Curriculum Vitae
Rainer Kaltenbaek

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Personal Information

Citizenship:	Austrian
Date of birth:	31.08.1979
Researcher unique identifier:	orcid.org/0000-0002-9991-9919

Higher Education

2004 – 2008 **PhD, Physics**, University of Vienna, Austria
Defense on July 16th, 2008 – passed with honors
Group of Prof. A. Zeilinger
Entanglement Swapping and Quantum Interference with Independent Sources

2002 – 2003 **MSc, Physics**, University of Vienna, Austria – passed with honors
Final exam on December 1st, 2003 – passed with honors
Group of Prof. A. Zeilinger
Active optical switching in long-distance quantum-state teleportation

1998 – 2002 **Undergraduate student**, physics, University of Vienna

Secondary Education

1989 – 1997 scientifically oriented academic high school, BRG Waidhofen/Thaya, Austria
School leaving examination on May 27th, 1997 – passed with honors

Employment history

2016 – … **Principal Investigator** of ULE-Cavity-Access, University of Vienna, Austria

2010 – … **Senior postdoctoral researcher**, Aspelmeyer group, University of Vienna, Austria

2013 – 2015 **Principal Investigator** of MAQROsteps, University of Vienna, Austria

2007 – 2010 **Postdoctoral researcher**, Resch group, Institute for Quantum Computing, University of Waterloo, Ontario, Canada

2006 – 2007 **Server administration and web development**, FairIT, Vienna

2002 – 2006 **Scientific employee (MSc & PhD) & computer administration**, Zeilinger group, Faculty of Physics, University of Vienna

Teaching Experience

2016 “Quantum information, entanglement and geometry”, seminar with R. Bertlmann, M. Aspelmeyer, F. Verstraete & A. Zeilinger

2011 – 2013 “Quantum Physics and Quantum Information I & II”, lecture together with M. Aspelmeyer, Faculty of Physics, University of Vienna, Austria

2010 USEQIP, Undergraduate School on Experimental Quantum Information Processing, Institute for Quantum Computing, University of Waterloo, Ontario, Canada

2005 – … Co-Supervision of 1 post doc, 6 PhD students, 12 MSc students, 4 coop students

2009 “Lectures on Experimental Quantum Cryptography”, Institute for Quantum Computing, University of Waterloo, Ontario, Canada

2003 Lab course quantum optics, Faculty of Physics, University of Vienna, Austria

Publication record overview

29 peer-reviewed publications, 5 conference proceedings, 1 book chapter and 3 extensive technical reports for ESA-funded projects, 2 papers in preparation, h-Index: 17, 1270 citations[1].

Selected invited talks

- *Towards testing quantum physics in deep space*
  ECT workshop 'Testing the limits of the quantum superposition principle in nuclear, atomic and optomechanical systems', Trento, Italy *(2016)*
- *Using quantum optomechanics for testing the quantum/classical border in space*
  Workshop on Macroscopic Quantum Coherence, St. Andrews, UK (2015)
- *Emergent quantum technology for testing the foundations of physics in space*
  Nordita's Science Writers Workshop on Quantum Theory, Stockholm, Sweden (2014)
- *MAQRO – macrorealism or quantum physics? A case for space*
  Is quantum theory exact? – Laboratori Nazionali di Frascati, Italy (2014)
- *Testing quantum physics in space using optically trapped nanospheres*
  Optical Trapping and Optical Micromanipulation, SPIE, San Diego (2013)
- *Space-based tests of quantum physics using massive mechanical resonators*
  TU Dresden, Institute for Aerospace Engineering, Dresden, Germany (2012)
- *Decoherence of optically trapped nanospheres in a double-slit experiment*
  International Conference on Quantum Information, Ottawa, Canada (2011)

Memberships in Scientific Societies

American Physical Society, Optical Society of America, German Physical Society (DPG)

Referee for

PRL, PRA, Nature Comm., Opt. Exp., NJP, Sci. Rep., EPL, Found. Phys., J. Mod. Opt., Plan. Space Sci., Opt. Las. Engin., JOSA, Entropy

Editor for

EPJ Quantum Technology – Lead guest editor for Thematic Series 'Space Applications of Quantum Technology'

[1] ISI web of knowledge, 13.10.2016; orcid.org/0000-0002-9991-9919

Research achievements

Since 2010, I have been working on quantum optomechanics using optically trapped particles on ground and in possible future quantum optomechanical experiments in space. I initiated and have led a growing international consortium of by now 32 research groups from 9 countries with the goal of realizing a medium-sized space mission (MAQRO). The MAQRO proposal was submitted to the 2010 and 2015 Cosmic Vision calls of the European Space Agency (ESA). In 2016, we submitted MAQRO as a "New Scientific Idea" for a fundamental-science mission to ESA. The mission's goal is to act as pathfinder for quantum technology in space and to test the foundations of quantum physics. In 2016, the COST Action QTSpace (CA 15220) started, which I co-proposed and participate in as a member of the Management Committee. In the course of my work, I initiated and scientifically led two ESA-funded studies (contract Nr. Po P5401000400 and AO/1-6889/11/NL/CBi), and I have been the PI of projects funded by the Austrian Research Promotion Agency (FFG Projects Nrs. 840089 and 854036). These projects have aimed at in-depth studies of the MAQRO mission concept and related technology development. I was awarded a Marie Curie fellowship from the European Commission and an APART fellowship from the Austrian Academy of Science. In addition to these efforts, I actively participated in research in the Aspelmeyer group leading to the first demonstration of cavity cooling of optically trapped particles (69 citations[2]) and a proposal for ground-based tests of quantum physics using high-mass matter-wave interferometry (140 citations[2]).

Until 2010, i.e., during my studies and my first post-doctoral fellowship, my scientific background was quantum and classical optics, optical imaging using ultra-fast laser physics and non-linear optics. During my master thesis (Zeilinger group, Vienna, Austria), I engaged in quantum communication using entangled photon pairs, e.g., long-distance quantum teleportation (137 citations[2]) and free-space distribution of entanglement (122 citations[2]) across the Danube. My PhD thesis was on the demonstration of quantum interference with independent photons (100 citations[2]) and entanglement swapping with independent sources (39 citations[2]), and I contributed to experimental one-way quantum computing (180 citations[2]) and tests of non-local hidden-variable models (156 citations[2]). As a post-doctoral researcher in the Resch group (Waterloo, Canada), I worked on quantum optics, non-linear optical imaging, quantum computing, quantum simulation, generalized measurements, bound entanglement and Bell-type experiments (a total of 14 peer-reviewed publications, 267 citations[2]). For example, we developed a novel dispersion-cancelled, non-linear optical interferometry technique (49 citations[2] and a cover on Nature Physics), and we demonstrated multi-qubit bound entanglement (34 citations[2]).

[2] ISI web of knowledge, 13.10.2016; orcid.org/0000-0002-9991-9919