

# Thomas Boulrier

*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, Raphaëlle 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 Skłodowska-Curie Action (MSCA) Fellowship.
- Oct 2018 – Now **Postdoctoral researcher at LCF (IOGS), Palaiseau, France**, *Quantum Optics group – "Quantum Simulation with Rydberg atom on tweezers"*, Pr. Antoine Browaeys' 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)

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- 2011–2012 **Undergraduate level**, *Lectures and Experimental Work (64h)*. *Thermodynamics and wave phenomena*.
- 2012–2013 **Undergraduate level**, *Lectures (64h)*. *Electromagnetic waves*.  
**Undergraduate level**, *Experimental Work (24h)*. *Thermodynamics and wave phenomena*.  
**Graduate level**, *Experimental Work, (32h)*. *Lasers: principles and applications*.
- 2013–2014 **Graduate level**, *Experimental Work, (8h)*. *Lasers: principles and applications*.  
[Lecturer at JQI Summer School – Washington DC \(4h\)](#)
- 2015–2018 **Graduate level**, *Lectures (4x1h)*..  
[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 Skłodowska-Curie Action (MSCA)**, *Individual Fellowship*, Global (3 years), Grant H2020-MSCA-IF-2015 – 701034 – MADAME.

## Publications in international refereed journals

- **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. arXiv: 1808.07637 (Accepted to Phys. Rev. X on 08/02/2019)
- 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).

## 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 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 Felú de Guixols, Spain.
- Spontaneous avalanche dephasing in Rydberg ensembles, Poster – International Conference On Laser Spectroscopy (ICOLS), 2017, Arcachon, France.

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- 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 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

2015–now **Referee for Physical Review Letters.**  
 2013–now **Various public presentations**, *Fête de la science*, *Nuit des étoiles*, *Maryland Day*.  
 Late 2018 **Personal website (*work in progress*)**, <https://tboulier.github.io/>.