Thomas Boulier

PhD in Quantum Physics

Education

2008 **Bachelor**, *École Normale Supérieure (ENS) and Université Pierre et Marie Curie (Paris 6)*.
Specialization in Fundamental Physics

2011 **Master**, *École Normale Supérieure (ENS) and Université Pierre et Marie Curie (Paris 6)*.
Specialization in Quantum Physics

2014 **PhD**, *Laboratoire Kastler Brossel (CNRS, ENS, UPMC, and Collège de France)*, Paris, France.
Supervised by Pr. Alberto Bramati, with the highest honors.

Examination Commission: Mauro Antezza, Pavlos Savvidis, Raphaelle Colombelli, Maxime Richard, Valia Voliotis, and Alberto Bramati.

Full Time Research Experience

Jun–Aug 2008 **Undergraduate training at PIIM, Marseille, France**, *"Probe Characteristics of a Hydrogen plasma", directed by Pr. Fabrice Doveil*.

Feb–Aug 2009 **Graduate training at School of Engineering and Applied Science, Harvard, MA, USA**, *"Repulsive Casimir effect between a microsphere and a plane: towards nanoscale quantum levitation", directed by Pr. Federico Capasso*.

Feb–May 2011 **Short graduate training at LPS, Paris-Sud University, Orsay, France**, *"Hubbard model for disordered fermions and bosons mixture", directed by Pr. Pascal Simon*.

Oct 2011 – Nov 2014 **PhD thesis at Laboratoire Kastler Brossel, Paris, France**, *"Controlled vortex lattices and non-classical light with microcavity polaritons", directed by Pr. Alberto Bramati and Pr. Elisabeth Giacobino*.

Feb 2015 – Sep 2018 **Postdoctoral researcher at Joint Quantum Institute (NIST and UMD, MD, USA)**, *Laser Cooling and Trapping group – "Strongly correlated systems on a double-well optical lattice", in the team of Dr. Trey Porto and Pr. William Phillips*.

Apr–Jul 2017 **Short-term Postdoctoral researcher at ETHZ, Zurich, Switzerland**, *Quantum Optics group, "Many-body Floquet engineering in a honeycomb optical superlattice", Pr. Tilman Esslinger team*, Part of the Marie Sklodowska-Curie Action (MSCA) Fellowship.

Oct 2018 – Oct 2019 **Postdoctoral researcher at LCF (IOGS), Palaiseau, France**, *Quantum Optics group – "Quantum Simulation with Rydberg atom on tweezers", Pr. Antoine Browaeys' team*.

Nov 2019 – now **Postdoctoral researcher at LKB (UPMC), Paris, France**, *Quantum Optics group – "Nonlinear quantum optics with tapered optical fibers", Dr. Quentin Glorieux' team*.

Additional Experience

Aug 2015 – Jun 2016 **Supervised the complete move and partial rebuilding of an ultracold atoms experiment**, *(Ultracold Rydbergs on a 3D double-well optical lattice)*, from NIST to UMD.

Teaching Experience

Assistant at Université Pierre et Marie Curie – Paris (192h)

2011–2012 **Undergraduate level (L2)**, *Exercices and Experimental Work (64h). Thermodynamics and wave phenomena*.

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2012–2013 **Undergraduate level (L3)**, *Exercices (64h). Electromagnetic waves.*

Undergraduate level (L2), *Experimental Work (24h). Thermodynamics and wave phenomena.*

Graduate level (M1), *Experimental Work, (32h). Lasers: principles and applications.*

2013–2014 **Graduate level (M1)**, *Experimental Work, (8h). Lasers: principles and applications.*

Lecturer at JQI Summer School – Washington DC (4h)

2015–2018 **Graduate level (PhD)**, *Lectures (4x1h).*

Lecturer at Institut Galilée – Villetaneuse (66h, vacations)

2019–2020 **Undergraduate level (L1)**, *Lectures, exercises and experimental work (35h equ. TD). Principles of Electricity.*

2020 **Undergraduate level (L2)**, *Lectures and exercises (21h equ. TD). Mathematics for Physicists.*

Students supervision

2011–2014 **4 undergraduate students**, *for duration of 2, 3, 4 and 6 months.*

2015–2018 **Full-time managing a 3 graduate students team and 1 undergrad**, *as lead postdoc.*

Grants and Awards

2016 **Marie Sklodowska-Curie Action (MSCA)**, *Individual Fellowship*, Global (3 years), Grant H2020-MSCA-IF-2015 – 701034 – MADAME.

2019 **Public Outreach Grant "Coup de Pouce"**, *La Diagonale Paris-Saclay*, co-managing the "ResearchX3D" project with Dr. Nikola Sibalić, 1 year.

2020 **Junior Research Chair**, *Ecole Normale Supérieure*, 2 years.

Publications in international refereed journals

- Barredo, D., Lienhard, V., Scholl, P., de Léséleuc, S., **Boulier, T.**, Browaeys, A., and Lahaye, T. (2019). Three-dimensional trapping of individual Rydberg atoms in ponderomotive bottle beam traps. *Phys. Rev. Lett.* **124** (2), 023201.
- **T. Boulier**, J Maslek, M Bukov, C Bracamontes, E Magnan, S Lellouch, E Demler, N Goldman, JV Porto, "Parametric instabilities in a 2D periodically-driven bosonic system: Beyond the weakly-interacting regime." *Phys. Rev. X* **9** (1), 011047 (2019)
- E. Magnan, J. Malsek, A. Ristelli, C. Bracamontes, **T. Boulier** and J. V. Porto, "A low-steering piezo-driven mirror." *Rev. of Sci. Instr.* **89.7** 073110 (2018)
- **T. Boulier**, S. Pigeon, E. Cancellieri, P. Robin, E. Giacobino and A. Bramati, "Coherent merging of counterpropagating exciton-polariton superfluids. *Phys. Rev. B* **98** 024503 (2018)
- J. Young, **T. Boulier**, E. Magnan, E. A. Goldschmidt, R. M. Wilson, S. L. Rolston, J. V. Porto and A. V. Gorshkov, Dissipation-induced dipole blockade and antiblockade in driven Rydberg systems. *Phys. Rev. A* **97.2** 023424 (2018).
- **T. Boulier**, E. Magnan, C. Bracamontes, J. Malsek, J. Young, E. A. Goldschmidt, A. V. Gorshkov, S. L. Rolston and J. V. Porto, Spontaneous avalanche dephasing in Rydberg ensembles. *Phys. Rev. A* **96.5,** 053409 (2017).
- E. A. Goldschmidt, **T. Boulier**, R. C. Brown, S. B. Koller, J. Young, A. V. Gorshkov, S. L. Rolston and J. V. Porto, Anomalous broadening in driven dissipative Rydberg systems. *Phys. Rev. Lett.* **116,** 113001 (2016).
- **T. Boulier**, E. Cancellieri, N. D. Sangouard, Q. Glorieux, A. V. Kavokin, D. M. Whittaker, E. Giacobino and A. Bramati, Injection of Orbital Angular Momentum and Storage of Quantized Vortices in Polariton Superfluids. *Phys. Rev. Lett.* **116,** 116402 (2016).
- **T. Boulier**, H. Terças, D. D. Solnyshkov, Q. Glorieux, E. Giacobino, G. Malpuech and A. Bramati, Annular Vortex Chain in a Resonantly Pumped Polariton Superfluid. *Sci. Rep.* **5,** 9230 (2015).

- E. Cancellieri, **T. Boulier**, R. Hivet, D. Ballarini, D. Sanvitto, M. H. Szymanska, C. Ciuti, E. Giacobino and A. Bramati, Merging of vortices and antivortices in polariton superfluids. *Phys. Rev. B* **90,** 214518 (2014).
- R. Hivet, E. Cancellieri, **T. Boulier**, D. Ballarini, D. Sanvitto, F. M. Marchetti, M. H. Szymanska, C. Ciuti, E. Giacobino and A. Bramati, Interaction-shaped vortex-antivortex lattices in polariton fluids. *Phys. Rev. B* **89,** 134501 (2014).
- **T. Boulier**, M. Bamba, A. Amo, C.Adrados, A. Lemaitre, E. Galopin, I. Sagnes, J.Bloch, C. Ciuti, E. Giacobino and A. Bramati, Polariton-Generated Intensity Squeezing in Semiconductor Micropillars. *Nature Communications* **5,** 3260, (2014).
- R. Hivet, H. Flayac, D. D. Solnyshkov, D. Tanese, **T. Boulier**, D. Andreoli, E. Giacobino, J. Bloch and A. Bramati, G. Malpuech and A. Amo, Half-solitons in a polariton quantum fluid behave like magnetic monopoles. *Nature Physics* **8,** 724–728, (2012).

Pre-prints

- M.J. Jacquet, F. Claude, A. Maitre, **T. Boulier**, E. Cancellieri, C. Adrados, A. Amo, S. Pigeon, Q. Glorieux, A. Bramati and E. Giacobino, 2020. Fluids of light for analogue gravity physics. arXiv preprint arXiv:2002.00043.

Publications in international refereed proceedings

- **T. Boulier**, J. Maslek, M. Bukov, C. Bracamontes, N. Goldman and J.V. Porto, Stability of Bose Einstein Condensates in Periodically Driven 2D Optical Lattices. *Bulletin of the American Physical Society* 2018/5/31
- **T. Boulier**, E. Cancellieri, N. D. Sangouard, R. Hivet, Q. Glorieux, E. Giacobino and A. Bramati, Lattices of quantized vortices in polariton superfluids. *Comptes Rendus de l'Académie des Sciences - Series IV - Physics-Astrophysics* **17,** 805-956 (2016)
- **T. Boulier**, R. Hivet, E. Cancellieri, Q. Glorieux, A. Bramati, and E. Giacobino, Microcavity polaritons: from quantum optics to quantum fluids. *European Quantum Electronics Conference* (p. EC_3_1). Optical Society of America (2015).
- **T. Boulier**, Q. Glorieux, E. Cancellieri, E. Giacobino, and A. Bramati, Orbital angular momentum injection in a polariton superfluid. *Proc. SPIE* **9370,** Quantum Sensing and Nanophotonic Devices XII, 93702R (2015).
- A. Amo, **T. Boulier**, E. Cancellieri, R. Hivet, D. Sanvitto, C. Ciuti, I. Carusotto, R. Houdre, A. Bramati, and E. Giacobino, Quantum Coherence in Polariton Fluids. *The Rochester Conferences on Coherence and Quantum Optics and the Quantum Information and Measurement meeting*, OSA Technical Digest (online) (Optical Society of America, 2013), paper T4A.1.
- R. Hivet, H. Flayac, D. Tanese, **T. Boulier**, D. Andreoli, J. Bloch, D. D. Solnyshkov, G. Malpuech, A. Amo, E. Giacobino and A. Bramati, Observation of Oblique Half-Solitons in polariton Superfluids. *Conference on Lasers and Electro-Optics 2012*, OSA Technical Digest (Optical Society of America, 2012), paper QM2C.3.
- A. Amo, M. Abbarchi, R. Hivet, H. Flayac, D. D. Solnyshkov, D. Tanese, **T. Boulier**, D. Andreoli, E. Giacobino, J. Bloch, A. Bramati and G. Malpuech, Macroscopic Self-trapping and Non-linear Oscillations in Coupled Polariton Condensates. *Frontiers in Optics 2012/Laser Science XXVIII*, OSA Technical Digest (online) (Optical Society of America, 2012), paper LM3J.3.

Communications at international conferences

- Parametric heating in a bosonic Floquet system, Talk – QuAMP, 2019, Birmingham, UK.
- Parametric heating in a bosonic Floquet system, Talk – DAQM, 2019, San Sebastian, Spain.
- Parametric instabilities in a bosonic Floquet system: Beyond the weakly-interacting regime, Poster – GdR-IQFA Meeting, 2018, Montpellier, France.

- Spontaneous avalanche dephasing in Rydberg ensembles, Talk – International Conference on Quantum Simulation (ICQSIM), 2017, Paris, France.
- Spontaneous avalanche dephasing in Rydberg ensembles, Poster – BEC conference, 2017, San Felíu de Guixols, Spain.
- Spontaneous avalanche dephasing in Rydberg ensembles, Poster – International Conference On Laser Spectroscopy (ICOLS), 2017, Arcachon, France.
- Properties of spontaneous avalanche dephasing in large Rydberg ensembles, Poster – 7th colloquium of the CNRS research network "Quantum Engineering, from Fundamental Aspects to Applications" (IQFA), 2016, Paris, France.
- Anomalous broadening in driven dissipative Rydberg systems, Talk – 47th Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics (DAMOP), 2016, Providence, MD, USA.
- Anomalous broadening in driven dissipative Rydberg systems, Talk – Coherent Control of Complex Quantum Systems (C3QS), 2016, Okinawa, Japan.
- Quantization of angular momentum in an interacting 2D quantum fluid of exciton-polariton, Talk – Workshop on Coherent Phenomena in Disordered Optical Systems, 2014, Trieste, Italy.
- Exploiting exciton nonlinearities to engineer squeezed light, Poster – 13th International Conference on Optics of Excitons in Confined Systems, 2013, Rome, Italy.
- Generation of squeezed states of light with exciton-polariton interactions, Talk – 14th Conference on Physics of Light-Matter Coupling in Nanostructures, 2013, Hersonissos, Greece.
- Nonlinear optics with exciton-polaritons, Poster, 2012, School of Physics: International School of Nanophotonics and Photovoltaics, Phuket, Thailand.

Local Communications

- Speaker at LPENS Seminar, Paris, FR, Nov 2019.
- Speaker at JQI/UMD Seminar, College park, USA, Oct 2017.
- Speaker at ETHZ Seminar Series, Zurich, Switzerland, May 2017.
- Speaker at NIST seminar, Maryland, USA, September 2014.
- Speaker at EPFL seminar, Lausanne, Switzerland, July 2014.
- Speaker at LKB Quantum Optics group seminar, Paris, France, January 2014.
- Speaker at Quandid ANR meeting, Marcoussis, France, September 2013.
- Poster presentation at LKB internal seminar, La Rochelle, France, June 2013.

Scientific mediation, public outreach

2019–now **ResearchX3D Project**, *Web-platform for sharing the history of experimental techniques*.

2019–now **Referee for Physical Review A**.

2015–now **Referee for Physical Review Letters**.

2013–now **Various public outreach**, *Fête de la science, Nuit des étoiles, Maryland Day*.

Laboratoire Kastler Brossel – UPMC – Paris

+33 7 68 87 09 36 • *bouliertom@gmail.com* • *https://tboulier.github.io/*