

Curriculum Vitae

Gerhard Kirchmair

Date of birth: 01 August 1981
Place of birth: Hall in Tirol
Citizenship: Austria
Address: Technikerstraße 21a, A-6020 Innsbruck
Phone: +43 512 507 4736
E-mail: gerhard.kirchmair@uibk.ac.at
www: <http://iqoqi.at/de/kirchmair-gruppe>



EDUCATION

03/2013- University Professor for Experimental Physics, University of Innsbruck & Institute for Quantum Optics and Quantum Information, Austrian Academy of Science
10/2010-02/2013 Postdoctoral Associate, Yale University
Group of Prof. Robert Schoelkopf
07/2010-09/2010 Scientific Researcher, Institute for Quantum Optics and Quantum Information
Group of Prof. Rainer Blatt
12/2006-06/2010 PhD, Physics, University of Innsbruck & Institute for Quantum Optics and Quantum Information
Thesis title: "Quantum non-demolition measurements and quantum simulation"
Thesis advisor: Prof. Rainer Blatt
10/2001-12/2006 Diploma, Physics, University of Innsbruck
Thesis title: "Frequency stabilization of a Titanium-Sapphire laser for precision spectroscopy on Calcium ions"
Thesis advisor: Prof. Rainer Blatt
09/1995-05/2000 HTL for electronics (high school), Innsbruck, Austria

EMPLOYMENT HISTORY

03/2013- Univ. Prof. University of Innsbruck, Austria
10/2010-03/2013 Postdoctoral Associate, Yale University, New Haven, USA
07/2010-09/2010 Postdoctoral Research Assistant, University of Innsbruck, Austria
07/2008-07/2010 Graduate Student Research Assistant, University of Innsbruck, Austria
12/2006-06/2008 Graduate Student Research Assistant, Institute for Quantum Optics and Quantum Information, Innsbruck Austria

TEACHING

02/2014- ongoing	Bachelor Seminar Experimental Physics
02/2014- ongoing	Advanced Lab course for Experimental Physics
10/2013- ongoing	Electronics Labcourse
10/2013- ongoing	Mathematics Introductory Course for Physicist, Lecture and Proseminar
03/2013- ongoing	Quantum Optics Seminar
06/2010-08/2010	Supervising undergraduate students during a summer internship
10/2007-02/2008	Undergraduate lab course supervisor "Physics II"
03/2007-07/2007	Undergraduate lab course supervisor "Physics I"
01/2003-02/2004	Physics tutor, introductory course on mechanics and thermodynamics

PHD STUDENT SUPERVISION

10/2015	Supervision of the PhD thesis of Christian Schneider . University of Innsbruck & Institute for Quantum Optics and Quantum Information of the Austrian Academy of Sciences, Innsbruck, Austria.
12/2013 -	Supervision of the PhD thesis of Oscar Garguilo . University of Innsbruck & Institute for Quantum Optics and Quantum Information of the Austrian Academy of Sciences, Innsbruck, Austria.
06/2013 -	Supervision of the PhD thesis of Phani Rahja Mupalla . University of Innsbruck & Institute for Quantum Optics and Quantum Information of the Austrian Academy of Sciences, Innsbruck, Austria.
01/2011 – 02/2013	Co-supervision with Robert Schoelkopf of the PhD thesis of Brian Vlastakis . Yale University.
01/2011 – 02/2013	Co-supervision with Robert Schoelkopf of the PhD thesis of Adam Sears . Yale University.

ADDITIONAL UNIVERSITY ACTIVITIES

09/2005-12/2006	Member of the committee to design a new curriculum for the Bachelor and Master studies in Physics, University of Innsbruck,
-----------------	---

SCHOLARSHIPS & AWARDS

- Promotion sub auspiciis Praesidentis rei publicae, 2011
- Award of the city of Innsbruck for scientific research, 2010
- Honorary award for excellent academic studies of the Minster for Science and Research, 2010
- University of Innsbruck merit grant in acknowledgment of excellent academic studies, 2002 – 2004

PEER REVIEW ACTIVITIES

- *Referee for APS Journals*
- *Referee for Natur Publishing Group Journals*

TALKS & PRESENTATIONS

- *Analog Quantum Simulation with Superconducting Qubits*
Quantum Optics conference Obergurgl, Austria, 2016
- *Quantum Simulation with Superconducting Qubits and Josephson Junction array resonators*
Seminar Talk Ustinov Group, Karlsruhe, Germany, 2015
- *Quantum Optics and Quantum Simulation with Superconducting Qubits*
CENS Seminar, Munic, Germany, 2015
- *Simulation of Dipolar Quantum Magnetism with Arrays of Superconducting Qubits*
Quantum Simulation Conference Benasque, Spain, 2015
- *Single photon Kerr effect and deterministic Schrödinger-cat creation in circuit QED*
Condensed Matter Conference, Paris University, 2014
- *Quantum optics with circuit QED & SC circuits in Innsbruck*
University of Hamburg, Germany, 2014
- *Quantum information Processing with SC qubits*
University of Innsbruck, Summer School 2014
- *Quantum optics with circuit QED & SC circuits in Innsbruck*
IQOQI Vienna, Austria, 2014
- *Analog Quantum Simulation and Hybrid Systems with Superconducting Qubits*
Kazan University, Russia, 2014
- *Single photon Kerr effect*
APS March meeting, USA, 2014
- *Analogue Quantum Simulation with 3D qubits*
Saarbrücken, Germany, 2014
- *Single photon Kerr effect and deterministic Schrödinger cat creation in circuit QED*
Saarbrücken, Germany, 2014
- *Single photon Kerr effect and deterministic Schrödinger cat creation in circuit QED*
Atom Institute Vienna, Austria, 2013
- *Single photon Kerr effect*
ccQED meeting Munic, Germany, 2013
- *Single photon Kerr effect and deterministic Schrödinger cat creation in circuit QED*
SFB FoQuS meeting Vienna, Austria, 2013
- *Single photon Kerr effect and deterministic Schrödinger cat creation in circuit QED*
Bilbao, Spain 2013
- *Observation of the Single photon Kerr effect and deterministic Schrödinger cat creation*
ETH Zurich, Switzerland, 2013
- *3D circuit QED*
IQOQI, Innsbruck, 2012
- *Experiments on a three mode cavity QED system: nothing is harmonic*
APS March Meeting, Boston, USA, 2012
- *Quantum non-demolition measurements and quantum simulation*
Yale University, JILA, Caltech, UCSB USA, 2010
- *State-independent experimental test of quantum contextuality with trapped ions*
DPG spring meeting Hannover, Germany, 2010
- *State-independent experimental test of quantum contextuality with trapped ions*
SFB FoQuS meeting Vienna, Austria, 2010
- *High fidelity entanglement of $^{43}\text{Ca}^+$ hyperfine clock states*
DPG spring meeting Hamburg, Germany, 2009
- *Experimental techniques for quantum information processing with trapped $^{43}\text{Ca}^+$ ions*
DPG spring meeting Darmstadt, Germany, 2008

- *Coherent manipulation of trapped ions*
Greenhorn meeting Freiburg, Germany, 2007

POSTERS

- *Observation of quantum state collapse and revival due to the single photon Kerr effect*
Gordon Research Conference, Stonehill College, USA, 2012
- *Quantum Simulation of the Klein Paradox with Trapped Ions*
ICAP Summer School, Cape Tribulation, Australia, 2010
- *State-independent experimental test of quantum contextuality with trapped ions*
Scala Summer School, Cargese, France 2009
- *High fidelity quantum gates with trapped $^{43}\text{Ca}^+$ ions*
Modern application of trapped ions, Les Houches, France 2008

FUNDING PROPOSALS

Name	Topic	Budget	Agency	Year
QNZT	Infrastructure for Micro and Nanofabrication	3.9 M€	BMWF	2013
ACQME	Microwave equipment for advanced qubit control	400 k€	ÖAW	2014
DK ALM	Doctoral college Atoms, Light and Molecules	3.2 M€	FWF	2015

PUBLICATION LIST

25 Peer reviewed articles

Web of science: >1400 citations, h-index 18

Google scholar: >3000 citations, h-index 21

(8 PRL, 4 Nature, 2 Science, 1 Nature Physics, 5 PRA, 2 PRB, 1 NJP, 1 EPJ D, 1 Sci. Rep)

1. Coherent control using superconducting qubits

N. Friis, A. Melnikov, **G. Kirchmair**, H. J. Briegel

Scientific Reports **5**, 18036, (2015), doi:10.1038/srep18036

2. Single-photon Resolved Cross-Kerr Interaction for Autonomous Stabilization of Photon-number States

E. T. Holland, B. Vlastakis, R. W. Heeres, M. J. Reagor, U. Vool, Z. Leghtas, L. Frunzio,

G. Kirchmair, M. H. Devoret, M. Mirrahimi, R. Schoelkopf

Phys. Rev. Lett. **115**, 180501 (2015), doi/10.1103/PhysRevLett.115.180501

3. Dipolar Spin Models with Arrays of Superconducting Qubits

M. Dalmonte, S. Mirzaei, P. R. Muppalla, D. Marcos, P. Zoller, **G. Kirchmair**

Phys. Rev. B **92**, 174507 (2015), doi: 10.1103/PhysRevB.92.174507

4. Strong Single-Photon Coupling in Superconducting Quantum Magnetomechanics

G. Via, **G. Kirchmair**, and O. Romero-Isart

Phys. Rev. Lett. **114**, 143602 (2015), doi: 10.1103/PhysRevLett.114.143602

5. **Tracking photon jumps with repeated quantum non-demolition parity measurement**
L. Sun, A. Petrenko, Z. Leghtas, B. Vlastakis, **G. Kirchmair**, K. M. Sliwa, A. Narla, M. Hatridge, S. Shankar, J. Blumoff, L. Frunzio, M. Mirrahimi, M. H. Devoret & R. J. Schoelkopf
Nature 511, 444 (2014), doi:10.1038/nature13436
6. **Deterministically encoding quantum information in 100-photon Schrödinger cat states**
B. Vlastakis, **G. Kirchmair**, Z. Leghtas, S. E. Nigg, L. Frunzio, S. M. Girvin, M. Mirrahimi, M. H. Devoret & R. J. Schoelkopf
Science 342, 607 (2013), doi: 10.1126/science.1243289
7. **Hardware-efficient autonomous quantum memory protection**
Z. Leghtas, **G. Kirchmair**, B. Vlastakis, R. J. Schoelkopf, M. H. Devoret & M. Mirrahimi
Phys. Rev. Lett. 111, 120501 (2013), doi:10.1103/PhysRevLett.111.120501
8. **Deterministic protocol for mapping a qubit to coherent state superpositions in a cavity**
Z. Leghtas, **G. Kirchmair**, B. Vlastakis, M. Devoret, R. J. Schoelkopf, M. Mirrahimi
Phys. Rev. A 87, 042315 (2013), doi/10.1103/PhysRevA.87.042315
9. **Observation of quantum state collapse and revival due to the single-photon Kerr effect**
G. Kirchmair, B. Vlastakis, Z. Leghtas, S. E. Nigg, H. Paik, E. Ginossar, M. Mirrahimi, L. Frunzio, S. M. Girvin & R. J. Schoelkopf
Nature, 495, 205 (2013), doi:10.1038/nature11902
10. **Photon shot noise dephasing in the strong-dispersive limit of circuit QED**
A. P. Sears, A. Petrenko, G. Catelani, L. Sun, H. Paik, **G. Kirchmair**, L. Frunzio, L. I. Glazman, S. M. Girvin, R. J. Schoelkopf
Phys. Rev. B 86, 180504 (2012), doi:10.1103/PhysRevB.86.180504
11. **Black-Box superconducting circuit quantization**
S. E. Nigg, H. Paik, B. Vlastakis, **G. Kirchmair**, S. Shankar, L. Frunzio, M. Devoret, R. Schoelkopf, S. Girvin
Phys. Rev. Lett. 108, 240502 (2012), doi/10.1103/PhysRevLett.108.240502
12. **Observation of High Coherence in Josephson Junction Qubits Measured in a Three-Dimensional Circuit QED Architecture**
H. Paik, D.I. Schuster, L. S. Bishop, **G. Kirchmair**, G. Catelani, A. P. Sears, B. R. Johnson, M. J. Reagor, L. Frunzio, L. Glazman, R. J. Schoelkopf
Phys. Rev. Lett. 107, 240501 (2011), doi:10.1103/PhysRevLett.107.240501
13. **Universal digital quantum simulation with trapped ions**
B. P. Lanyon, C. Hempel, D. Nigg, M. Müller, R. Gerritsma, F. Zähringer, P. Schindler, J. T. Barreiro, M. Rambach, **G. Kirchmair**, M. Hennrich, P. Zoller, R. Blatt and C. F. Roos
Science 334, 57 (2011), doi:10.1126/science.1208001
14. **Quantum Simulation of the Klein Paradox with Trapped Ions**
R. Gerritsma, B. P. Lanyon, **G. Kirchmair**, F. Zähringer, C. Hempel, J. Casanova, J. J. García-Ripoll, E. Solano, R. Blatt, and C. F. Roos
Phys. Rev. Lett. 106, 060503 (2011), doi:10.1103/PhysRevLett.106.060503

- 15. Compatibility and noncontextuality for sequential measurements.**
O. Gühne, M. Kleinmann, A. Cabello, J.-A. Larsson, **G. Kirchmair**, F. Zähringer, R. Gerritsma, C.F. Roos
Phys. Rev. A 81, 022121 (2010), doi:10.1103/PhysRevA.81.022121
- 16. Realization of a quantum walk with one and two trapped ions.**
F. Zähringer, **G.Kirchmair**, R. Gerritsma, E.Solano, R.Blatt & C.F.Roos
Phys. Rev. Lett. 104 100503 (2010), doi:10.1103/PhysRevLett.104.100503
- 17. Quantum simulation of the Dirac equation.**
R. Gerritsma, **G.Kirchmair**, F. Zähringer, E.Solano, R.Blatt & C.F.Roos
Nature 463, 68 (2010), doi:10.1038/nature08688
- 18. State-independent experimental test of quantum contextuality.**
G. Kirchmair, F. Zähringer, R. Gerritsma, M. Kleinmann, O.Gühne, A.Cabello, R.Blatt & C.F.Roos
Nature 460, 494 (2009), doi:10.1038/nature08172
- 19. High-Fidelity entanglement of $^{43}\text{Ca}^+$ hyperfine clock states.**
G.Kirchmair, J.Benhelm, F.Zähringer, R.Gerritsma, C.F.Roos & R.Blatt
Phys. Rev. A, 79, 020304 (2009), doi/10.1103/PhysRevA.79.020304
- 20. Absolute Frequency Measurement of the $^{40}\text{Ca}^+$ $4s^2S_{1/2} - 3d^2D_{5/2}$ Clock Transition.**
M. Chwalla, J. Benhelm, K. Kim, **G. Kirchmair**, T. Monz, M. Riebe, P. Schindler, A. S. Villar, W. Hänsel, C. F. Roos, R. Blatt, M. Abgrall, G. Santarelli, G. D. Rovera & Ph. Laurent
Phys. Rev. Lett. 102, 023002 (2009), doi/10.1103/PhysRevLett.102.023002
- 21. Deterministic entanglement of ions in thermal states of motion.**
G.Kirchmair, J.Benhelm, F.Zähringer, R.Gerritsma, C.F.Roos & R. Blatt
New J. Phys., 11, 023002 (2009), doi:10.1088/1367-2630/11/2/023002
- 22. Experimental quantum-information processing with $^{43}\text{Ca}^+$ ions.**
J.Benhelm, **G.Kirchmair**, C.F.Roos & R.Blatt
Phys. Rev. A 77, 062306 (2008), doi:10.1103/PhysRevA.77.062306
- 23. Precision measurement of the branching fractions of the $^4P_{3/2}$ decay of Ca II.**
R. Gerritsma, **G. Kirchmair**, F. Zähringer, J. Benhelm, R. Blatt, C. F. Roos
Eur. Phys. J. D 50,13 (2008), doi:10.1140/epjd/e2008-00196-9
- 24. Towards fault-tolerant quantum computing with trapped ions.**
J.Benhelm, **G.Kirchmair**, C.F.Roos & R.Blatt
Nature Physics 4, 463 (2008), doi:10.1038/nphys961
- 25. Measurement of the hyperfine structure of the $S_{1/2} - D_{5/2}$ transition in $^{43}\text{Ca}^+$.**
J.Benhelm, **G.Kirchmair**, U. Rapol, T.Körber, C.F.Roos & R.Blatt,
Phys. Rev. A, 75, 032506 (2007), doi:10.1103/PhysRevA.75.032506

News & Views relating to articles

- [NV5] "Storing Quantum Information in Schrödinger's Cats"
Peter Leek
Science 342, 568 (2013), doi: 10.1126/science.1245510
- [NV4] "Superconducting Qubits Are Getting Serious"
Matthias Steffen
Physics 4, 103 (2011), doi: 10.1103/Physics.4.103
- [NV3] "Toward Control of Large-Scale Quantum Computing"
David P. DiVincenzo
Science 334, 50 (2011) doi: 10.1126/science.1211284
- [NV2] "Quantum physics: Trapped ion set to quiver"
Christoph Wunderlich
Nature 463, 37 (2010), doi:10.1038/463037a
- [NV1] "Quantum mechanics: Hidden context"
Boris Blinov
Nature 460, 464 (2009), doi:10.1038/460464a

Thesis

- [T2] **G. Kirchmair**, PhD Thesis (2010) "Quantum non-demolition measurements and quantum simulation" (2010)
<http://www.quantumoptics.at/>
- [T1] **G. Kirchmair**, Diploma Thesis (2006) "Frequency stabilization of a Titanium-Sapphire laser for precision spectroscopy on Calcium ions"
<http://www.quantumoptics.at/>

Popular Scientific Articles

- [P2] Neue Methode zu Codierung von Quanteninformation
M. Schwarzenberg
Naturwissenschaftliche Rundschau 6/2014 (792)
- [P1] Schrödinger Katzen mit 111 Photonen
G. Kirchmair
Physik in unserer Zeit, 2/2014 (45)