Edoardo Lauria

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Personal information

Date of birth:	4th January 1989	Citizenship:	Italian
Place of birth:	Ivrea, Italy	Languages:	Italian (native), English (fluent), French (basic)

Employment

Mar. 2023	-	current	Postdoctoral Fellow (Quantic group) LPENS, École Normale Supérieure - PSL CAS, Mines Paris - PSL Université PSL, Sorbonne Université, CNRS.
Oct. 2022	-	Feb. 2023	Visitor École Polytechnique, CPHT, Paris, France.
Jan. 2020	-	Sept. 2022	Postdoctoral Fellow *Simons Collaboration for the Nonperturbative Bootstrap* École Polytechnique, CPHT, Paris, France.
Oct. 2018	-	Dec. 2019	Postdoctoral Fellow *Simons Collaboration for the Nonperturbative Bootstrap* Durham University, Durham, UK.

Education

Sept. 2014	-	Oct. 2018	Ph.D in Physics, KU Leuven, Belgium Advisors: Nikolay Bobev and Antoine Van Proeyen Title: *Points, Lines, Surfaces at Criticality* (Published by Springer Theses, 2019)
Sept. 2011	-	Apr. 2014	M.Sc. in Physics, Università di Torino, Italy Advisor: Marco Billò Title: *Defects in Conformal Field Theories* Final grade: 110/110 *"cum laude"* (with distinction)
Sept. 2008	-	Sept. 2011	B.Sc. in Physics, Università di Torino, Italy Advisor: Roberto Tateo Title: *Quantum Hamiltonian and Riemann Zeta function* Final grade: 110/110

Fellowships and awards

- Von Humboldt Research Fellowship for Postdoc, July 2022. (Declined);
- Springer Theses, 2019. "Nominated as an outstanding Ph.D. thesis by the Institute for Theoretical Physics, KU Leuven, Leuven, Belgium";
- Visiting Graduate Fellowship, Perimeter Institute for Theoretical Physics, Waterloo (Canada), September 2017 – December 2017.

Qualifications

- Abilitazione Scientifica Nazionale, valid from 05/11/2024 to 05/11/2035 (art. 16, comma 1, Legge 240/10);
- Qualification for the position of 'maître de conférences', section 29 (Constituants élémentaires). Number 23229385764, obtained on 1 February 2023;
- Dottore di ricerca, decreto direttoriale di equipollenza dottorato n. 2539 del 09/11/2021.

Teaching and mentoring experience

2018 - 2019 – Durham University

Tutoring for master classes in:

- *String Theory*, taught by Prof. S. Ross;
- *Supersymmetry*, taught by Prof. S. Cremonesi;
- *Renormalization Group*, taught by Prof. V. Niarchos;
- *Advanced QFT*, taught by Prof. N. Iqbal;
- *Group Theory*, taught by Prof. D. Dorigoni.

2016 - 2018 – KU Leuven

- Graded homework problems for master classes in *Weak and Strong Interactions*, taught by Prof. Alexander Sevrin;
- Exercises sessions (in class) for the bachelor student of the course in *Electromagnetism and Relativity*, taught by Prof. Wojciech De Roeck.

2018 - 2024 – Students mentored

- Jingxiang Wu, Ph.D student at the Perimeter Institute for Theoretical Physics under the supervision of Prof. Davide Gaiotto and Lorenzo Di Pietro, and now postdoc at the Mathematical Institute of Oxford University. Our collaboration resulted in the paper *3d Abelian Gauge Theories at the Boundary*, JHEP 1905 (2019) 091;

- Xiang Zhao, Ph.D student at the École Polytechnique de Paris under the supervision of Prof. Balt van Rees and now postdoc at the École Polytechnique de Lausanne. Our collaboration resulted in the paper *Line and surface defects for the free scalar field*, JHEP 01 (2021) 060;

- Pierluigi Niro, Ph.D student at the Université Libre de Bruxelles under the supervision of Prof. Riccardo Argurio and now postdoc at University of California, Los Angeles. Our collaboration resulted in a series of papers: *3d large N vector models at the boundary*, SciPost Phys. 11 (2021) 3, 050, *Vacuum stability, fixed points, and phases of QED_3 at large N_f*, Phys.Rev.D 108 (2023) 6, L061902, and *Conformal boundary conditions for a 4d scalar field*, SciPost Phys. 16 (2024), 090;

- Michael Milam, master student at the École Polytechnique under the supervision of Prof. Balt van Rees and now Ph.D student in Saclay with Ruben Minasian. Title of the thesis: *Renormalization Group Flows of Minimal Models in Anti-de Sitter Space*, awarded with the prestigious *Prix du Stage de Recherche* (Research Internship Prize) on December 2021. Our collaboration resulted in the paper *Perturbative RG flows in AdS: an étude*, JHEP 03 (2024) 005;

- Philine van Vliet, Ph.D student at DESY in Hamburg under the supervision of Dr. Pedro Liendo, now postdoc at École Normale Supérieure with Miguel Paulos. Our collaboration resulted in a series of papers: *Bootstrapping line defects with $O(2)$ global symmetry*, JHEP 11 (2022) 018, and *Analytic and numerical bootstrap for the long-range Ising model* JHEP 03 (2024) 136;

- Karanbir Tiwana, Ph.D student at ENS and INRIA under the supervision of Prof. Antoine Tilloy. With Prof. Tilloy, we are currently working on applying Tensor Networks techniques to address problems with line defects in 2d QFTs.

Research

Summary of research interests

My research is focused on understanding non-perturbative aspects of Quantum Field Theories (QFTs) and Conformal Field Theories (CFTs), with or without boundaries or defects, with applications ranging from condensed matter to strings. I try to address these problems within the bootstrap framework, namely by exploiting theory's consistency conditions and without referring to any particular microscopic description. My results include: a partial classification of conformal boundary conditions for the 4d Maxwell theory and for a free massless scalar in dimensions $d = 3, 4$; a classification of unitary conformal defects in the theory of a free massless scalar in $d > 2$; a bootstrap study of conformal line defects with continuous global symmetry and of long-range vector models; a study of renormalization group flows for QFTs in AdS background. I have worked on similar classification problems for supersymmetric CFTs (SCFTs) without defects: in the context of the superconformal bootstrap to study a family of 3d SCFTs connected by a conformal manifold, and in the context of $\mathcal{N} = 2$ supegravity theories in $d = 4, 5, 6$.

Keywords : Conformal Field Theories, Conformal Bootstrap, Defects, Boundary Conditions, Strong Coupling, Quantum Field Theory in curved background, Gauge Theories, Renormalization Group, Supersymmetry.

Publications

The full list can be found on iNSPIRE, or on arXiv. Authors appear in alphabetic order.

1. Monographs:

(authors appear in alphabetical order)

1. Edoardo Lauria, *Points, Lines, and Surfaces at Criticality*, Springer Theses, 2019. "Nominated as an outstanding Ph.D. thesis by the Institute for Theoretical Physics, KU Leuven, Leuven, Belgium";
2. Edoardo Lauria and Antoine Van Proeyen, $\mathcal{N} = 2$ *Supergravity in* $D = 4, 5, 6$ *Dimensions*, Lect.Notes Phys. 966 (2020), Springer.

2. Journal publications:

Publications with peer review process

1. A. Antunes, E. Lauria and B.C van Rees, *A bootstrap study of minimal model deformations*, JHEP 05 (2024) 027;
2. L. Di Pietro, E. Lauria and P. Niro, *Conformal boundary conditions for a 4d scalar field*, SciPost Phys. 16 (2024), 090;
3. C. Behan, E. Lauria, M. Nocchi and P. van Vliet, *Analytic and numerical bootstrap for the long-range Ising model*, JHEP 03 (2024) 136;
4. E. Lauria, M. Milam and B.C. van Rees, *Perturbative RG flows in AdS: an étude*, JHEP 03 (2024) 005;
5. L. Di Pietro, E. Lauria and M. Niro, *Vacuum stability, fixed points, and phases of* QED_3 *at large* N_f, Phys.Rev.D 108 (2023) 6, L061902;
6. A. Gimenez-Grau, E. Lauria, P. Liendo and P. Van Vliet, *Bootstrapping line defects with* $O(2)$ *global symmetry*, JHEP 11 (2022) 018;
7. C. Behan, L. Di Pietro, E. Lauria and B.C. van Rees, *Bootstrapping boundary-localized interactions II: Minimal models at the boundary*, JHEP 03 (2022) 146;
8. L. Di Pietro, E. Lauria and P. Niro, *3d large N vector models at the boundary*, SciPost Phys. 11 (2021) 3, 050;
9. C. Behan, L. Di Pietro, E. Lauria and B.C. van Rees, *Bootstrapping Boundary-Localized Interactions*, JHEP 12 (2020) 182;
10. E. Lauria, P. Liendo, B.C. van Rees and X. Zhao, *Line and surface defects for the free scalar field*, JHEP 01 (2021) 060;
11. L. Di Pietro, D. Gaiotto, E. Lauria and J. Wu, *3d Abelian Gauge Theories at the Boundary*, JHEP 1905 (2019) 091;
12. E. Lauria, M. Meineri and E. Trevisani, *Spinning operators and defects CFTs*, JHEP 1908 (2019) 066;

13. E. Lauria, M. Meineri and E. Trevisani, *Radial Coordinates for Defect CFTs*, JHEP 1811 (2018) 148;

14. M. Baggio, N. Bobev, S. Chester, E. Lauria and S.S. Pufu, *Decoding a Three Dimensional Conformal Manifold*, JHEP 1802 (2018) 062;

15. N. Bobev, E. Lauria and D. Mazáč, *Superconformal Blocks for SCFTs with Eight Supercharges*, JHEP 1707 (2017) 061;

16. M. Billò, V. Gonçalves, E. Lauria and M. Meineri, *Defects in Conformal Field Theories*, JHEP 1604 (2016) 091.

Proceedings

1. E. Lauria, *Exact results in defect conformal field theories*, Fortsch.Phys. 64 (2016) 333-335.

Invited talks at seminar series and conferences

- 20/03/2024 - Uppsala Math. Dept. Journal Club, Uppsala, Sweden. Title of the seminar: *Conformal Field Theories (and their defects)*;

- 19/03/2024 - Crete Center for Theoretical Physics, on Zoom. Title of the seminar: *A bootstrap study of RG flows in AdS_2*;

- 6/02/2024 - University of Torino, Torino, Italy. Title of the seminar: *Bootstrapping the Long-Range Ising model*;

- 30/01/2024 - ENS Bootstrap Journal Club, Paris, France. Title of the seminar: *Bootstrapping RG flows in AdS*;

- 26/10/2023 - Pisa Journal Club, on Zoom. Title of the seminar: *A study on RG flows in AdS*;

- 07/10/2024 - *TLS*, INRIA, Paris, France. Title of the seminar: *Conformal Field Theories (and the bootstrap): an invitation*;

- 19/04/2022 - *Seed Seminar of Mathematics and Physics*, on Zoom. Title of the seminar: *Boundary conditions for free fields*;

- 16/12/2021 - *Rencontres Théoriciennes* at Institut Henri Poincaré, Paris, France. Title of the seminar: *Boundary conditions for free fields*;

- 16/12/2021 - *Belgian Joint Seminars*, on Zoom. Title of the seminar: *Boundary conditions for free fields*;

- 02/03/2021 - ETH Zurich, on Zoom. Title of the seminar: *Bootstrapping Defect-Localized interactions*;

- 30/09/2020 - Porto University, on Zoom. Title of the seminar: *Bootstrapping Defect-Localized interactions*;

- 16/11/2019 - Conference *North British Mathematical Physics Seminars*, Durham University, Durham, UK. Title of the seminar: *3d Abelian Gauge Theories at the Boundary*;

- 01/11/2019 - University of Swansea, UK. Title of the seminar: *3d Abelian Gauge Theories at the Boundary*;
- 02/10/2019 - University of Southampton, UK. Title of the seminar: *3d Abelian Gauge Theories at the Boundary*;
- 07/08/2019 - Conference *Boundaries and Defects in QFT*, Perimeter Institute, Waterloo, ON, Canada. Title of the seminar: *3d Abelian Gauge Theories at the Boundary*;
- 23/05/2019 - *Rencontres Théoriciennes* at Institut Henri Poincaré, Paris, France. Title of the seminar: *3d Abelian Gauge Theories at the Boundary*;
- 09/05/2019 - DESY, Hamburg, Germany. Title of the seminar: *3d Abelian Gauge Theories at the Boundary*;
- 20/03/2019 - King's College London, London, UK. Title of the seminar: *3d Abelian Gauge Theories at the Boundary*;
- 26/02/2019 - University of Torino, Torino, Italy. Title of the seminar: *3d Abelian Gauge Theories at the Boundary*;
- 21/02/2019 - Conference *South-East Mathematical Physics Seminars* at King's College London, London, UK. Title of the seminar: *3d Abelian Gauge Theories at the Boundary*;
- Durham CPT's Journal Club, Durham University, Durham, UK, February 2019. Title of the seminar: *3d Abelian Gauge Theories at the Boundary*;
- Perimeter Institute's Journal Club, Waterloo, ON, Canada, September 2017. Title of the seminar: *An Eťude on $\mathcal{N} = 2$ conformal manifolds in 3d*;
- 13/06/2016 - Workshop *GGI on CFTs and RG flow in $d > 2$*, Firenze, Italy, May 2016. Title of the seminar: *Defects in Conformal Field Theories*;
- Gong Show at *The String Theory Universe* Conference, Milano Bicocca, Milano, Italy, February 2017. Title of the seminar *Bootstrapping SCFTs with 8 supercharges*;
- Gong Show at *The String Theory Universe* Conference, KU Leuven, Leuven, Belgium, September 2015. Title of the seminar: *Defects in Conformal Field Theories.*

Other activities

Organization of scientific events

- Co-organizer of theoretical Physics seminars at Durham University, 2019-2020;
- Co-organizer of the Seed seminars of Mathematics and Physics. This seminar series is structured into three-month thematic periods. Each thematic period is composed by: a kick-off event held in-person at Institut Henri Poincaré (IHP) in Paris and a number of online talks (a list can be found here). We are currently supported by the Fondation Mathématique Jacques Hadamard, the CNRS, the IHES; The in-person events organized at IHP are:
  - 18 October 2023, Sphere Packings and CFT;
  - 17 January 2024,From discrete models to condensed matter;

- 27 March 2024, Integrable systems;
- 9 November 2024, New trends in QFT, modularity, resurgence.

- Co-organizer of the one-day conference on Matrix models for quantum systems, at IHES in Paris, 7 June 2024.

Referee activity

- Journal of High Energy Physics (SISSA);
- European Physical Journal Plus;
- SciPost Physics.

December 9, 2024