Dr. HdR. Eddy Collin
Ing. Physics
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Born the 26/08/1975
French nationality, doubled German
Married, two children

Researcher Institut Néel/MCBT dept. UPR 2940 – CNRS

Experimentalist, Condensed Matter and Low Temperature Physics

CAREER

Oct. 2021-now: Director of Research CNRS – DR2. *"Condensed Matter at Ultra-Low Temperatures"*
July 2014-now: Appointed **head of ULT group**.
Feb. 2014: Entitled to head Research, HdR *"Low Temperature Micro and Nano Electro-Mechanics"*
Nov. 2009: Researcher CNRS - CR1. *Opening the microkelvin range to 'new' physics*
Work on NEMS (Nano-Electro-Mechanical-Systems) at Ultra-low temperatures
Nov. 2004: Researcher permanent position CNRS - CR2. **Ultra-Low Temperature** group at the **Institut Néel, CNRS**, (Grenoble, France)
Work on quantum fluids and solids (Helium-3, Helium-4, and confined electrons thereon)

2003-2004: Post-doc. **Quantronics group** at the **SPEC, CEA** (D. Estève and D. Vion, Saclay, France)
Work on quantum computing and superconducting qu-bits (Josephson junctions' circuits)
2002: Post-doc. **electrons on Helium** group at the **Royal Holloway College** (M.J. Lea, London, UK)
Work on electrons confined in 2D and quantum computing (electrons on Helium-4)
2001-1999: PhD thesis in ultra-low temperature physics at the **CRTBT, CNRS** (H. Godfrin and Yu.M. Bunkov, Grenoble, France)
Work on "the effects of disorder on superfluid and 2D ^{3}He at ultra-low temperatures"

1998: Master « **radiation and matter** » at the **University Joseph Fourier, UJF** (Grenoble, France)
1996-1998: Engineering student at the **ENSP-G** (Grenoble, France), now PHELMA
Option "functional materials": quantum mechanics, semiconductors, solid state matter
June-August 1997: Engineering training period at the **SIEMENS** high frequency laboratory (Munich, Germany). *Work on a battery-free piezoelectric high-voltage/high-frequency remote control*
1994-1995: Spec. Maths class **P'** at the lycée **Carnot** (Paris, France)
1993: C Baccalaureate (Science) at the lycée **Honoré de Balzac** (Mitry-Mory 77, France)

DEGREES

Entitled to head research (HdR) degree in physics (UJF Grenoble), the 21/02/2014
Reviewers: A.D. Armour, D. Estève, J.M. Parpia, and G.R. Pickett
Qualified for the position of reader in physics, the 30/01/2003
PhD in condensed matter physics (UJF Grenoble) the 29/01/2002; distinction very good, with congratulations from the jury. *Reviewers: T. Dombre, M. Roger, and E. Varoquaux*
Master (DEA) degree, radiation and condensed matter physics (UJF Grenoble); distinction good, 4th (out of approx. 20 students)
Engineer in physics ENSP-G (INP-G Grenoble, now **PHELMA**); distinction good
TOEFL (Test of English passed in 1996 from ENSP-G school); English level: *fluent*.
License degree science and structure of matter (Jussieu, Paris VI)
Baccalaureate in Science (Paris); distinction good

RESEARCH INTERESTS

My research concerns low and ultra-low temperature physics, with a specific focus on fundamental issues in both quantum and classical aspects. I am particularly concerned with micro and nano mechanics, and quantum-limited microwave optomechanical detection.
The very specific route that I am following is the study of mesoscopic mechanical modes (of 10 µm typical object width, with 10 MHz typical resonance frequency) that can sustain large amplitude motion, up to a few 100 nm when driven. Passive cooling enables to study them in-equilibrium with their environment (down to their quantum ground state around 500 µK): the thermodynamic baths that couple to these modes are then the subject of the study, following mean properties but also fluctuations. This is a specific way of performing quantum sensing, probing e.g. intrinsic Two-Level-Systems or immersing the devices in a quantum fluid. This unique platform opens the way for experiments on quantum thermodynamics and mechanical quantum decoherence.
A specific (and demanding) care is taken in precise calibrations, and a thorough understanding of nonlinear features. This enables to be truly quantitative, with a complete control over the system.

PATENTS

1: *"Dispositif de réinitialisation de bits quantiques à deux états d'énergie*", N° 04805408.4-1225-FR2004002864 (CEA 11-2004),
2: *"Technique de compensation des non-linéarités pour les résonateurs micro et nano-mécaniques permettant l'augmentation du régime de dynamique linéaire*", extension PCT n° WO 2017114689 A1 (CNRS 05-2015).

FUNDING

2023-now: Member of ANR project MORETOME, *NEMS smart sensing. Lead by X. Zhou (IEMN).*
2018-2023: French representative at EMP *(European Microkelvin Platform, H2020 "Infrastructure")*
2015-2021: PI of ERC-CoG grant ULT-NEMS n° 647917 *"Ultra-Cold Nanomechanics"*
2015-2017: PI of ANR MajoranaPRO, *following the retirement of previous PI Yu.M. Bunkov*
2010-2014: PI of the French ANR Grant: QNM (Quantum Nano Mechanics)
Grant between Institut Néel CNRS Grenoble, LOMA CNRS Bordeaux, and Quantronics CEA Saclay
2009-2013: Member of the European FRP7 Microkelvin collaboration
Collaboration between 12 European partners aiming at opening the microkelvin temperature range to new users. French coordination by H. Godfrin
2005-2008: Member of ANR project ULTIMA, *Ultra Low Temperature Instrument for Measurements in Astrophysics. Lead by the ULT Grenoble team: Yu.M. Bunkov, E. Collin and H. Godfrin*

Pre. 2004: participation as post-doc. To E.U. projects *COSLAB (Cosmology in the Laboratory), Surface e- on mesoscopic structures (low dimensional ideal electronic systems), and Squbit2 (Superconducting quantum bits circuits, second grant).*

GENERAL DUTIES

01/08/2022: Associate Editor *J. of Low Temperature Physics (JLTP)*; Eds. N. Sullivan, J. Pekola. Member of the scientific board since 15/07/2019.
Co-organization of international schools *(board member of "Cryocourse", directed by C. Enss)*

Main organizer of *Cryocourse 2021, Grenoble Chichilianne, 20-28 September 2021*
Co-organization of international conferences *(QFS2010 in France, ULT2014 in Argentina)*
Co-organization of international workshops *(COSLAB2004 in France)*

Co-Web Master of ULT group, and related websites
https://neel.cnrs.fr/equipes-poles-et-services/ultra-basses-temperatures-ubt
Since 2019: Data Management Plan of *the ULT group, and Néel EMP partners*,
https://hub.neel.cnrs.fr/index.php/s/cnYYDcAJ63YTdDe
2014-2017: Appointed nanomechanics expert at OMNT *(Observatoire micro&nano technologies, CNRS-CEA joint unit created in 2005 for technological survey*

Supervision of Master students: L. Filleau (2006), Y. Bilbao-Zarraga (2008), J. Kofler (2009), T. Moutonnet (2010), H.A. Ngoma (2017)
Supervision of PhD students: M. Defoort (2011-2014 PhD), O. Maillet (2014-2018 PhD), D. Cattiaux (2017-2021 PhD), S. Kumar (2017-2021 PhD co-dir.), I. Golokolenov (2019-2022 PhD), B. Alperin (2020-2024 PhD co-dir.), A. Delattre (2022-now PhD), M. Dicosta (2025-now PhD)
Supervision of Post-Docs.: K.J. Lulla (2011-2012), A.I. Maldonado Cid (2016), X. Zhou (2016-2017), R. Gazizulin (2016-2018)

General duties as reviewing articles PhD/HDR, scientific board **O.V. LOUNASMAA prize** (2020), consulting board for conferences, interaction with journalists, admin. tasks, seminars, etc…

TEACHING & OUTREACH

Teaching at Master level *(summer school Cryocourse 2007, 2011, 2019, 2021, Heidelberg winter school 2009 and Heidelberg teaching seminar in 2014)*: Nuclear Magnetic Resonance (NMR), Micro/nano-mechanics, Superfluid ^{3}He, and ULT cryogenics. UGA *Quantum Matter* Master 2 *"outreach"* lecture since 2020.
Since 2013: Participation to the CNRS cryogenics lectures, *"initiation to ULT physics"*
Laboratory tours and visits of ULT goup for students and visitors; punctual participation to various *"open-door days"*.

COLLABORATIONS

Active collaborations with:
University of Nottingham, A.D. Armour (theory)
Royal Holloway University of London, A. Casey and L. Levitin (nanomechanics, quantum fluids and dark matter search)
University of Lancaster, V. Tsepelin and S. Kafanov (nanomechanics, quantum fluids and turbulence)
Aalto University, M. Sillanpää (nanomechanics and quantum technologies)
IEMN CNRS, X. Zhou (nanomechanics and engineering)
Néel CNRS, O. Bourgeois (nanothermics)

PUBLICATIONS

About 100 publications in peer-reviewed journals (see list), among which:

- "Heat conduction measurements in ballistic 1D phonon waveguides indicate breakdown of the thermal conductance quantization"
  Adib Tavakoli, Kunal Lulla, Thierry Crozes, Natalio Mingo, Eddy Collin, and Olivier Bourgeois
  Nature Comm. Vol. 9, 4287 (2018).

- "Detecting a phonon flux in superfluid ^{4}He by a nanomechanical resonator"
  A. M. Guénault, A. Guthrie, R.P. Haley, S. Kafanov, Yu. A. Pashkin, G. R. Pickett, V. Tsepelin, D. E. Zmeev, E. Collin, R. Gazizulin, and O. Maillet
  Phys. Rev. B Vol. 101, 060503 (2020).

- "A macroscopic object passively cooled into its quantum ground state of motion: beyond single-mode cooling"
  Dylan Cattiaux, Ilya Golokolenov, Sumit Kumar, Mika Sillanpää, Laure Mercier de Lépinay, Rasul Gazizulin, Xin Zhou, Andrew D. Armour, Olivier Bourgeois, Andrew Fefferman and Eddy Collin
  Nature Comm. Vol. 12, 6182 (2021).

- "Mesoscopic Quantum Thermo-mechanics: a new frontier of experimental physics"
  E. Collin
  AVS Quantum Sci. Vol. 4, 020501 (2022).

- "Nanomechanical damping via electron-assisted relaxation of two-level systems"
  Olivier Maillet, Dylan Cattiaux, Xin Zhou, Rasul R. Gazizulin, Olivier Bourgeois, Andrew D. Fefferman, and Eddy Collin
  Phys. Rev. B Vol. 107, 064104 (2023).

- "Thermodynamics of a single mesoscopic phononic mode"
  Ilya Golokolenov, Arpit Ranadive, Luca Planat, Martina Esposito, Nicolas Roch, Xin Zhou, Andrew Fefferman, and Eddy Collin
  Phys. Rev. Research Vol. 5, 013046 (2023).

- "Aluminum nuclear demagnetization refrigerator for powerful continuous cooling"
  Matthias Raba, Sébastien Triqueneaux, James Butterworth, David Schmoranzer, Emilio Barria, Jérôme Debray, Guillaume Donnier-Valentin, Thibaut Gandit, Guillaume Gay, Anne Gerardin, Johannes Goupy, Olivier Tissot, Eddy Collin, and Andrew Fefferman
  Phys. Rev. Applied Vol. 22, 024027 (2024).

- "Waveguides in a quantum perspective"
  E. Collin, A. Delattre
  New J. Phys. Vol. 27, 093502 (2025).

CONFERENCE CONTRIBUTIONS

About 60 conference contributions (*excluding* collaborators' ones), among which the *invited talks*:

- "Probing mesoscopic lengthscales in (super)fluid ^{3}He"
  Grand Challenges in QFS, Buffalo, USA (7-8 August 2015).

- "Nanomechanical beams for sub-coherence length studies in superfluid 3He" (invité)
  QFS 2016, Prague, Czech Republic (10-16 August 2016).

- "Interplay between amplitude fluctuations and nonlinear dynamics in NEMS"
  FNS conference, La Thuile, Italy (05-10 February 2017).

- "Frequency fluctuations in nanomechanical resonators"
  FNS2019, Palm Springs, USA (10-14 February 2019).

- "Brute-force cooling and on-chip thermometry for microwave opto-mechanics"
  QFS 2019, Edmonton, Canada (7-13 August 2019).

- "A macroscopic object passively cooled into its quantum ground state of motion"
  LT29, Sapporo, Japan (18-24 August 2022).

- "In-equilibrium thermodynamics of a mesoscopic mechanical object: towards the quantum ground-state"
  FNS Delft, Netherlands (6-9 June 2023).

- "Low temperature fluctuations of a mesoscopic mechanical mode"
  ULT2025 Lancaster, UK (15-18 August 2025).