

Xavier Rojas

Royal Society URF and Proleptic Lecturer

Contact Information

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Employment

2016 - now **Royal Society University Research Fellow and Proleptic Lecturer (Oct 2016 - now).**

Location : Royal Holloway, University of London, UK

Project : Cavity optomechanics with superfluid 4He in a nanofluidic environment.

2015 - 2016 **Postdoctoral Researcher (Mar 2015 - Sep 2016).**

Location : Royal Holloway, University of London, UK

Supervisor : John Saunders

Project : Study of topological superfluidity of helium 3 confined in nanofluidic geometries, as a model system to further our understanding of topological quantum matter.

2012 - 2015 **Postdoctoral Researcher (Apr 2012 - Feb 2015).**

Location : University of Alberta, Edmonton, Canada

Supervisor : John P. Davis

Project : Development of acoustic techniques for the study of quantum fluids (helium 3 and 4) in the presence of nanofluidic confinement.

2012 **Postdoctoral Researcher (Jan - Mar 2012).**

Location : Laboratoire de Physique Statistique, Ecole Normale Supérieure, Paris, France

Supervisor : Sébastien Balibar

Project : Study of giant plasticity of helium 4 quantum crystals

2008 - 2011 **Ph.D. of Science (Sep 2008 - Dec 2011).**

Location : Laboratoire de Physique Statistique, Ecole Normale Supérieure, Paris, France

Supervisor : Sébastien Balibar

Title : Supersolidity and Quantum Plasticity

Academic Grant & Awards

- 2021-2024 **Royal Society URF renewals**, *PI (£397,868)*, Superfluid Optomechanics for Quantum Sensing Applications, (awarded not yet announced).
- 2021-2024 **STFC, Co-I (£1,690,391)**, Quantum Enhanced Superfluid Technologies for Dark Matter and Cosmology.
- 2021-2024 **STFC, PI (£610,404)**, Quantum Simulators for Fundamental Physics.
- 2018-2021 **EPSRC Standard Research, Co-I (£1,406,300)**, Topological mesoscopic superfluidity of helium 3.
- 2018-2021 **Royal Society Research Grant, PI (£200,000)**, 2D phononic crystals for superfluid optomechanics in the quantum regime.
- 2018-2021 **Royal Society Enhancement Award, PI (£110,092)**, Superfluid optomechanics towards the quantum Rregime.
- 2017 **Royal Holloway Strategic Funding, PI (£5,622)**, FEM simulation for designing nanofabricated structures.
- 2016-2021 **Royal Society University Research Fellowship, PI (£486,383)**, Cavity optomechanics with superfluid 4He in a nanofluidic Environment.
- 2013-2015 **Postdoctoral Research Fellowship, PI (70,000 CAD/year)**, allocated by Alberta Innovation Technology Future and University of Alberta, Canada.
- 2008-2011 **PhD Scholarship**, merit-based scholarship allocated by the French Ministry of Higher Education and Research, France.
- 2007-2008 **MSc Scholarship**, merit-based scholarship allocated by Université Paris 6, France.

Publications

h-index : 15 (2008 - 2021), 23 publications (592 citations).

2021 **Superfluid Optomechanics with Phononic Nanostructures**

S. Spence, Z. X. Koon, S. Horsley and **X. Rojas**

Physical Review Applied **15**, 034090 (2021).

Fragility of surface states in topological superfluid 3He

P.J. Heikkinen, A. Casey, L.V. Levitin, **X. Rojas**, A. Vorontsov, P. Sharma, N. Zhelev, J.M. Parpia, J. Saunders

Nature Communication **12**, 1574 (2021).

2020 **Comment on "Stabilized Pair Density Wave via Nanoscale Confinement of Superfluid 3He"**

L.V. Levitin, **X. Rojas**, P.J. Heikkinen, A. Casey, J.M. Parpia, J. Saunders

Physical Review Letters **125**, 059601 (2020).

- 2018 **Fabrication of micro fluidic cavities using Si-to-glass anodic bonding**
 N. Zhelev, T.S. Abhilash, R.G. Bennett, E.N. Smith, B. Ilic, J.M. Parpia, LV Levitin, **X. Rojas**, A. Casey, J. Saunders
 Review of Scientific Instruments **89**, 073704 (2018).
- 2017 **Ultralow-dissipation superfluid micromechanical resonator**
 F. Souris, **X. Rojas**, P. H. Kim, and J. P. Davis
 Physical Review Applied **7**, 044008 (2017).
The A-B transition in superfluid ^3He under confinement in a thin slab geometry
 N. Zhelev, T.S. Abhilash, E.N. Smith, R.G. Bennett, **X. Rojas**, L. Levitin, J. Saunders, and J.M. Parpia
 Nature Communications **8**, 15963 (2017).
- 2016 **Optomechanics and Thermometry of Cryogenic Silica Microresonators**
 A. J. R. MacDonald, B. D. Hauer, **X. Rojas**, P. H. Kim, G. G. Popowich, J. P. Davis
 Physical Review A **93**, 013836 (2016).
Dislocations in a quantum crystal, Solid helium : A model and an exception
 S. Balibar, J. Beamish, A. Fefferman, A. Haziot, **X. Rojas**, F. Souris
 Comptes Rendus Physique, **17** 264-275 (2016).
Dealing with discordance : a novel approach for analysing U–Pb detrital zircon datasets
 J. R. Reimink, J. H.F.L. Davies, J. W.F. Waldron, **X. Rojas**
 Journal of Geological Society **173**, 4, 577 (2016).
- 2015 **Thermo-mechanical characterization of on-chip buckled dome Fabry-Perot Micro-cavities**
 M. H. Bitarafan, H. Ramp, T. Allen, C. Potts, **X. Rojas**, A. J. MacDonald, J. P. Davis, R. G. DeCorby
 J. Opt. Soc. Am. B **32**, 1214 (2015).
Superfluid nanomechanical resonator for quantum nanofluidics (*)**
X. Rojas and J. P. Davis
 Physical Review B **91**, 024503 (2015).
Optical microscope and tapered fiber coupling apparatus for a dilution refrigerator
 A. J. R. MacDonald, G. G. Popowich, B. D. Hauer, P. H. Kim, A. Fredrick, **X. Rojas**, P. Doolin, J. P. Davis
 Review of Scientific Instrument **86**, 013107 (2015).
Resolving oxygen isotopic disturbance in zircon : A case study from the low $\delta^{18}\text{O}$ Scourie dikes, NW Scotland
 J. H.F.L. Davies, R. J. Stern, L. M. Heaman, **X. Rojas**, E. L. Walton, S. Andrew DuFrane
 American Mineralogist, **100**, 1952 (2015).
- 2014 **Ultrasonic Interferometer for First-Sound Measurements of Confined Liquid ^4He**
X. Rojas, B. D. Hauer, A. J. MacDonald, P. Saberi, Y. Yang, J. P. Davis
 Physical Review B **89**, 174508 (2014). – *Selected as Editors' Suggestion.*
Remote Sensing in Hybridized Arrays of Nanostrings
 T. S. Biswas, Jin Xu, **X. Rojas**, C. Doolin, B. D. Hauer, K. S. D. Beach, J. P. Davis

- Nano Letter **14**, 2541 (2014).
- 2013 **The Giant Plasticity of a Quantum Crystal**
A. Haziot, **X. Rojas**, A. D. Fefferman, J. R. Beamish, S. Balibar
Physical Review Letters **110**, 035301 (2013). – *Selected as Editors' Suggestion.*
Haziot et al. Reply :
Physical Review Letters **111**, 119602 (2013).
- 2012 **Elastic Effects in Torsional Oscillators Containing Solid Helium**
J. R. Beamish, A. D. Fefferman, A. Haziot, **X. Rojas**, S. Balibar
Physical Review B (R) **85**, 180501 (2012). – *Selected as Editors' Suggestion.*
Disorder, Supersolidity, and Quantum Plasticity in Solid Helium 4
S. Balibar, A. D. Fefferman, A. Haziot, **X. Rojas**
Journal of Low Temperature Physics **168**, 221 (2012).
⁴He Crystal Quality and Rotational Response in a Transparent Torsional Oscillator
A. D. Fefferman, **X. Rojas**, A. Haziot, S. Balibar, J. T. West and M. H. W. Chan
Physical Review B, **85**, 094103 (2012).
Migration of ³He impurities along Dislocation Lines in ⁴He Single Crystals
X. Rojas, A. Haziot, S. Balibar
J. Phys. : Conf. Ser. **400**, 012062 (2012).
- 2010 **Anomalous Softening of Helium 4 Crystals**
X. Rojas, A. Haziot, V. Bapst, H.J. Maris, and S. Balibar
Physical Review Letters **105**, 145302 (2010).
How to Prepare an Ideal ⁴He Crystal
C. Pantalei, **X. Rojas**, D.O. Edwards, H.J. Maris, and S. Balibar
Journal of Low Temperature Physics **159**, 452 (2010).
Acoustic Properties of ⁴He Crystals in the Limit of Zero Impurity
X. Rojas, C. Pantalei, H.J. Maris, and S. Balibar
Journal of Low Temperature Physics **158**, 478 (2010).
[Proceedings](#)
- 2011 **Quantum Crystals : From Quantum Plasticity to Supersolidity**
S. Balibar, A. Haziot, **X. Rojas**
Proceeding of SPIE Vol. **7945**, 794502 (2011).

Talks & Posters

- 2019 **Invited Talk** : Superfluid Optomechanics within the nanofluidic environment
British Optomechanics Research Network meeting, UK
GdR MecaQ 4th Annual Meeting, France
- 2018 **Poster** : Proposal for superfluid optomechanics within the nanofluidic environment
Gordon Research Conference : The Rise of Quantum Acoustics, Ventura, CA, USA
- 2017 **Invited Talk** : Superfluid Optomechanics within the nanofluidic environment
IoP meeting : Nanomechanics at Low Temperature, Nottingham, UK
IoP meeting : Low Temperature Group, Manchester, UK

- Lancaster, Department of Physics seminar, Lancaster, UK
 Royal Holloway, Department of Physics seminar, Lancaster, UK
Poster : Proposal for superfluid optomechanics within the nanofluidic environment
 QTC 2017, Aalto, Finland
 LT28, Goteborg, Sweden
Poster : Thermal transport in mesoscopic superfluid ^3He to detect topological excitations
 ULT 2017, Heidelberg, Germany
- 2016 **Poster** : Nanofluidic Structures for the Study of Mesoscopic Topological Superfluidity
 QFS2016, Prague, Czech Republic
- 2015 **Invited talk** : Superfluid Nanomechanical Resonator in Confined Geometries
 QFS2015, Niagara Falls, USA
Invited talk : Search for Majorana Fermions in Superfluid Helium 3
 Grand Challenges in Quantum Fluids and Solids Workshop, Buffalo, USA
- 2014 **Talk** : Fourth Sound Measurements of Superfluid ^4He Confined in Nanofluidic Cavities
 LT27, Buenos Aires, ARGENTINA
- 2013 **Invited talk** : First-sound Measurements of Liquid ^4He near T_λ in Microfluidic Devices
 QFS 2013, Matsue, JAPAN
- 2011 **Poster** : Migration of ^3He Impurities along Dislocation Lines in ^4He Single Crystals
 ULT 2011, Daejong, SOUTH KOREA
 LT 26, Beijing, CHINA
Invited talk : Migration of ^3He Impurities along Dislocation Lines in ^4He Single Crystals
 Supersolidity Workshop 2011, New York, USA
Talk : The Rotation Anomaly of High Quality ^4He Single Crystals
 APS March Meeting 2011, Dallas, USA
- 2010 **Poster** : Anomalous Softening of Helium 4 Crystals
 QFS 2010, Grenoble, France
Invited talk : Anomalous Softening of Helium 4 Crystals
 Supersolidity Workshop 2010, Paris, France
- 2009 **Talk** : Acoustic Properties of a Supersolid
 Ph.D. seminar of LPS-ENS, Paris, France
Poster : Elastic Properties of Solid Helium 4 : Polycrystals vs Single Crystals
 QFS 2009, Chicago, USA
Poster : Elastic Properties of Solid Helium 4 : Polycrystals vs Single Crystals
 Supersolidity Workshop 2009, Banff, Canada
Talk : Acoustic Properties of a Supersolid
 Congress of the Société Française de Physique 2009, Palaiseau, France

Education

Qualifications

- 2019 **Qualification**, by the National French Council of Universities (CNU), section 28.
 2013 **Qualification**, by the National French Council of Universities (CNU), section 28.

Diplomas

- 2008 - 2011 **Ph.D. of Science**, delivered by *Université Pierre et Marie Curie, Paris, France*.
Title : Supersolidity and Quantum Plasticity
Supervisor : Sébastien Balibar
Location : Laboratoire de Physique Statistique, Ecole Normale Supérieure
Defended : 20th December 2011
- 2008 **Master of Science : Condensed Matter Physics**, delivered by *Université Pierre et Marie Curie, Ecole Normale Supérieure and Université d'Orsay*.
- 2006 **Bachelor of Science : Fundamental Physics**, delivered by *Université Pierre et Marie Curie*.
- 2003 **High School Diploma**, *Lycée Hélène Boucher, Paris*.

Internships

- 2008 **Wetting properties of ⁴He on graphite**, *January to March*.
Laboratoire de Physique Statistique, Ecole Normale Supérieure, Paris, France
Supervisor : Sébastien Balibar
- 2007 **Quantum noise of a subnanosecond single electron source**, *May to June*.
Laboratoire Pierre Aigrain, Mesoscopic Physics Group, Ecole Normale Supérieure, Paris, France
Supervisor : Bernard Plaçais
- 2006 **Study of the Ising model in 1D and 2D**, *July to August*.
Laboratoire de Physique Théorique des Hautes Energies, Université Pierre et Marie Curie, Paris, France
Supervisor : Vladimir Dotsenko
- 2006 **Mass spectrometry by time of flight at high energy**, *January to February*.
Centre d'Etude des Environnements Terrestre et Planétaires de Saint-Maur, Université Pierre et Marie Curie, France
Supervisor : Jacques Berthelier

Summer schools

- 2009 **Cryocourse 2009**, *Marie Curie Advanced Cryogenics Course*, organized by H. Godfrin and M. Paalanen, FINLAND.
(2 weeks)

Teaching

@ Royal Holloway, University of London, UK

- 2019 - 2021 **Lecturing**, *PH1920 - Physics of the Universe (1st year students)*, half module.
- 2019 - 2021 **Lecturing**, *PH1110 - Mathematics for scientist 1 (1st year students)*, half module.
- 2018 - 2019 **Lecturing**, *PH1120 - Mathematics for scientist 2 (1st year students)*, 9 lectures.
- 2017 - 2019 **Demonstrating**, *PH2130 - Mathematical methods (2nd year students)*, 11 classes.
- 2017 - 2019 **Demonstrating**, *PH3010 - Physics skills (3rd year students)*, 3 classes.

@ University of Alberta, Edmonton, Canada

- 2013 - 2014 **Lecturing**, *Modern Physics 208 (1st and 3rd year students)*, 6 lectures.
- 2012 - 2013 **Lecturing**, *Optics 130 (1st and 3rd year students)*, 2 lectures.

@ Conservatoire National des Arts et Métiers (CNAM), Paris, France

2011 - 2012 **Lecturing & Demonstrating**, *Electric Engineering (3rd year students)*, 30 lectures.

@ Université Pierre et Marie Curie, Paris, France

2010 - 2011 **Teaching Assistant**, *Classical Physics (1st year students)*, 64 hours.

2009 - 2010 **Teaching Assistant**, *Classical Physics (1st year students)*, 64 hours, Faculté de Médecine Pitié-Salpêtrière.

2008 - 2009 **Teaching Assistant**, *Classical Physics and Statistics (1st year students)*, 64 hours.

Supervising

@ Royal Holloway, University of London, UK

2019 - now **Co-supervising**, 1 postdoc (*Angadjit Singh*).

2017 - now **Supervising**, 1 PhD student (*Sebastian Spence*), 4 years.

2019 - 2020 **Supervising**, 1 MSc student (*Simon Perrett*), 4th year research project.

2017 - 2018 **Supervising**, 1 EuroMaster student (*Zaynab Tahir*), 1 year.

2017 **Supervising**, 1 MSc student (*James Halson*), Summer Placement - 6 weeks.

2016 **Supervising**, 1 MSc student (*Zhe Xian Koong*), Summer Placement - 6 weeks.

@ University of Alberta, Canada

2012 - 2015 **Supervising**, 2 BSc students (*Parnian Sabieri, Alberto Palomino*) - Summer Placement (5 months).

2012 - 2015 **Co-supervising**, 2 MSc students (*Yikai Yang, Allison MacDonald, Tommy Clark*) - Master thesis (2 years).

2012 - 2015 **Co-supervising**, 5 PhD students (*Hugh Ramp, Brad Hauer, Callum Dollin, Paul Kim, Tushar Biswas*).

@ Laboratoire de Physique Statistique, Ecole Normale Supérieure, France

2008 - 2011 **Supervising**, 1 high-school student (*Jane Collpart*), 2 weeks.

2008 - 2011 **Co-Supervising**, 1 BSc student (*Victor Bapst*), 1 month.

2008 - 2011 **Co-Supervising**, 1 MSc student (*Ariel Haziot*), 2 months.

Examining

2018 **Examining**, PhD student's viva (*Rupert Mellor*), *Nano Electro Mechanical Systems at Ultra Low Temperatures as Probes for Quantum Fluids*, July 2018.

Administrative roles at Royal Holloway

2020 - now **Early-Career Researchers Representative**, for the Research and Knowledge Exchange committee, School of Engineering, Physical, and Mathematical Sciences.

2018 - now **Research Staff Representative**, for the Equality and Diversity committee, Department of Physics.

2017 - now **Communication Lead**, of the communication committee for the Department of Physics.

2017 - now **Website Content Champion**, for the Department of Physics, Royal Holloway.

2017 - 2019 **Co-Chair**, of the Research Staff Forum for the Department of Physics, Royal Holloway.

Organising committee

- 2019 - now **Member of the scientific advisory board**, *British Optomechanics Research Network (BORN)*, UK.
- 2019 **Member of the international programme and advisory committee**, *International Conference on Quantum Fluids and solids 2019*.
- 2012 - 2014 **Referee**, *annual poster session, Graduate Physics Student Association (3 years)*, University of Alberta, Canada.
- 2010 - 2011 **Co-Organizator**, *twice-monthly PhD student seminar, Laboratoire de Physique Statistique (2 years)*, Ecole Normale Supérieure, France.

Refereeing

- 2013 - now **Reviewer for**, *Physical Review L, Physical Review B, Physics Review Applied, New Journal of Physics, Journal of Low Temperature Physics, Optics Communications, Optics Express, Ultrasonics, Journal of Visualized Experiment, npj quantum information*.