

# Simon Gröblacher

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## 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.

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## 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.

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## 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.

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## 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.**

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## Additional work experience

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

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## 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

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## Publications and Presentations

Publications 39 publications in peer-reviewed journals – incl. 7 Nature, 1 Science, 3 Nature Phys., 7 Phys. Rev. Lett., 1 Nano Lett., 1 Optica

Total citations: 7100; h-index: 25 (as of September 2020, Google Scholar).

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

## Peer-reviewed journals

\* indicates equal contribution

1. 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).
2. A. Wallucks, I. Marinković, B. Hensen, R. Stockill, and S. Gröblacher  
*A quantum memory at telecom wavelengths*  
Nature Phys. **16**, 772–777 (2020).
3. 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).
4. 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).
5. 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).
6. 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).
7. 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).
8. 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).
9. I. Marinković\*, A. Wallucks\*, R. Riedinger, S. Hong, M. Aspelmeyer, and S. Gröblacher  
*An optomechanical Bell test*  
Phys. Rev. Lett. **121**, 220404 (2018).
10. 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).
11. M. Sanz, W. Wieczorek, S. Gröblacher, and E. Solano  
*Electro-mechanical Casimir effect*  
Quantum **2**, 91 (2018).
12. 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).
13. 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).
14. 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).
15. 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).
16. 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).
17. J. Guo, R. A. Norte, and S. Gröblacher  
*Integrated optical force sensors using focusing photonic crystal arrays*  
Opt. Express **25**, 9196–9203 (2017).
18. R. A. Norte, J. P. Moura, and S. Gröblacher  
*Mechanical resonators for quantum optomechanics experiments at room temperature*  
Phys. Rev. Lett. **116**, 147202 (2016).
19. 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).

20. 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).
21. 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).
22. 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).
23. 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).
24. 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).
25. S. Gröblacher, S. Gigan, and M. Paternostro  
*Phase-space behavior and conditional dynamics of an optomechanical system*  
Phys. Rev. A **88**, 023813 (2013).
26. 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).
27. J. Li, S. Gröblacher, and M. Paternostro  
*Enhancing non-classicality in mechanical systems*  
New J. Phys. **15**, 033023 (2013).
28. 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).
29. 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).
30. 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).
31. M. Aspelmeyer, S. Gröblacher, K. Hammerer, and N. Kiesel  
*Quantum optomechanics – throwing a glance*  
J. Opt. Soc. Am. B **27**, A189–A197 (2010).
32. 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).
33. 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).
34. G. D. Cole, S. Gröblacher, K. Gugler, S. Gigan, and M. Aspelmeyer  
*Monocrystalline  $\text{Al}_x\text{Ga}_{1-x}\text{As}$  heterostructures for high-reflectivity high-Q micromechanical resonators in the megahertz regime*  
Appl. Phys. Lett. **92**, 261108 (2008).
35. 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).
36. 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).
37. 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).
38. 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).

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

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## Electronic preprints

40. J. Li and [S. Gröblacher](#)  
*Entangling the vibrational modes of two massive ferromagnetic spheres using cavity magnomechanics*  
arXiv:2007.09083 (2020).
41. Y. Chu and [S. Gröblacher](#)  
*A perspective on hybrid quantum opto- and electromechanical systems*  
arXiv:2007.03360 (2020).
42. M. Leeuwenhoek, [S. Gröblacher](#), M. P. Allan, and Y. M. Blanter  
*Modeling Green's functions measurements with two-tip scanning tunneling microscopy*  
arXiv:2005.00362 (2020).

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## Proceedings

43. 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).

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## Popular science

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

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## Dissertation

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

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## Master thesis

46. [S. Gröblacher](#), *Experimental Investigation of Quantum Communication Protocols in Higher Dimensions*  
University of Vienna (2005).

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## Books

47. [Gröblacher, Simon](#). *Quantum opto-mechanics with micromirrors: combining nano-mechanics with quantum optics*.  
Heidelberg: Springer, 2012.

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## Patents

48. M. Leeuwenhoek, M. Allan, R. A. Norte, and [S. Gröblacher](#). *Novel atomic force microscopy probes with phononic crystals*.  
Patent pending (2019).
49. R. A. Norte and [S. Gröblacher](#). *High-selectivity dry release of dielectric structures*.  
Patent pending (2019).
50. [S. Gröblacher](#), M. Forsch, and R. Stockill. *Quantum wavelength converter between a microwave signal and an optical signal*.  
NL2021950B1 (2018).
51. R. A. Norte and [S. Gröblacher](#). *Method for Fabrication of Large-Aspect-Ratio Nano-Thickness Mirrors*.  
NL2019631B1 (2017).
52. R. A. Norte and [S. Gröblacher](#). *Photonic Crystal Mirrors on Tethered Membrane Resonator*.  
NL2016081B1 (2016).