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# Quantum Communication and Quantum Networking

First International Conference, QuantumComm 2009  
Naples, Italy, October 26-30, 2009  
Revised Selected Papers

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# Preface

QUANTUMCOMM 2009—the International Conference on Quantum Communication and Quantum Networking (from satellite to nanoscale)—took place in Vico Equense near Naples, Italy, during October 26–30, 2009.

The conference made a significant step toward stimulating direct dialogue between the communities of quantum physics and quantum information researchers who work with photons, atoms, and electrons in pursuit of the common goal of investigating and utilizing the transfer of physical information between quantum systems.

This meeting brought together experts in quantum communication, quantum information processing, quantum nanoscale physics, quantum photonics, and networking. In the light of traditional approaches to quantum information processing, quantum communication mainly deals with encoding and securely distributing quantum states of light in optical fiber or in free space in order to provide the technical means for quantum cryptography applications. Exciting advances in the area of quantum communication over the last decade have made the metropolitan quantum network a reality. Several papers presented at this meeting have demonstrated that quantum cryptography is approaching the point of becoming a high-tech application rather than a research subject. The natural distance limitation of quantum cryptography has been significantly augmented using ideas of global quantum communication with stable-orbit satellites. The results presented at this conference demonstrated that practical secure satellite communication is clearly within reach.

The rapid advancement of modern nanoscale technology makes it clear that quantum photonic devices naturally communicate with each other either electromagnetically or by virtue of quantum electron transport. Basic laws of quantum physics and quantum electromagnetics govern this type of communication at the nanoscale. To a macroscopic observer such nanoscale systems could appear in the form of a structured or unstructured network. The cross-disciplinary merger of quantum physics and nanophotonics with principles of networking opens new perspectives for developing modern quantum communication applications in the form of practical devices. Several technical sections at this conference confirmed that the interaction of quantum systems could provide not only an exciting research opportunity but will also create a base for interesting and novel applications, ranging from quantum repeaters to near-field nanoscale optical detectors.

This conference was devoted to the discussion of new challenges in quantum communication and quantum networking that extends from nanoscale devices to global satellite communication networks. It placed particular emphasis on basic quantum

science effects and on emerging technological solutions leading to practical applications in the communication industry, culminating with a special section on hybrid information processing.

Alexander Sergienko  
Saverio Pascazio  
Paolo Villorosi



**Nanophotonics Devices for Quantum Communication**

Lorenzo Pavesi University of Trento, Italy

**Hybrid Quantum Systems: Connecting Photons, Atoms, Solid-State Devices**

Jörg Schmiedmayer Technical University of Vienna, Austria

**Superconducting Nanoscale Devices in Quantum Communication**

Andrea Fiore Technical University Eindhoven, The Netherlands

**Nanomechanical Quantum Systems and Their Interaction with Nonclassical Light**

Markus Aspelmeyer University of Vienna, Austria

**Entanglement as a Resource for Quantum Communication**

Saverio Pascazio University of Bari, Italy

**Practical Applications of Quantum Communication and Networking**

Andreas Poppe Austrian Institute of Technology – AIT

**Workshop on Quantum and Classical Information Security**

**Quantum and Classical Information Security**

Romain Alléaume Institut télécom / Télécom ParisTech, France

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