Simon Gröblacher

Kavli Institute of Nanoscience
Delft University of Technology
Lorentzweg 1
NL-2628 CJ Delft
✉ *s.groeblacher@tudelft.nl*
groeblacherlab.org

Current positions

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

06/2018– Director and Co-Founder, **Nenso Solutions**, Delft, The Netherlands
Nanofabrication and High-Tech Consultancy.

Previous positions

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.

08/2019–07/2024 **Vrij Programma**, Netherlands Organisation for Scientific Research (NWO); Coordinator.

05/2019–05/2020 **Attract Grant**, EU Research and Innovation Programme.

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.
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

09/2020 **Scientific Appreciation Award**, *for excellence in research*, State of Lower Austria.
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 Recognition 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, among 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 42 publications in peer-reviewed journals – incl. 7 Nature, 1 Science, 3 Nature Phys., 7 Phys. Rev. Lett., 1 Nano Lett., 1 Optica

Total citations: 7200; h-index: 25 (as of November 2020, Google Scholar).

Presentations 80+ invited talks at conferences or seminars at international venues.

Peer-reviewed journals

* indicates equal contribution

1. M. Leeuwenhoek, F. Groenewoud, K. van Oosten, T. Benschop, M. P. Allan, and S. Gröblacher
Fabrication of on-chip probes for double-tip scanning tunneling microscopy
Microsyst. Nanoeng. **6**, 99 (2020).
2. Y. Chu and S. Gröblacher
A perspective on hybrid quantum opto- and electromechanical systems
Appl. Phys. Lett. **117**, 150503 (2020).
3. M. Leeuwenhoek, S. Gröblacher, M. P. Allan, and Y. M. Blanter
Modeling Green's function measurements with two-tip scanning tunneling microscopy
Phys. Rev. B **102**, 115416 (2020).
4. J. Li, A. Wallucks, R. Benevides, N. Fiaschi, B. Hensen, T. P. Mayer Alegre, and S. Gröblacher
Proposal for optomechanical quantum teleportation
Phys. Rev. A **102**, 032402 (2020).
5. A. Wallucks, I. Marinković, B. Hensen, R. Stockill, and S. Gröblacher
A quantum memory at telecom wavelengths
Nature Phys. **16**, 772–777 (2020).
6. J. Li and S. Gröblacher
Stationary quantum entanglement between a massive mechanical membrane and a low frequency LC circuit
New J. Phys. **22**, 063041 (2020).
7. 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).
8. 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).
9. 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).
10. 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).
11. 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).
12. I. Marinković*, A. Wallucks*, R. Riedinger, S. Hong, M. Aspelmeyer, and S. Gröblacher
An optomechanical Bell test
Phys. Rev. Lett. **121**, 220404 (2018).
13. 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).
14. M. Sanz, W. Wieczorek, S. Gröblacher, and E. Solano
Electro-mechanical Casimir effect
Quantum **2**, 91 (2018).
15. 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).
16. 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).
17. R. Riedinger*, A. Wallucks*, I. Marinković*, C. Löschnauer, M. Aspelmeyer, S. Hong, and S. Gröblacher
Remote quantum entanglement between two micromechanical oscillators
Nature **556**, 473–477 (2018).
18. 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).
19. 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).

20. J. Guo, R. A. Norte, and S. Gröblacher
Integrated optical force sensors using focusing photonic crystal arrays
Opt. Express **25**, 9196–9203 (2017).

21. R. A. Norte, J. P. Moura, and S. Gröblacher
Mechanical resonators for quantum optomechanics experiments at room temperature
Phys. Rev. Lett. **116**, 147202 (2016).

22. 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).

23. 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).

24. 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).

25. 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).

26. 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).

27. 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).

28. S. Gröblacher, S. Gigan, and M. Paternostro
Phase-space behavior and conditional dynamics of an optomechanical system
Phys. Rev. A **88**, 023813 (2013).

29. 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).

30. J. Li, S. Gröblacher, and M. Paternostro
Enhancing non-classicality in mechanical systems
New J. Phys. **15**, 033023 (2013).

31. 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).

32. 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).

33. 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).

34. M. Aspelmeyer, S. Gröblacher, K. Hammerer, and N. Kiesel
Quantum optomechanics – throwing a glance
J. Opt. Soc. Am. B **27**, A189–A197 (2010).

35. 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).

36. 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).

37. 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).

38. 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).

39. 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).

40. 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).

41. 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).

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

Electronic preprints

43. I. Marinković*, M. Drimmer*, B. Hensen, and S. Gröblacher
Hybrid integration of silicon photonic devices on lithium niobate for optomechanical wavelength conversion
arXiv:2010.08493 (2020).

44. J. Li and S. Gröblacher
Entangling the vibrational modes of two massive ferromagnetic spheres using cavity magnomechanics
arXiv:2007.09083 (2020).

Proceedings

45. 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

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

Dissertation

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

Master thesis

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

Books

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

Patents

50. M. Leeuwenhoek, M. Allan, R. A. Norte, and S. Gröblacher. *Novel atomic force microscopy probes with phononic crystals.*
Patent pending (2019).

51. R. A. Norte and S. Gröblacher. *High-selectivity dry release of dielectric structures.*
Patent pending (2019).

52. S. Gröblacher, M. Forsch, and R. Stockill. *Quantum wavelength converter between a microwave signal and an optical signal.*
NL2021950B1 (2018).

53. R. A. Norte and S. Gröblacher. *Method for Fabrication of Large-Aspect-Ratio Nano-Thickness Mirrors.*
NL2019631B1 (2017).

54. R. A. Norte and S. Gröblacher. *Photonic Crystal Mirrors on Tethered Membrane Resonator.*
NL2016081B1 (2016).