

Benjamin Roussel

Curriculum Vitæ

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Research interests

Quantum mechanics, quantum information, quantum computing, mesoscopic physics, quantum optics, signal processing, quantum fields.

Academic background

- 17/01/2021 – now **Postdoctoral Researcher**, *Department of Applied Physics – Aalto University*, Aalto, Finland.
- 01/01/2018 – 31/12/2020 **Research Fellow**, *Advanced Concepts Team – European Space Agency*, Leiden, the Netherlands.
- 01/09/2014 – 15/09/2017 **PhD in Physics**, *ENS de Lyon*, Lyon, France, Advisor: P. Degiovanni.
Autopsy of a quantum electrical current
- 01/09/2013 – 31/07/2014 **MSc Science de la Matière**, *ENS de Lyon*, Lyon, France.
Major in Physics
- 01/09/2011 – 31/07/2012 **BSc Science de la Matière**, *ENS de Lyon*, Lyon, France.
Major in Physics

Teaching

- 01/09/2015 – 31/06/2017 **Teaching assistant (64h per year)**, *Université Claude Bernard Lyon 1*.
30h per year of C++ (tutorials)
24h per year of geometrical optics (laboratory classes)
10h per year of career guidance for students
Quantum information and foundations tutorials
In charge of managing Python scripts for physics teacher training

Supervision

- 01/09/2019 – 31/10/2020 **Supervision of an Ariadna**, *Advanced Concepts Team*, 30 k€. Title: Quantum Shannon Theory and Quantum Darwinism
With A. Feller, we have funded this project within the framework of ESA's Ariadna programme.
- 01/09/2020 – 31/11/2020 **Supervision of a 3 months research internship**, *Advanced Concepts Team*, Student: T. Gustafsson.
Signal processing techniques in relativistic quantum field theory
- 01/05/2019 – 31/07/2019 **Supervision of a 3 months research internship**, *Advanced Concepts Team*, Student: G. Cauquil.
Decoherence and quantum Darwinism with a complex environment
- 01/05/2015 – 31/07/2015 **Supervision of a 3 months research internship**, *ENS de Lyon*, Student: E. Chanrion.
Radiation emitted by a single-electron source

Conference organization

14/11/2019 – 15/11/2019 **Organization of a two-day workshop on quantum mechanics**,
European Space Research and Technology Centre, European Space Agency,
Noordwijk, The Netherlands.
Open Questions in Quantum Physics: Information, Computation and Foundations

Skills

Computing

Programming C/C++, Perl, Python, Haskell, Fortran & Lua
Parallelism OpenMP, MPI & hybrid OpenMP/MPI (IDRIS trainings)
VCS SVN & Git
SQL SQLite & PostGreSQL

Activities

Hobbies Music (violin), reading, photography

Publications and conferences

Articles

- 2021 A. Feller, B. Roussel, I. Frérot, and P. Degiovanni. Phys. Rev. Lett. **126**, page 188901.
Comment on “strong quantum darwinism and strong independence are equivalent to spectrum broadcast structure”.
B. Roussel, C. Cabart, G. Fève, and P. Degiovanni. PRX Quantum **2**, page 020314.
Processing quantum signals carried by electrical currents.
- 2020 A. Feller, G. Cœuret Cauquil, and B. Roussel. Phys. Rev. A **101**, page 062107.
Einselection from incompatible decoherence channels.
- 2019 B. Roussel and A. Feller. Phys. Rev. D **100**, page 045016.
Time-frequency approach to relativistic correlations in quantum field theory.
R. Bisognin, A. Marguerite, B. Roussel, M. Kumar, C. Cabart, C. Chapdelaine, A. Mohammad-Djafari, J.-M. Berroir, E. Bocquillon, B. Plaçais, et al. Nature communications **10**, pages 1–12.
Quantum tomography of electrical currents.
- 2018 C. Cabart, B. Roussel, G. Fève, and P. Degiovanni. Phys. Rev. B **98**, page 155302.
Taming electronic decoherence in one-dimensional chiral ballistic quantum conductors.
- 2017 B. Roussel, C. Cabart, G. Fève, É. Thibierge, and P. Degiovanni. Phys. Status Solidi (b), page 1600621.
Electron quantum optics as quantum signal processing.
- 2016 A. Marguerite, C. Cabart, C. Wahl, B. Roussel, V. Freulon, D. Ferraro, Ch. Grenier, J.-M. Berroir, B. Plaçais, T. Jonckheere, J. Rech, T. Martin, P. Degiovanni, A. Cavanna, Y. Jin, and G. Fève. Phys. Rev. B **94**, page 115311.
Decoherence and relaxation of a single electron in a one-dimensional conductor.

- É. Thibierge, D. Ferraro, B. Roussel, C. Cabart, A. Marguerite, G. Fève, and P. Degiovanni. Phys. Rev. B **93**, page 081302.
Two-electron coherence and its measurement in electron quantum optics.
- B. Roussel, P. Degiovanni, and I. Safi. Phys. Rev. B **93**, page 045102.
Perturbative fluctuation dissipation relation for nonequilibrium finite-frequency noise in quantum circuits.
- 2014 D. Ferraro, B. Roussel, C. Cabart, É. Thibierge, G. Fève, Ch. Grenier, and P. Degiovanni. Phys. Rev. Lett. **113**, page 166403.
Real-time decoherence of Landau and Levitov quasiparticles in quantum hall edge channels.
- Books**
- 2020 P. Degiovanni, N. Portier, C. Cabart, A. Feller, and B. Roussel. EDP Sciences.
Physique quantique, information et calcul – Des concepts aux applications.
- PhD thesis**
- 2017 B. Roussel.
Autopsy of a quantum electrical current.
- Conferences**
- 2021 *International Wigner Workshop*, Virtual conference.
A time-frequency approach to relativistic correlations in quantum field theory (oral presentation).
- 2019 *Conference on Quantum Information and Quantum Control*, Fields Institute, Toronto, Canada.
Quantum tomography of electrical currents (oral presentation).
- 2018 *March Meeting*, LACC, Los Angeles, USA.
Extracting single electron wavefunctions from a quantum electrical current (oral presentation).
Chiral modes in optics and electronics of 2D systems, Centre Paul Langevin, Aussois, France.
Taming electronic decoherence in quantum hall edge channels (oral presentation).
- 2017 *Talk*, Lorentz Institute, Leiden, Netherlands.
Quantum optics with electrons: a new look at quantum coherent electronics (invited talk).
CQT Talk, CQT, NUS, Singapore.
Quantum optics with electrons: a new look at quantum coherent electronics (invited talk).
Nanophysics, from fundamental to applications : reloaded, Quy Nhon, Vietnam.
Signal processing for electron quantum optics (oral presentation).
Quantum Information and Measurement IV: Quantum Technologies, Université Pierre et Marie Curie, Paris, France.
Electron quantum optics as signal processing (oral presentation).
March Meeting, Ernest Morial Convention Center, New Orleans, USA.
Electron quantum optics as signal processing (oral presentation).
- 2016 *33rd International Conference on the Physics of Semiconductors*, Beijing, China.
Joule heating in the quantum regime (poster).

19th International Conference on Superlattices, Nanostructures and Nanodevices, City University of Hong Kong, Hong Kong, China.
Heat dissipation for single electron excitations in quantum hall edge channels (poster).

2015 *GDR Physique Quantique Mésooscopique*, Aussois, France.
Joule heating in the quantum regime (poster).

2014 *1st $\hbar k_B$ Workshop: Thermodynamics of out-of-equilibrium quantum systems*, Institut Néel, Grenoble, France.
Contextuality in quantum thermodynamics (oral presentation).