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To all members of the
Faculty of Physics

Vienna, 21 January 2020

Invitation to the public defense of the doctoral thesis

"Single photons for quantum information: demonstration of novel quantum communication schemes and realization of a narrow-bandwidth source for interaction with atoms"

by

Francesco Massa

Tuesday, 28 January 2020, 15:00 p.m.
Josef Stefan lecture hall, 3rd floor, Boltzmanngasse 5, 1090 Vienna

Quantum technologies promise to revolutionize the future of information processing. Among them single photons represent one of the best candidates for real-world applications due to their mobility, lack of decoherence and ease of manipulation.
This thesis presents three experimental projects covering both fundamental and technological research in quantum information with single photons.
The first experiment shows that a single photon in quantum superposition allows for the simultaneous transmission of two classical bits between two distant parties, which is used to implement an anonymous quantum communication protocol.
The second experiment consists in the proof-of-principle implementation of a novel quantum key distribution protocol in which the users are only capable of classical operations, while the quantum resources are delegated to an external untrusted server.
Finally, for the third project a source of narrow-bandwidth (10 MHz) degenerate photon pairs tuned to Rubidium D2 line is built and characterized. Due to their narrow spectral bandwidth the produced photons can be efficiently coupled to Rubidium hyperfine transitions. The source therefore constitutes an important tool for the realization and characterization of atom-mediated two-photon quantum gates.

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