

Simon Gröblacher

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Delft University of Technology
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Research positions

- 12/2017– Associate Professor, **Delft University of Technology**, Delft, The Netherlands
Quantum optomechanics with photonic crystal cavities.
- 11/2014–11/2017 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

- 11/2019–10/2021 **Quantum/Nano startimpulsprogramma**, Nationale Wetenschaps Agenda; jointly with Richard Norte.
- 08/2019–07/2024 **Vrij Programma**, Netherlands Organisation for Scientific Research (NWO).
- 05/2019–05/2020 **Attract Grant**, EU Research and Innovation Programme; jointly with Richard Norte.
- 01/2017–12/2020 **Projectruimte**, Foundation for Fundamental Research on Matter (FOM).
- 11/2016–10/2021 **Vidi Grant**, Netherlands Organisation for Scientific Research (NWO).
- 03/2016–02/2021 **Starting Grant**, European Research Council (ERC).
- 07/2015–06/2019 **Projectruimte**, Foundation for Fundamental Research on Matter (FOM).
- 05/2015–04/2019 **Frontiers of Nanoscience**, TU Delft / Leiden University; jointly with Milan Allan.
- 11/2014–10/2019 **Startup Grant**, Delft University of Technology.

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 Society.
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 2018/2019 **Graduate course on quantum optics.**
since 2015/2016 **Undergraduate introductory course on quantum mechanics.**
since 2014/2015 **Undergraduate lab course on optomechanics.**

Additional work experience

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

Languages

- German native speaker
English fluent, written and spoken
Portuguese fluent, written and spoken
Spanish good knowledge, written and spoken
French basic knowledge, written and spoken

Publications and Presentations

- Publications 36 publications in peer-reviewed journals – 14 senior-authored (1 Science, 2 Nature, 1 Nature Phys., 1 Nano Lett., 1 Optica, 5 Phys. Rev. Lett., 2 Opt. Express, 1 Nanotechnology), 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), 12 co-authored (2 Nature, 2 Phys. Rev. Lett., 2 New J. Phys., 1 Phys. Rev. A, 2 Appl. Phys. Lett., 1 Opt. Express, 1 Quantum, 1 J. Opt. Soc. Am. B);
Total citations: 6700; h-index: 23 (as of February 2020, Google Scholar).
Presentations 80+ invited talks at conferences or seminars at international venues.

Peer-reviewed journals

* indicates equal contribution

1. J. Guo, R.A. Norte, and S. Gröblacher
Feedback cooling of a room temperature mechanical oscillator close to its motional groundstate
Phys. Rev. Lett. **123**, 223602 (2019).
2. R. Stockill*, M. Forsch*, G. Beaudoin, K. Pantzas, I. Sagnes, R. Braive, and S. Gröblacher
Gallium phosphide as a piezoelectric platform for quantum optomechanics
Phys. Rev. Lett. **123**, 163602 (2019).
3. M. Forsch*, R. Stockill*, A. Wallucks, I. Marinković, C. Gärtner, R. A. Norte, F. van Otten, A. Fiore, K. Srinivasan, and S. Gröblacher
Microwave-to-optics conversion using a mechanical oscillator in its quantum ground state
Nature Phys. **16**, 69–74 (2020).
4. M. Leeuwenhoek, R. A. Norte, K. M. Bastiaans, D. Cho, I. Battisti, Y. M. Blanter, S. Gröblacher, and M. P. Allan
Nanofabricated tips for device-based scanning tunneling microscopy
Nanotechnology **30**, 335702 (2019).
5. L. Magrini, R. A. Norte, R. Riedinger, I. Marinković, D. Grass, U. DeliĆ, S. Gröblacher, S. Hong, and M. Aspelmeyer
Near-field coupling of a levitated nanoparticle to a photonic crystal cavity
Optica **5**, 1597–1602 (2018).
6. I. Marinković*, A. Wallucks*, R. Riedinger, S. Hong, M. Aspelmeyer, and S. Gröblacher
An optomechanical Bell test
Phys. Rev. Lett. **121**, 220404 (2018).
7. C. Gärtner*, J. P. Moura*, W. Haaxman, R. A. Norte, and S. Gröblacher
Integrated optomechanical arrays of two high reflectivity SiN membranes
Nano Lett. **18**, 7171–7175 (2018).
8. M. Sanz, W. Wieczorek, S. Gröblacher, and E. Solano
Electro-mechanical Casimir effect
Quantum **2**, 91 (2018).
9. R. A. Norte, M. Forsch, A. Wallucks, I. Marinković, and S. Gröblacher
Platform for measurements of the Casimir force between two superconductors
Phys. Rev. Lett. **121**, 030405 (2018).
10. J. Li, S. Gröblacher, S.-Y. Zhu, and G. S. Agarwal
Generation and detection of non-Gaussian phonon-added coherent states in optomechanical systems
Phys. Rev. A **98**, 011801(R) (2018).
11. R. Riedinger*, A. Wallucks*, I. Marinković*, C. Löschner, M. Aspelmeyer, S. Hong, and S. Gröblacher
Remote quantum entanglement between two micromechanical oscillators
Nature **556**, 473–477 (2018).
12. J. P. Moura*, R. A. Norte*, J. Guo, C. Schäfermeier, and S. Gröblacher
Centimeter-scale suspended photonic crystal mirrors
Opt. Express **26**, 1895–1909 (2018).
13. 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).
14. J. Guo, R. A. Norte, and S. Gröblacher
Integrated optical force sensors using focusing photonic crystal arrays
Opt. Express **25**, 9196–9203 (2017).
15. R. A. Norte, J. P. Moura, and S. Gröblacher
Mechanical resonators for quantum optomechanics experiments at room temperature
Phys. Rev. Lett. **116**, 147202 (2016).
16. 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).
17. 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).
18. 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).

19. 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).
20. A. H. Safavi-Naeini, J. T. Hill, S. Meenehan, J. Chan, S. Gröblacher, and O. Painter
Two-dimensional phononic-photon band gap optomechanical crystal cavity
Phys. Rev. Lett. **112**, 153603 (2014).
21. 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).
22. S. Gröblacher, S. Gigan, and M. Paternostro
Phase-space behavior and conditional dynamics of an optomechanical system
Phys. Rev. A **88**, 023813 (2013).
23. 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).
24. J. Li, S. Gröblacher, and M. Paternostro
Enhancing non-classicality in mechanical systems
New J. Phys. **15**, 033023 (2013).
25. 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).
26. 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).
27. 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).
28. M. Aspelmeyer, S. Gröblacher, K. Hammerer, and N. Kiesel
Quantum optomechanics – throwing a glance
J. Opt. Soc. Am. B **27**, A189–A197 (2010).
29. 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).
30. 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).
31. 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).
32. 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).
33. 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).
34. 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).
35. 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).
36. S. Gröblacher, T. Jennewein, A. Vaziri, G. Weihs, and A. Zeilinger
Experimental Quantum Cryptography with Qutrits
New J. Phys. **8**, 75 (2006).

Electronic preprints

37. J. Li and S. Gröblacher
Stationary quantum entanglement between a massive mechanical membrane and a low frequency LC circuit
arXiv:2002.03345 (2020).

38. A. Wallucks, I. Marinković, B. Hensen, R. Stockill, and S. Gröblacher. *A quantum memory at telecom wavelengths* arXiv:1910.07409 (2019).

Proceedings

39. 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

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

Dissertation

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

Master thesis

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

Books

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

Patents

44. M. Leeuwenhoek, M. Allan, R. A. Norte, and S. Gröblacher. *Novel atomic force microscopy probes with phononic crystals*. Patent pending (2019).
45. R. A. Norte and S. Gröblacher. *High-selectivity dry release of dielectric structures*. Patent pending (2019).
46. M. Forsch, R. Stockill and S. Gröblacher. *Quantum wavelength converter between a microwave signal and an optical signal*. Patent pending (2019).
47. R. A. Norte and S. Gröblacher. *Method for Fabrication of Large-Aspect-Ratio Nano-Thickness Mirrors*. NL2019631B1 (2019).
48. R. A. Norte and S. Gröblacher. *Photonic Crystal Mirrors on Tethered Membrane Resonator*. NL2016081B1 (2016).