

# Richard Alexander Norte

## Education

---



**California Institute of Technology (Caltech)**, California, USA – 08/2014

**Ph.D. degree in Physics**, Advisor: Prof. Oskar Painter

Dissertation: Nanofabrication for On-Chip Optical Levitation, Atom-Trapping, & Superconducting Quantum Circuits



**Stanford University**, California, USA – 06/2007

Bachelors of Science in Physics with Honors

Bachelors of Science in Mathematics with Honors

## Professional Experience

---

01/24 – **Present** Associate Professor, **Delft University of Technology**, Delft, The Netherlands  
Precision & Microsystems Engineering, Faculty 3ME  
Department of Quantum Nanoscience, Faculty TNW

06/18 – **Present** Director and Founder of **NanoTactiX**, Delft, The Netherlands  
Lead Microchip Architect for **Iridia Inc.** – helped to enable a **\$24 million series-A financing** round in 2021

---

08/18 - 01/24 Assistant Professor, **Delft University of Technology**, Delft, The Netherlands

11/14 – 08/14 Post-Doctoral Researcher, **Delft University of Technology**, Delft, The Netherlands  
Quantum optomechanics, Groeblacher lab.

01/09 – 11/14 Research Assistant, **Caltech**, Pasadena, California  
Optomechanics with photonic crystals, atomic ensembles, and superconducting quantum circuits.  
P.I: Prof. Oskar Painter & Prof. Jeff H. Kimble

06/07 – 01/09 Ph.D. Researcher and Lecturer, **Caltech**, Pasadena, California  
Research in gravitational wave theory of black holes. Advisor: Prof. Yanbei Chen

## Professional Milestones

---

- 2024 Supervised 5 PhDs, 14 Masters, and 4 Postdocs & awarded over \$3 million for nanotechnology research.
- 2022 Enabled \$24 million Series-B round for DNA-based data-storage via my microchip strategy consultancy in Delft.
- 2021 Selected for the Rising Stars Cover of Advanced Materials (IF: 31.8)
- 2019 Featured on the cover of Scientific American: Extreme Physics special issue (July 2019)
- 2019 Achieved laser-cooling of microchip mechanical oscillator from room temperature to 1 mK (PRL 2019)
- 2018 Measured the Casimir effect through a superconducting transition (PRL 2018) – featured in Scientific American
- 2017 Branco Weiss Fellowship Finalist (Top 7% world-wide)
- 2017 Demonstrated a first observation of a quantum state of a macro-sized mechanical object (Science, 2018)
- 2017 Developed thinnest dielectric reflectors to date- now raised over \$2.8 million for these technologies
- 2016 Developed world's most precise micro-mirror force sensors at room temperature (PRL, Science, Nature Photonics 2016)
- 2015 First microchip interface between single phonons & photons (Nature, 2016)
- 2015 Quantum ground state cooling of nano-mechanical superconducting oscillator (Nature Communications, 2015)

## Awards & Honors

---

- 2022 Awarded prestigious € 2.1 million ERC Starting Grant to develop new directions in nanotechnology.
- 2022 Awarded Interstellar Initiative Strategic Grant from Limitless Space Institute: \$150,000
- 2021 MIT Grant – Quantum Motion Sensor for quantum accelerometer: 95,000 €
- 2021 NWO Take off Grant for quantum accelerometers: 40,000 €
- 2020 Awarded Interstellar Initiative Strategic Grant from Limitless Space Institute: \$150,000
- 2019 Awarded Breakthrough Prize Foundation Grant– Starshot Lightsails RFP Phase 1: \$250,000

- 2019 Awarded NWO Start-Up Grant- to measure quantum vacuum forces from superconductors – 400,000 €
- 2019 Cohesion Grant winner, Faculty of 3mE, TU Delft, the Netherlands: 70,000 € (in collaboration with Prof. Miguel Bessa)
- 2019 Awarded NWA ORC Grant: 1,600,000 € for our consortium (300,000 € for our PhD project with Prof. Toeno van der Sar)
- 2018 Awarded ATTRACT EU H2020 Grant: 100,000 € for our consortium to develop optical quantum accelerometry
- 2018 Nationale Wetenschaps Agenda Quantum/Nano Startimpulseprogramma: 100,000 € to develop quantum navigation
- 2009 National Science Foundation Graduate Research Fellowship Honorable Mention
- 2008 Rose Hills Foundation Science & Engineering Grant Recipient (\$30,000 Grant)
- 2006 Harvard Business School Ventures in Management (1 of 33 grants awarded worldwide)

## Scientific Papers

---

\* indicate equal contribution      + corresponding author

High-Strength Amorphous Silicon Carbide for Nanomechanics

M. Xu, D. Shin, P.M. Sberna, R. van der Kolk, A. Cupertino, M.A. Bessa<sup>+</sup>, **R.A. Norte<sup>+</sup>**

*Advanced Materials* (2023)

♦ [Selected for Cover of \*Advanced Materials'\* \(IF:31\)](#)

Mechanical Overtone Frequency Combs

M. H. J. de Jong, A. Ganesan, A. Cupertino, S. Groeblacher, **R. A. Norte<sup>+</sup>**

*Nature Communications* 14, 1458 (2023)

Resolution Limits of Resonant Sensors with Duffing Non-Linearity

T. Manzanque, M. K. Ghatkesar, F. Alijani, M. Xu, **R. A. Norte**, P.G. Steeneken

*Physical Review Applied* 19, 054074 (2023)

Tuning the Q-factor of nanomechanical string resonators by torsion support design

Z. Li, M. Xu, **R. A. Norte**, A. M. Aragón, F. van Keulen, F. Alijani, P.G. Steeneken

*Applied Physics Letters* 122 (1), 013501 (2023)

Mechanical Mode Dissipation by Substrate Mode Coupling in SiN Resonators

Matthijs H. J. de Jong, Malte A. ten Wolde, Andrea Cupertino, Simon Groeblacher, Peter G. Steeneken, **R. A. Norte<sup>+</sup>**

*Applied Physics Letters* **121**, 032201 (2022)

D. Shin<sup>\*</sup>, A. Cupertino<sup>\*</sup>, M.H.J. de Jong, P.G. Steeneken, M.A. Bessa<sup>+</sup>, **R.A. Norte<sup>+</sup>**

*Spiderweb nanomechanical resonators via Bayesian optimization: inspired by nature and guided by machine learning*

*Advanced Materials* 34 (3), 2106248, Rising Stars Issue (2022)

♦ [Selected for Cover of \*Advanced Materials'\* \(IF:31\) Rising Stars Issue](#)

♦ [Top 5% of all research outputs ever tracked by Altmetrics \(Score 75\)](#)

M.H.J. de Jong, J. Li, C Gärtner, **R. A. Norte**, S. Gröblacher

*Coherent mechanical noise cancellation and cooperativity competition in optomechanical arrays*

*Optica* 9 (2), 170-176 (2021)

S. Bahamonde, M. Faizal, J. Q. Quach, **R. A. Norte**

*Quantum Weak Equivalence Principle and the Gravitational Casimir Effect in Superconductors*

*International Journal of Modern Physics D*, 29, No. 14 2043024 (2020)

♦ [Essay awarded an honorable mention for the Gravity Research Foundation 2020 Awards for Essays on Gravitation](#)

J. M. Fink, M. Kalaee, **R. A. Norte**, A. Pitanti, O. Painter

*Efficient microwave frequency conversion mediated by a photonics compatible silicon nitride nanobeam oscillator*

*Quantum Science and Technology* 5 (3), 034011 (2020)

J. Guo, **R. A. Norte<sup>+</sup>**, S. Gröblacher<sup>+</sup>

*Feedback cooling of a room temperature mechanical oscillator close to its motional groundstate*

*Physical Review Letters* **123**, 223602 (2019)

**R. A. Norte<sup>+</sup>**, M.Forsch, A. Wallucks, I. Marinković, S. Gröblacher<sup>+</sup>

*Platform for measurements of the Casimir force between two superconductors*

*Physical Review Letters*, **121**, 030405 (2018)

♦ [Featured in \*Scientific American\* \(August 2018\)](#)

♦ [Top 5% of all research output ever tracked by Alemetrics \(Score 56\)](#)

L. Magrini, **R. A. Norte**, R. Riedinger, I. Marinković, D. Grass, U. Delić, S. Gröblacher, S. Hong, M. Aspelmeyer  
*Nanophotonic near-field levitated optomechanics*  
*Optica* 5 (12), 1597-1602 (2018)  
[♦ Featured in the cover of Optica \(December 2018\)](#)

C. Gärtner\*, J. P. Moura\*, W. Haaxman, **R. A. Norte**, and S. Gröblacher  
*Integrated optomechanical arrays of two high reflectivity SiN membranes*  
*Nano letters* 18 (11), 7171-7175

M. Leeuwenhoek, **R. A. Norte**, K. M. Bastiaans, D. Cho, I. Battisti, Y. M. Blanter, S. Gröblacher, and M. P. Allan  
*Nanofabricated tips as a platform for double-tip and device based scanning tunneling microscopy*  
*Nanotechnology* 30 (33), 335702 (2019)

J. P. Moura\*, **R. A. Norte**\*<sup>+</sup>, J. Guo, C. Schäfermeier, S. Gröblacher<sup>+</sup>  
*Centimeter-Scale Suspended Photonic Crystal Mirrors*  
*Optics Express* 26, 1895 – 1909 (2018)

S. Hong\*, R. Riedinger\*, I. Marinković\*, A. Wallucks\*, S. G. Hofer, **R. A. Norte**, M. Aspelmeyer, S. Gröblacher  
*Hanbury Brown and Twiss interferometry of single phonons from an optomechanical resonator*  
*Science* 358, 203–206 (2017)

J. Guo, **R. A. Norte**, S. Gröblacher  
*Integrated Optical Force Sensors using Focusing Photonic Crystal Arrays*  
*Optics Express* 25, 9196-9203 (2017)

**R. A. Norte**, J. P. Moura, S. Gröblacher  
*Mechanical Resonators for Quantum Optics Experiments at Room Temperature*  
*Physical Review Letters*, 116, 147202 (2016)

[♦ PRL Editor's Suggestion](#) ♦ [Featured as APS Physics Viewpoint](#) ♦ [Research Highlight in Nature Photonics](#)  
[♦ Cover of Scientific American \(July 2018\)](#) ♦ [Featured in Scientific American \(Apr 2019\)](#) ♦ [Editor's Choice in Science](#)

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)  
[♦ Featured in Nature- News & Views](#)

J. M. Fink, M. Kalaei, A. Pitanti, **R. Norte**, L. Heinzle, M. Davanco, K. Srinivasan, and O. Painter  
*Quantum Electromechanics on Silicon Nitride Nanomembranes*  
*Nature Communications*. 7, 12396 (2016)

S.-P. Yu, J. D. Hood, J. A. Muniz, M. J. Martin, **R. A. Norte**, C.-L. Hung, S. M. Meenehan, J. Cohen, O. Painter, H. J. Kimble  
*Nanowire Photonic Crystal Waveguides for Single-Atom Trapping and Strong Light-Matter Interactions*  
*Applied Physics Letters* 104, 11110-3 (2014)

Kang-Kuen Ni, **Richard Norte**, Dalziel Wilson, Jon Hood, Darrick Chang, Oskar Painter, H. J. Kimble  
*Enhancement of Mechanical Q-Factors by Optical Trapping*  
*Physical Review Letters* 15, 035007 (2012)

Paolo Pani<sup>§</sup>, Emanuele Berti<sup>¶</sup>, Vitor Cardoso<sup>‡</sup>, Yanbei Chen<sup>||</sup>, **Richard Norte**<sup>+</sup>  
*Gravitational-Wave Signatures of the Absence of an Event Horizon - Nonradial Oscillations of a Thin-Shell Gravastar*  
*Physical Review Letters D*, 80, 124047 (2009)

Paolo Pani<sup>§</sup>, Emanuele Berti<sup>¶</sup>, Vitor Cardoso<sup>‡</sup>, Yanbei Chen<sup>||</sup>, **Richard Norte**<sup>+</sup>  
*Gravitational-Wave Signatures of the Absence of an Event Horizon – Extreme Mass Ratio Inspirals in the Spacetime of Thin-Shell Gravastar*, *Physical Review Letters D*, 80, 124047 (2009)

## Media & Popular Science

---

- ♦ Featured on Dutch National Newspaper (**de Volkskrant**) – “By chance we combined two Nobel Prize winning techniques” (2023)
- ♦ Featured in Physics World: “Spiderweb structure inspires nanomechanical gravity sensor”- Isabelle Dumé (2022)
- ♦ Invited on IEEE Soft Robotics Podcast: “Microchip Sensors Inspired by Spiderwebs” – Marwa ElDiwiny (2022)
- ♦ Featured in Electronic Design: “MEMS Spiderweb Forms Super-Sensitive, Noise-Resisting Vibration Sensor” – B. Schweber (2022)
- ♦ Featured on the cover of **Scientific American**: Extreme Physics issue (July 2019 issue)
- ♦ **Scientific American** Feature: “Is Gravity Quantum?” – Charles Q. Choi (August 2018 issue)
- ♦ Science Alert feature: “Physicists Are Testing a Mysterious Force That Exists Between Superconducting Wires”– David Nield (2018)
- ♦ **Cover of Scientific American**: “How Does the Quantum World Cross Over?” – Tim Folger (July 2018 issue)
- ♦ Laser Focus World: “Suspended Photonic Crystal Mirrors Could Become Lightsails for Interstellar Probes”- John Wallace (2017)
- ♦ Featured in **Science**: ‘Bouncing to higher sensitivity’ – Ian Osborne, Science, Vol. 352, Issue 6286, pp. 669-670 (2016)
- ♦ **APS Physics**: Viewpoint – ‘Trampolines Sense a Disturbance in the Force’ – John Teufel, Physics **9**, 40 (2016).
- ♦ Featured in **Nature Photonics Research Highlight**: ‘Reaching Room Temperature’ – David Pile, Nature Photonics, **10**, 285 (2016)
- ♦ **Nature News & Views**: ‘Quantum Physics: Photons Pairs with Phonons’ – Miles Blencowe, Nature **530**, 284-285 (2016)
- ♦ On-Chip Platform for Light-Atom Coupling featured in PhD Comics – ‘A Quantum Entanglement’ –Jorge Chan (2014)
- ♦ Editor for Nobel Laureate, Robert Laughlin: “A Different Universe: Reinventing Physics from the Bottom Down” (2006)

## Consulting , Teaching & Outreach

---

- 2018 – Present    **NanoTactiX B.V.**: Lead microchip consultant for Iridia Inc: Managed 4-person, multi-million dollar project to demonstrate the first microchip-based DNA data storage technology. In 2021, Iridia closed a \$24 million series-B financing round led by Western Digital, LifeSci Venture Partners, JSR Corporation & North Sound Venture.
- 2018 – Present    **Delft University of Technology, Engineering Dynamics (ME46055)** – Responsible for teaching a ~150 student Masters course on classical dynamics in the Mechanical Engineering Faculty.
- 2020 – Present    **Delft University of Technology, Nanotechnology (AP3222)** – Responsible for teaching the flagship Nanotechnology course for the Kavli Institute of Nanoscience at Delft.
- 2016 – Present    **Breakthrough Prize Foundation**: Working with the Starshot Initiative- \$100 million international initiative to develop laser-propelled nanocrafts. Advising on main challenge: **Lightsail: Integrity under Thrust** – realization of light-sails using photonic crystals.
- 2014 – 2018       **Delft University of Technology**: Directly advised 4 PhDs from Simon Gröblacher's Lab, 1 PhD from Milan Allan's Lab, and 1 PhD from Markus Aspelmeyers Lab. Inaugural member of Simon Groblacher's lab.
- 2007-2009       **California Institute of Technology**: Taught two years of advanced quantum and statistical mechanics Well versed in course and exam preparation, grading, and teaching for 40-60 student lectures, three times a week.
- 2007-2009       **Caltech Young Engineering and Science Scholars** Physics Instructor: Coordinated, taught and mentored underrepresented high-achieving students in physics, mathematics and engineering courses at Caltech.
- 2005-2007       **Stanford Summer Engineering Academy Mentorship**: Mentoring and teaching of physics, math, and electrical engineering courses for incoming underrepresented Stanford students.

## Invited Talks & Presentations

---

- June 2023 Frontier of Nanomechanical Systems (FNS 2023) – invited speaker –  
“High-Q spiderweb nanomechanics inspired by machine learning”
- May 2023 Invited Seminars & Colloquia at Stanford University, Harvard University and Brown University –  
“Propelling Interstellar Exploration: Extreme-Aspect-Ratio Nanotechnology in a Post-Moore Era”
- Apr. 2023 Measuring by Light 2023 – invited speaker  
“Mechanical Overtone Frequency Combs”
- Nov. 2020 Inside Quantum Technology – New York: “Room temperature quantum sensing”
- Jan. 2017 Physics@Veldhoven 2017, Light and Matter Focus Session Speaker  
“Ultra-thin Photon Trampoline and Future Directions”
- Oct. 2016 QuTech Materials, Plenary Speaker  
“*Suspending Buildings from Strings: Nanofabrication Techniques for Quantum-Limited Sensing*”
- Jun. 2016 Casimir School of Research, Kavli Technology Colloquim, Plenary Speaker  
“*Ultra-Delicate Nanofabrication Techniques: Producing Next Generation Device*”
- May 2016 International Conference on Quantum Science and Applications , Eskesehir, Turkey  
Invited Plenary Speaker & Scientific Committee Member  
“*Towards the Observation of Macroscopic Quantum Physics at Room Temperature*”
- Mar. 2016 Selected as Research Highlight at Dig-it Research Startup Exhibition  
“On-Chip Optical Sensors with Attonewton Sensitivity”
- Jun. 2012 Caltech Institute of Quantum Information and Matter Seminar, Inaugural Speaker  
“*Optically Trapping Nanomembranes*”

## Patents

---

- R. A. Norte, M. Leeuwenhoek, M. Allan, and S. Gröblacher. Novel AFM probes with phononic crystals. NL2024495B1 (2019).
- R. A. Norte and S. Gröblacher. High-selectivity dry release of dielectric structures. NL2023917B1 (2019).
- R. A. Norte and S. Gröblacher. Method for Fabrication of Large-Aspect-Ratio Nano-Thickness Mirrors. NL2019631B1 (2017)
- R. A. Norte and S. Gröblacher. Photonic Crystal Mirrors on Tethered Membrane Resonator. NL2016081B1 (2016).

## Languages

---

Native Spanish (Spoken and written)

Native English (Spoken and written)

Dutch (Beginner)