fields.

Bell Nonlocality   Bell Nonlocality with Networks   Network Nonlocality

Entang. swapping

Structure:

WP0 (LAAS) — New methods for network quantum information theory and processing

WP1 (INRIA) — Theoretical frameworks for network quantum information protocols

WP3 (TUDA) — Estimating ground-state energy on a distributed quantum computer

WP2 (INRIA) — Toward real-world quantum networks

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We are hiring:

Our consortium offers PhD and postdoc positions in quantum information, polynomial optimization, and operator theory. We welcome applicants with excellent profiles for both short and long-term stays. Spontaneous applications to our member groups are encouraged! welcome!