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Faculty of Physics

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Doctoral programme in
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To all members of the
Faculty of Physics

Vienna, 23 January 2020

Invitation to the public defense of the doctoral thesis

“Towards scalable photonic entanglement generation”

by

Rui Ferreira Vasconcelos

Thursday, 30 January 2020, 14:00 p.m.

Josef Stefan lecture hall, 3rd floor, Boltzmannngasse 5, 1090 Vienna

This thesis focuses on the scalable generation of photonic cluster states and attempts a transition from photonic entanglement sources based on spontaneous parametric down-conversion (SPDC), which are intrinsically probabilistic, to sources based on atom-like single-photon emitters (SPE), which are fundamentally deterministic.

Firstly, a type-II SPDC source was characterised and modified to produce 4-qubit cluster states. These were then applied to the demonstration of elements of measurement-based error correction, where an arbitrary logical qubit is protected against phase noise.

Secondly, a scalable SPE-based entanglement-generation protocol, which resorts to a single optical transition of an emitter and an unbalanced polarising interferometer, is presented.

The basic unit of this iterative scheme is experimentally demonstrated, using a nitrogen-vacancy (NV) centre as the single-photon emitter, by producing an entangled state between a spin of the NV centre and the polarisation of an emitted photon.

Defense committee:

Armando Rastelli, Johannes Kepler Universität Linz, A (reviewer)

Ben Lanyon, University of Innsbruck, A (reviewer)

Philip Walther (supervisor)

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