Simon Gröblacher

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Delft University of Technology
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Research positions

11/2014– Assistant Professor, **Delft University of Technology**, Delft, The Netherlands
Quantum optomechanics with photonic crystal cavities.

04/2011–08/2014 Post-Doctoral Fellow, **California Institute of Technology**, Pasadena, CA, USA
Optomechanics, silicon nanophotonics. Advisor: Prof. Oskar Painter

09/2013–08/2014 Post-Doctoral Fellow, **University of Vienna**, Vienna, Austria
01/2011–03/2011 Optomechanics, macroscopic quantum states, quantum optics. Advisor: Prof. Markus Aspelmeyer

02/2006–01/2011 Research & Teaching Assistant, **Austrian Academy of Sciences / University of Vienna**, Vienna, Austria
Optomechanics, macroscopic quantum states, quantum optics. Advisors: Prof. Markus Aspelmeyer & Prof. Anton Zeilinger

10/2004–12/2005 Scientific Assistant, **University of Vienna**, Vienna, Austria
Quantum information processing in higher dimensions, entangled photons, orbital angular momentum. Advisor: Prof. Anton Zeilinger

01/2004–09/2004 Research Assistant, **Universidade Federal do Rio de Janeiro**, Rio de Janeiro, RJ, Brazil
Research stay in the quantum optics group of Prof. Paulo H. S. Ribeiro

Education

2006–2011 **Ph.D., Physics**, *University of Vienna*, Vienna, Austria, *with distinction*.
2001–2005 **Masters, Physics**, *University of Vienna*, Vienna, Austria, *with distinction*.
06/1999 **Austrian Matura**, *Bundesrealgymnasium Ringstraße*, Krems, Austria, *with distinction*.
07/1997–06/1998 **Exchange year**, *American Field Service (AFS)*, Colégio Sagrado Coração de Jesus, Ijuí, RS, Brazil.
1991–1999 **Secondary school**, *Bundesrealgymnasium Ringstraße*, Krems, Austria.

PhD thesis

Title *Quantum opto-mechanics with micromirrors: combining nano-mechanics with quantum optics*
Supervisors Prof. Markus Aspelmeyer & Prof. Anton Zeilinger
University of Vienna (2010)

Diploma thesis

Title *Experimental Investigation of Quantum Communication Protocols in Higher Dimensions*
Supervisors Prof. Anton Zeilinger
University of Vienna (2005)

Funding

01/2017–12/2020 **Projectruimte**, Foundation for Fundamental Research on Matter (FOM), 600k€.
11/2016–10/2021 **Vidi Grant**, Netherlands Organisation for Scientific Research (NWO), 800k€.
03/2016–02/2021 **Starting Grant**, European Research Council (ERC), 1500k€.
07/2015–06/2019 **Projectruimte**, Foundation for Fundamental Research on Matter (FOM), 400k€.
05/2015–04/2019 **Frontiers of Nanoscience; jointly with Milan Allan**, TU Delft / Leiden University, 240k€.
11/2014–10/2019 **Startup Grant**, Delft University of Technology, 1050k€.

Fellowships

09/2011–08/2014 **Marie Curie International Outgoing Fellowship**, European Commission.
07/2011–06/2012 **Fellowship of the Institute for Quantum Information and Matter**, California Institute of Technology.
01/2008–12/2009 **DOC fellowship**, Austrian Academy of Sciences.
10/2007–01/2011 **Doctoral programme Complex Quantum Systems (CoQuS)**, Austrian Science Fund (FWF).
01/2004–09/2004 **Top-Stipendium Exchange Scholarship**, State of Lower Austria.

Awards

10/2014 **ASciNA award**, *for excellent scientific work*, Austrian Scientists & Scholars in North America.

12/2012 **Loschmidt Prize**, *for distinguished theses*, Austrian Chemical-Physical Scoiety.

03/2012 **Doc.Award 2011**, *for outstanding doctoral theses*, University of Vienna & City of Vienna.

12/2011 **Award of Excellence**, *for excellent and outstanding dissertations*, Austrian Ministry for Science and Research.

11/2011 **Scientific Achievement Award**, *for excellence in research*, State of Lower Austria.

05/2011 **PhD Thesis Prize**, *in recognition of the highest level of excellence*, European Physical Society.

11/2010 **ESG-Nano-Award 2010**, *for scientific activities in the field of nanosciences and nanotechnologies*, Erwin Schrödinger Society for Nanosciences (ESG).

03/2010 **Bank Austria Research Award 2010**, *for particularly interesting and promising research projects*, Bank Austria Foundation for Science and Research at the University of Vienna.

10/2006 **INiTS Award 2006**, *for innovative applied research*, Founder Service of the Austrian Universities (INiTS).

06/2003 **Top-Stipendium Scholarship**, State of Lower Austria.

Teaching

since 2015/2016 **Undergraduate introductory course on quantum mechanics**.

since 2014/2015 **Undergraduate lab course on optomechanics**.

Additional science related work experience

Research • 08/2003–09/2003. *Investigation of the efficiency of the Skim-Programs at BELLE*, for the Institute of High Energy Physics of the Austrian Academy of Sciences at the BELLE-Experiment, KEK, Tsukuba, Japan

Outreach • 12/2007–03/2008. Series of popular scientific presentations for senior high-school students for the state of Lower Austria.
• Initiated, fund-raised and co-organized the *'First European Young Scientists Conference on Quantum Information'* in Vienna, Austria, August 27–31, 2007, with more than 100 international participants.

Teaching • May 21–June 08, 2012. Lecture on *Strongly coupled optomechanics*, Singapore School of Physics, Singapore.
• 09/2007–02/2008. Tutor for advanced lab course "Quantenoptik Praktikum", University of Vienna.

Peer review • Referee for Nature, Science, Nature Phys., Phys. Rev. Lett., Phys. Rev. X, amongst others.

Miscellaneous experience

02/2006–10/2006 **Civilian service**, *system administrator*, environmental organisation Global 2000.

04/2005–03/2011 **System administrator**, University of Vienna & Austrian Academy of Sciences.

10/2004–12/2005 **Photographer**, Vienna Online.

02/2001–09/2001 **European Voluntary Service**, *Project: "Märjamaa Cultural House", Raplamaa, Estonia*, European Commission.

07/1998–07/2002 **Volunteer**, *recruitment and screening of candidates and host families, organization of orientations and group gatherings, liaison with host schools and organization of social activities*, American Field Service (AFS).

Languages

German native speaker

Portuguese fluent, written and spoken

English fluent, written and spoken

Spanish good knowledge, written and spoken

French average knowledge, written and spoken

Publications and Presentations

Publications 24 publications in peer-reviewed journals – 4 senior-authored (1 Science, 1 Nature, 1 Phys. Rev. Lett., 1 Opt. Express), 10 first-authored (3 Nature, 1 Nature Phys., 1 Nature Commun., 1 New J. Phys., 1 Appl. Phys. Lett., 1 Europhys. Lett., 2 Phys. Rev. A), 10 co-authored (2 Nature, 2 Phys. Rev. Lett., 2 New J. Phys., 2 Appl. Phys. Lett., 1 Opt. Express, 1 J. Opt. Soc. Am. B); Total citations: 4500; h-index: 20 (as of October, 2017, Google Scholar).

Presentations 40+ invited talks at conferences or seminars at international venues.

Peer-reviewed journals

* indicates equal contribution

1. S. Hong*, R. Riedinger*, I. Marinković*, A. Wallucks*, S. G. Hofer, R. A. Norte, M. Aspelmeyer, and S. Gröblacher
Hanbury Brown and Twiss interferometry of single phonons from an optomechanical resonator
Science **358**, 203–206 (2017).
2. J. Guo, R. A. Norte, and S. Gröblacher
Integrated optical force sensors using focusing photonic crystal arrays
Opt. Express **25**, 9196–9203 (2017).
3. R. A. Norte, J. P. Moura, and S. Gröblacher
Mechanical Resonators for Quantum Optomechanics Experiments at Room Temperature
Phys. Rev. Lett. **116**, 147202 (2016).
4. R. Riedinger*, S. Hong*, R. A. Norte, J. A. Slater, J. Shang, A. G. Krause, V. Anant, M. Aspelmeyer, and S. Gröblacher
Non-classical correlations between single photons and phonons from a mechanical oscillator
Nature **530**, 313–316 (2016).
5. S. Gröblacher, A. Trubarov, N. Prigge, G. D. Cole, M. Aspelmeyer, and J. Eisert
Observation of non-Markovian micromechanical Brownian motion
Nature Commun. **6**, 7606 (2015).
6. J. D. Cohen*, S. M. Meenehan*, G. S. MacCabe, S. Gröblacher, A. H. Safavi-Naeini, F. Marsili, M. D. Shaw, and O. Painter
Phonon counting and intensity interferometry of a nanomechanical resonator
Nature **520**, 522–525 (2015).
7. S. M. Meenehan*, J. D. Cohen*, S. Gröblacher*, J. T. Hill, A. H. Safavi-Naeini, M. Aspelmeyer, and O. Painter
Silicon optomechanical crystal resonator at millikelvin temperatures
Phys. Rev. A **90**, 011803(R) (2014).
8. A. H. Safavi-Naeini, J. T. Hill, S. Meenehan, J. Chan, S. Gröblacher, and O. Painter
Two-dimensional phononic-photonic band gap optomechanical crystal cavity
Phys. Rev. Lett. **112**, 153603 (2014).
9. S. Gröblacher*, J. T. Hill*, A. H. Safavi-Naeini*, J. Chan, and O. Painter
Highly efficient coupling from an optical fiber to a nanoscale silicon optomechanical cavity
Appl. Phys. Lett. **103**, 181104 (2013).
10. S. Gröblacher, S. Gigan, and M. Paternostro
Phase-space behavior and conditional dynamics of an optomechanical system
Phys. Rev. A **88**, 023813 (2013).
11. A. H. Safavi-Naeini*, S. Gröblacher*, J. T. Hill*, J. Chan, M. Aspelmeyer, and O. Painter
Squeezed light from a silicon micromechanical resonator
Nature **500**, 185–189 (2013).
12. J. Li, S. Gröblacher, and M. Paternostro
Enhancing non-classicality in mechanical systems
New J. Phys. **15**, 033023 (2013).
13. S. Ramelow, A. Mech, M. Giustina, S. Gröblacher, W. Wieczorek, J. Beyer, A. Lita, B. Calkins, T. Gerrits, S. W. Nam, A. Zeilinger, and R. Ursin
Highly efficient heralding of entangled single photons
Opt. Express **21**, 6707–6717 (2013).
14. A. H. Safavi-Naeini, J. Chan, J. T. Hill, S. Gröblacher, H. Miao, Y. Chen, M. Aspelmeyer, and O. Painter
Laser noise in cavity-optomechanical cooling and thermometry
New J. Phys. **15**, 035007 (2013).
15. J. Chan, T. P. Mayer Alegre, A. H. Safavi-Naeini, J. T. Hill, A. Krause, S. Gröblacher, M. Aspelmeyer, and O. Painter
Laser cooling of a nanomechanical oscillator into its quantum ground state
Nature **478**, 89–92 (2011).
16. M. Aspelmeyer, S. Gröblacher, K. Hammerer, and N. Kiesel
Quantum optomechanics – throwing a glance
J. Opt. Soc. Am. B **27**, A189–A197 (2010).
17. S. Gröblacher, K. Hammerer, M. R. Vanner, and M. Aspelmeyer
Observation of strong coupling between a micromechanical resonator and an optical cavity field
Nature **460**, 724–727 (2009).
18. S. Gröblacher, J. B. Hertzberg, M. R. Vanner, G. D. Cole, S. Gigan, K. C. Schwab, and M. Aspelmeyer
Demonstration of an ultracold micro-optomechanical oscillator in a cryogenic cavity
Nature Phys. **5**, 485–488 (2009).

19. G. D. Cole, S. Gröblacher, K. Gugler, S. Gigan, and M. Aspelmeyer
Monocrystalline $Al_xGa_{1-x}As$ heterostructures for high-reflectivity high-Q micromechanical resonators in the megahertz regime
Appl. Phys. Lett. **92**, 261108 (2008).

20. S. Gröblacher, S. Gigan, H. R. Böhm, A. Zeilinger, and M. Aspelmeyer
Radiation-pressure self-cooling of a micromirror in a cryogenic environment
Europhys. Lett. **81**, 54003 (2008).

21. T. Paterek, A. Fedrizzi, S. Gröblacher, T. Jennewein, M. Żukowski, M. Aspelmeyer, A. Zeilinger
Experimental Test of Nonlocal Realistic Theories Without the Rotational Symmetry Assumption
Phys. Rev. Lett. **99**, 210406 (2007).

22. M. Stütz, S. Gröblacher, T. Jennewein, and A. Zeilinger
How to create and detect N-dimensional entangled photons with an active phase hologram
Appl. Phys. Lett. **90**, 261114 (2007).

23. S. Gröblacher, T. Paterek, R. Kaltenbaek, Č. Brukner, M. Żukowski, M. Aspelmeyer, and A. Zeilinger
An experimental test of non-local realism
Nature **446**, 871–875 (2007).

24. S. Gröblacher, T. Jennewein, A. Vaziri, G. Weihs, and A. Zeilinger
Experimental Quantum Cryptography with Qutrits
New J. Phys. **8**, 75 (2006).

Electronic preprints

25. R. Riedinger*, A. Wallucks*, I. Marinković*, C. Löschnauer, M. Aspelmeyer, S. Hong, and S. Gröblacher
Remote quantum entanglement between two micromechanical oscillators
arXiv:1710.11147 (2017).

26. J. P. Moura*, R. A. Norte*, J. Guo, C. Schäfermeier, and S. Gröblacher
Centimeter-Scale Suspended Photonic Crystal Mirrors
arXiv:1707.08128 (2017).

Proceedings

27. G. D. Cole, I. Wilson-Rae, M. R. Vanner, S. Gröblacher, J. Pohl, M. Zorn, M. Weyers, A. Peters, and M. Aspelmeyer
Megahertz monocrystalline optomechanical resonators with minimal dissipation, 23rd IEEE International Conference on Microelectromechanical Systems (Hong Kong, China, January 24-28, 2010).

Popular science

28. N. Kiesel, W. Wieczorek, S. Gröblacher, and M. Aspelmeyer
Licht macht Druck
Phys. Unserer Zeit **42**, 276–284 (2011).

Dissertation

29. S. Gröblacher, *Quantum opto-mechanics with micromirrors: combining nano-mechanics with quantum optics*
University of Vienna (2010).

Master thesis

30. S. Gröblacher, *Experimental Investigation of Quantum Communication Protocols in Higher Dimensions*
University of Vienna (2005).

Books

31. Gröblacher, Simon. *Quantum opto-mechanics with micromirrors: combining nano-mechanics with quantum optics.*
Heidelberg: Springer, 2012.