

# Juliette Monsel

## Researcher in theoretical physics

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Nationality: French

*Research interests: stochastic thermodynamics, quantum open systems, quantum optics, optomechanics and electronic transport.*

### Education

- 2020 **Qualification**, *National Council of Universities (CNU)*, France.  
Certificate allowing me to apply to “Maître de Conférence” positions, permanent Assistant Professor positions with an important teaching component, at French universities.
- 2019 **Ph.D.**, *Université Grenoble Alpes*, France.  
Theoretical Physics.
- 2016 **M.Sc.**, *École Normale Supérieure de Lyon*, France.  
Major: Physics, Mention: highest honors
- 2014 **B.Sc.**, *École Normale Supérieure de Lyon*, France.  
Major: Physics, Mention: highest honors
- 2011 – 2013 **Classe Préparatoire**, *Lycée La Martinière Monplaisir*, Lyon, France.  
Two-year intensive course preparing for the competitive entrance examinations to French leading institutions of higher education. Track: Mathematics-Physics.

### Research experience

- 2020 – current **Postdoctoral researcher**, *Department of Microtechnology and Nanoscience, Chalmers University of Technology*, Gothenburg, Sweden.  
Advisor: Janine Splettstoesser. Quantum thermodynamics.
- Studied thermodynamic of electronic transport
  - Analyzed optomechanical cooling in a thermodynamic perspective
- 2019 – 2020 **Postdoctoral researcher**, *Institut Néel*, Grenoble, France.  
(4 months) Advisor: Alexia Auffèves. Quantum thermodynamics and optomechanics.
- Explored the potential of carbon nanotubes for thermodynamic experiments
  - Studied stochastic thermodynamics with Kerr resonators
- 2016 – 2019 **Doctoral researcher**, *Institut Néel*, Grenoble, France.  
(3 years, 2 months) Supervisor: Alexia Auffèves. Quantum thermodynamics and optomechanics.
- Demonstrated the potential of hybrid optomechanical systems and one-dimensional atoms to experimentally explore quantum thermodynamics
  - Proposed methods to define and measure work in the quantum regime
- 2016 **Master intern**, *Institut Néel*, Grenoble, France.  
(4 months) Supervisor: Alexia Auffèves. Fluctuation theorems in a hybrid optomechanical system.
- 2015 **Master intern**, *Institut Néel*, Grenoble, France.  
(3 months) Supervisor: Alexia Auffèves. Hybrid optomechanical system in the ultra-strong coupling regime.
- 2014 **Bachelor intern**, *Institut Lumière Matière*, Lyon, France.  
(2 months) Supervisor: Julien Laverdant. Experimental control of polarization with a spatial light modulator.

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## Teaching experience

- 2017, 2018 (64 hours/year) **Teaching Assistant**, *Université Grenoble Alpes*, France.  
Newtonian mechanics for first year undergraduates.
- Supervised students during tutorials ( $2 \times 1,5$  hours/week,  $\sim 30$  students) and practical work (3 hours/week,  $\sim 15$  students)
  - Graded examinations and practical work reports
  - Wrote exercises for the examinations
- 2013 – 2014 (7 months) **Tutor for homework assistance**, *Trait d'Union program*, Villeurbanne, France.  
Took part in a homework assistance program for students from high schools in disadvantaged areas (2 hours/week).

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## Student supervision

- 2020 – current Assistant supervisor of a Ph.D. student at Chalmers University of Technology.
- Apr. – Jul. 2022 Co-supervisor of a master student from École Normale Supérieure de Lyon (France) at Chalmers University of Technology for a four-month project.
- Oct. 2021 – Jul. 2022 Co-supervisor of a master student from University of Regensburg (Germany) at Chalmers University of Technology.
- 2016 Informal co-supervisor of a first-year master student during his two-month internship at the Institut Néel, Grenoble, France.

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## Training

- 2017 **How to develop as a teacher**, *Doctoral school of Physics*, Grenoble, France.  
Two-day training program on communication and group animation techniques for teaching.
- 2016 – 2019 **Research and Higher Education (RES) label**, *Doctoral school of Physics*, Grenoble, France.  
Teaching oriented Ph.D. program leading to the production of a portfolio documenting the development of my teaching and research skills (in French): <http://juliette-monsel.byethost15.com>.
- 2016 **Introduction to the profession of teacher-researcher**, *Doctoral school of Physics*, Autrans, France.  
Three-day workshop on topics related to teaching at the university.

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## Awards and Grants

- 2022 **Travel grant** from *Chalmers Foundation* to go to Vienna for a research visit and the annual Quantum Thermodynamics Conference in July 2023.
- 2020 **Springer Thesis Award**, recognizing outstanding Ph.D. research.
- 2016 **Ph.D. grant** from the *CFM Foundation for Research*.

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## Publications

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### Preprints

- 2023 J. Monsel, J. Schulenburg, J. Splettstoesser, *Non-geometric pumping effects on the performance of interacting quantum-dot heat engines*. arXiv: 2303.15420.
- 2022 J. Tabanera-Bravo, F. Vigneau, J. Monsel, K. Aggarwal, L. Bresque, F. Fedele, F. Cerisola, G. A. D. Briggs, J. Anders, A. Auffèves, J. M. R. Parrondo, N.

Ares, *Stability of long-sustained oscillations induced by electron tunneling*. arXiv: 2211.04074.

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## Articles

- 2023 L. Tesser, M. Acciai, C. Spånslätt, J. Monsel, J. Splettstoesser, “Charge, spin, and heat shot noises in the absence of average currents: Conditions on bounds at zero and finite frequencies,” *Physical Review B*, **107**, 075409.
- 2022 F. Vigneau, J. Monsel, J. Tabanera, K. Aggarwal, L. Bresque, F. Fedele, F. Cerisola, G. A. D. Briggs, J. Anders, J. M. R. Parrondo, A. Auffèves, N. Ares, “Ultrastrong coupling between electron tunneling and mechanical motion,” *Physical Review Research*, **4**, 043168, First theory author.
- J. Monsel, J. Schulenburg, T. Baquet, J. Splettstoesser, “Geometric energy transport and refrigeration with driven quantum dots,” *Physical Review B*, **106**, 035405, Editors’ suggestion.
- 2021 J. Monsel, N. Dashti, S. K. Manjeshwar, J. Eriksson, H. Ernbrink, E. Olsson, E. Torneus, W. Wieczorek, J. Splettstoesser, “Optomechanical cooling with coherent and squeezed light: The thermodynamic cost of opening the heat valve,” *Physical Review A*, **103**, 063519.
- 2020 J. Monsel, M. Fellous-Asiani, B. Huard, A. Auffèves, “The Energetic Cost of Work Extraction,” *Physical Review Letters*, **124**, 130601.
- 2018 J. Monsel, C. Elouard, A. Auffèves, “An autonomous quantum machine to measure the thermodynamic arrow of time,” *npj Quantum Information*, **4**, 59.

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## Books

- 2020 J. Monsel, *Quantum Thermodynamics and Optomechanics* (Springer Theses, Recognizing Outstanding Ph.D. Research). Springer International Publishing.

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## Conferences and seminars

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### Invited talks

- 2022 “Geometric energy transport and refrigeration with driven quantum dots,” *Workshop on Geometric Resources for Quantum Engineering II*, invited by Diego Frustaglia, University of Seville, Spain, Nov. 24 – 25. Website: <https://personal.us.es/frustaglia/workshop2022.html>.
- “Stochastic entropy production in electron transport through quantum dots,” *Quantum Energetics Workshop*, invited by Alexia Auffèves, Institut Néel, Grenoble, France, Jun. 7.
- 2019 “An autonomous quantum machine to measure the thermodynamic arrow of time,” *Workshop on Quantum Networks and Non-equilibrium Systems*, invited by Andrew Briggs and Natalia Ares, Obergurgl, Austria, Jan. 16 – 19. Website: <http://www.ati.ac.at/~obergurgl2019>.

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## Contributed talks

- 2023 “Dissipative cavity optomechanics with a suspended frequency-dependent mirror,” *DPG Spring Meeting of the Atomic, Molecular, Quantum Optics and Photonics Section (SAMOP)*, Hannover, Germany, Mar. 5 – 10. Website: <https://www.dpg-verhandlungen.de/year/2023/conference/samop/part/q/session/48/contribution/7>.
- “Ultrastrong coupling between electron tunneling and mechanical motion,” *Information as Fuel FQXi workshop*, Obergurgl, Austria, Feb. 3 – 8. Website: <https://fqxi.org/>.
- 2021 “Optomechanical cooling with coherent and squeezed light: the thermodynamic cost of opening the heat valve,” *Annual Quantum Thermodynamics Conference*, Online (Genève, Switzerland), Oct. 4 – 8.
- “Optomechanical cooling with coherent and squeezed light: the thermodynamic cost of opening the heat valve,” *Condensed matter days (JMC)*, Online (Rennes, France), Aug. 24 – 27. Website: <https://jmc17.sciencesconf.org>.
- “Optomechanical cooling with coherent and squeezed light: the thermodynamic cost of opening the heat valve,” *Thermodynamics and Information in the Quantum Regime*, Online, Jul. 7 – 9. Video: <https://www.youtube.com/watch?v=5BT9kkFDPCQ>.
- “Optomechanical cooling with coherent and squeezed light: The thermodynamic cost of opening the heat valve,” *Joint European Thermodynamics Conference*, Online (Prague, Czech Republic), Jun. 14 – 18. Website: <https://www.jetc2021.eu>.
- 2020 “The energetic cost of work extraction,” *Annual Quantum Thermodynamics Conference*, Online (Barcelona, Spain), Oct. 13 – 17. Video: <http://qtd2020.icfo.eu/index.php/2020/10/08/juliette-monsel/>.
- 2019 “An autonomous optomechanical energy converter,” *Annual Meeting of the GDR MecaQ (French research network on Quantum Optomechanics, Nanomechanics)*, Palaiseau, France, Oct. 3 – 4.
- “An autonomous quantum machine to measure the thermodynamic arrow of time,” *Annual Quantum Thermodynamics Conference*, Espoo, Finland, Jun. 23 – 28. Website: <https://qtd2019.aalto.fi/>.
- “Measuring the arrow of time in a hybrid optomechanical system,” *II Workshop on Quantum Information and Thermodynamics*, Natal, Brazil, Mar. 11 – 22. Video: <https://www.youtube.com/watch?v=jhz0Az8H2UU>.
- 2018 “Energy conversion in a hybrid optomechanical system: Laser-like behavior and cooling,” *Condensed matter days (JMC)*, Grenoble, France, Aug. 27 – 31. Website: <https://jmc2018.sciencesconf.org/>.
- 2017 “Fluctuation theorems in a hybrid optomechanical system,” *Annual colloquium of the GDR IQFA (French research network on Quantum Engineering, from Fundamental Aspects to Applications)*, Nice, France, Nov. 29 – Dec. 1.
- “Measuring the arrow of time in a hybrid optomechanical system,” *VI Quantum Information Workshop*, Paraty, Brazil, Aug. 21 – 25.

“Thermodynamics and hybrid optomechanical system,” *Congress of the French Physical Society (SFP)*, Orsay, France, Jul. 3 – 7. Website: <https://congressfp.sciencesconf.org>.

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### Invited seminars

- 2023 “Optomechanical cooling with coherent and squeezed light and frequency-dependent mirrors: The thermodynamic cost of opening the heat valve,” *Seminar, invited by Martin Bowen*, Institute of Physics and Chemistry of Materials of Strasbourg, CNRS – Unistra, France, Apr. 12. Website: <https://www.ipcms.fr/en/evenement/seminar-presented-by-juliette-monsel/>.
- “Energy transport and refrigeration with driven quantum dots,” *Seminar, invited by Ville Maisi*, Center for Nanoscience, Lund University, Sweden, Mar. 31. Website: <https://www.nano.lu.se/calendar/quantum-physics-meeting-juliette-monsel-energy-transport-and-refrigeration-driven-quantum-dots>.
- “Optomechanical cooling with coherent and squeezed light,” *Seminar, invited by Romain Albert, in Gerhard Kirchmair’s group*, Institute for Quantum Optics and Quantum Information, Innsbruck, Austria, Feb. 8.
- 2022 “Geometric energy transport and refrigeration with driven quantum dots,” *Seminar, invited by Natalia Ares*, Department of Engineering, University of Oxford, UK, Apr. 8.
- 2021 “Quantum thermodynamics,” *SmallTalks [about Nanoscience]*, Chalmers University of Technology, Gothenburg, Sweden, Dec. 6.
- “Optomechanical cooling with coherent and squeezed light,” *UniKORN Seminar Series*, Online, Nov. 3.
- “Optomechanical cooling with coherent and squeezed light: The thermodynamic cost of opening the heat valve,” *NanoThermodynamics seminar, invited by Peter Samuelsson*, Online (Lund University), Mar. 19.
- 2019 “Thermodynamics of hybrid optomechanical systems,” *Seminar, invited by Janine Splettstoesser*, Department of Microtechnology and Nanoscience, Chalmers University of Technology, Gothenburg, Sweden, Sep. 11.
- 2018 “Fluctuation theorems in a hybrid optomechanical system,” *Seminar, invited by Natalia Ares*, Department of Materials, University of Oxford, UK, Mar. 7.

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### Contributed posters

- 2023 “Role of nonequilibrium fluctuations and feedback in a quantum dot thermal machine,” *Annual Quantum Thermodynamics Conference*, Vienna, Austria, Jul. 17 – 21. Website: <https://qtd2023.conf.tuwien.ac.at/>.
- 2022 “Geometric energy transport and refrigeration with driven quantum dots,” *A nano focus on quantum materials*, Chalmers University of Technology, Gothenburg, Sweden, Nov. 28 – 29.
- “Geometric energy transport and refrigeration with driven quantum dots,” *Excellence Initiative Nano Community Building*, Varberg, Sweden, Aug. 22 – 24.

“Geometric energy transport and refrigeration with driven quantum dots,” *Frontier of Quantum and Mesoscopic Thermodynamics*, Prague, Czech Republic, Aug. 1 – 6. Website: <https://fqmt.fzu.cz/22>.

“Geometric energy transport and refrigeration with driven quantum dots,” *Annual Quantum Thermodynamics Conference*, Online (Belfast, UK), Jun. 27 – Jul. 1. Website: <https://blogs.qub.ac.uk/qtd2022/posters/>.

2021 “Geometric energy transport in time-dependently driven quantum dots,” *QuESTech Final Conference*, Marstrand, Sweden, Nov. 9 – 10.

“Geometric energy transport in time-dependently driven quantum dots,” *Excellence Initiative Nano Poster Day*, Chalmers University of Technology, Gothenburg, Sweden, Oct. 26.

2020 “Optomechanical cooling efficiency: The cost of turning a valve,” *Quantum Technology International Conference*, Online (Barcelona, Spain), Nov. 2 – 4. Website: <https://premc.org/conferences/qtech-quantum-technology/>.

“The energetic cost of work extraction,” *Workshop on Prospects of Ultrastrong light-matter interactions*, Gothenburg, Sweden, Sep. 13 – 17.

2017 “Measuring the arrow of time in a hybrid optomechanical system,” *VI Quantum Information School*, Paraty, Brazil, Aug. 14 – 18.

“Measuring the arrow of time in a hybrid optomechanical system,” *Annual Quantum Thermodynamics Conference*, Oxford, United Kingdom, Mar. 13 – 17.

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## Service to the community

Reviewer Phys. Rev. Lett. (2023), Sci. Rep. (2022), Phys. Rev. A (2021 – 2023), J. Stat. Mech. Theory Exp. (2021), Phys. Rev. E (2021, 2022), J. Phys. A Math. (2021), New J. Phys. (2020), Commun. Phys. (2020)

Scientific outreach Speaker and guide (2016 – 2019) at the “Fête de la Science”, a yearly national French event during which scientific institutions promote science through animations and laboratory tours aimed at high school students and the general public.

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## Volunteer experience

2020 – current **Cykelköket**, Gothenburg, Sweden.

The “Bike kitchen” is an open Do-It-Yourself bicycle workshop.

- Helped people and taught them how to repair their bikes
- Took part in the administration of the workshop as a board member from Sep. 2020 to Sep. 2022

2017 – 2020 **uN p'Tit véLo dAnS La Tête**, Grenoble, France.

Nonprofit self-repair workshop aiming at teaching bicycle mechanics and promoting bike riding.

- Learned bicycle mechanics by dismantling and repairing bikes for the association
- Explained to members of the association how to repair their bikes
- Took part in meetings and helped organize events as a member of the board from Sep. 2018 to Feb. 2020

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## Skills

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## Languages

English    fluent

French    native speaker

Italian    good comprehension (B2)

Swedish    currently learning (B1)

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## Computer

Programming    Python, Git, Matlab, C++

Operating systems    Linux, Windows, MacOS

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## Interests

Bicycle    My main mean of transportation since 2017, volunteer mechanics and board member in Do-It-Yourself bicycle workshops.

Programming    *Open-source software* development with Python, answering questions on *Stack-Overflow*.