CURRICULUM VITAE June 2023

Name:	Andrea Cavaglià
Position:	RTDB tenure-track researcher,
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Studies

- 19th January 2015 : PhD in Mathematical Physics, City University London.
  Title of Thesis: "Nonsemilinear one-dimensional PDEs: analysis of PT deformed models and numerical study of compactons". Supervisor: Prof. Andreas Fring.
- 15th December 2009 : MSc level degree in Physics of the Fundamental Interactions, at the University of Torino, Italy, specialised in Theoretical Physics, cum laude.
  Title of Thesis: "Integrable models and the AdS/CFT correspondence". Supervisor: Prof. Roberto Tateo.
- 25th September 2007: BSc level degree in Physics at the University of Torino, cum laude.
  Title of final project: "Potential scattering and Regge poles". Supervisor: Prof. Stefano Sciuto.
- 25th September 2006: Music Diploma in Classical Guitar, at the Conservatorio G. Cantelli, Novara, Italy.
- 7th July 2004: High School Diploma at the Liceo C. Botta, Ivrea, Italy, 100/100.

Academic positions

- July 2022-present: RTDB tenure-track researcher at the Physics Department, UniTo.
- October 2017-June 2022: postdoctoral Research Associate in the Theoretical Physics group, Department of Mathematics at King's College London.

- September 2013-August 2017 (except September 2014): junior/post-doctoral researcher at the Department of Theoretical Physics of the University of Torino.
- May 2010 - April 2013: full-time PhD student at City University London, funded through a City University Research Fellowship.

Teaching and supervision

Present teaching

- 2022-present: "Complementi di Metodi Matematici per la Fisica", MSc degree in Physics, UniTo.
- 2022-present: "Quantum effects in Materials: From Theory to Modelling", MSc degree in Materials Science, UniTo.

Past teaching

- Advanced course for PhD students and early career postdocs ar the Young Researchers Integrability School and Workshop 2019, Erwin Schrödinger Institute, Vienna.
- During the postdoc position at King's College London, I taught informally some lectures of the courses *Numerical and Computational Methods* and *Applied Analytic Methods* of the BSc degree in Mathematics.
- Teaching assistant for the courses *Programming Part 1* and *Programming Part 2*, *Mathematical Typesetting* and *Probability and Statistics* of the BSc degree in Mathematics, City University London.

Student supervision

- 2016: Co-supervisor of a PhD student in Theoretical Physics at UniTo, Dr. Massimo Mattelliano. Thesis: "Integrability in the 1D Hubbard model".
- I was co-supervisor of 6 MSc students in Theoretical Physics at UniTo.

Research

I am interested in the non-perturbative properties of quantum field theory, conformal field theories and the AdS/CFT correspondence. My research approaches these problems with a focus on so-called integrable systems – where special mathematical structures raise the hope of finding exact solutions, which can be extremely instructive for understanding the mechanisms of non-perturbative phenomena. The class of systems tractable with integrability continues growing – from spin chains to gauge theories in four dimensions. The development of these methods is far from complete and is a field in continuous evolution. My main current research directions are:

- Application of integrability to the solution of the maximally supersymmetric Yang-Mills gauge theory in 4D ($\mathcal{N}$=4 SYM theory), $\mathcal{N}$=6 superconformal Chern-Simons theory in 3D and other important examples of conformal field theories realising the AdS/CFT correspondence.
- Synergy of integrability with the conformal bootstrap for the study of these models.
- General study of the mathematical structures of integrable models, such as the quantum separation of variables.
- Study of the space of quantum field theories in 2D, in particular the universal deformation flows generated by the operator $T\bar{T}$.

Scientific papers

Preprint

- A. Cavaglià, S. Ekhammar, N. Gromov and P. Ryan, "Exploring the Quantum Spectral Curve for AdS_3/CFT_2", arXiv:2211.07810, submitted for publication to Journal of High Energy Physics.

Published articles

1) A. Cavaglià, N. Gromov, J. Julius and M. Preti, "Integrated Correlators from Integrability: Maldacena-Wilson Line in $\mathcal{N}$=4 SYM', Journal of High Energy Physics 04 (2023) 026.
2) A. Cavaglià, N. Gromov, J. Julius and M. Preti, "Bootstrability in Defect CFT: Integrated Correlators and Sharper Bounds", Journal of High Energy Physics 05 (2022) 164.
3) A. Cavaglià, N. Gromov, J. Julius and M. Preti, "Integrability and Conformal Bootstrap: One Dimensional Defect CFT", Physical Review D, 105 (2022) 2, L021902.
4) A. Cavaglià, N. Gromov, B. Stefański jr. and A. Torrielli, "Quantum Spectral Curve for AdS_3/CFT_2: a proposal", Journal of High Energy Physics 12 (2021) 048.
5) A. Cavaglià, N. Gromov and F. Levkovich-Maslyuk, "Separation of variables in AdS/CFT: functional approach for the fishnet CFT", Journal of High Energy Physics 06 (2021) 131.
6) A. Cavaglià, D. Grabner, N. Gromov and A. Sever, "Colour-twist operators. Part I. Spectrum and wave functions", Journal of High Energy Physics 06 (2020) 092.
7) A. Cavaglià, N. Gromov and F. Levkovich-Maslyuk, "Separation of variables and scalar products at any rank", Journal of High Energy Physics 09 (2019) 052.
8) D. Bombardelli, A. Cavaglià, R. Conti and R. Tateo, "Exploring the spectrum of planar AdS_4/CFT_3 at finite coupling", Journal of High Energy Physics 1804 (2018) 117.

9) A. Cavaglià, N. Gromov and F. Levkovich-Maslyuk, "Quantum spectral curve and structure constants in $\mathcal{N}$=4 SYM: cusps in the ladder limit", Journal of High Energy Physics 1810 (2018) 060.

10) D. Bombardelli, A. Cavaglià, D. Fioravanti, N. Gromov and R. Tateo, "The full Quantum Spectral Curve for AdS_4 / CFT_3", Journal of High Energy Physics 09 (2017) 140.

11) A. Cavaglià, S. Negro, I. Szécsényi and R. Tateo, "$T\bar{T}$-deformed 2D quantum field theories", Journal of High Energy Physics 10 (2016) 112.

12) A. Cavaglià, N. Gromov and F. Levkovich-Maslyuk, "On the exact interpolating function in ABJ theory", Journal of High Energy Physics 12 (2016) 086.

13) L. Anselmetti, D. Bombardelli, A. Cavaglià and R. Tateo, "12 loops and triple wrapping in ABJM theory from integrability", Journal of High Energy Physics 10 (2015) 117.

14) A. Cavaglià, M. Cornagliotto, M. Mattelliano and R. Tateo,"A Riemann-Hilbert formulation for the finite temperature Hubbard model", Journal of High Energy Physics 06 (2015) 015.

15) A. Cavaglià, D. Fioravanti, N. Gromov and R. Tateo, "Quantum Spectral Curve of the $\mathcal{N}$ = 6 Supersymmetric Chern-Simons Theory", Physical Review Letters 113 (2014) 2, 021601.

16) A. Cavaglià, D. Fioravanti and R. Tateo, "Discontinuity relations for the AdS_4/CFT_3 correspondence", Nuclear Physics B 877 (2013) 852.

17) A. Cavaglià and A. Fring, "PT-symmetrically deformed shock waves", Journal of Physics A: Mathematical and Theoretical, Volume 45 444010 (2012).

18) A. Cavaglià, D. Fioravanti, M. Mattelliano and R. Tateo, "On the AdS_5/CFT_4 TBA and its analytic properties", RIMS Kokyuroku Bessatsu B28 017-048 (2011). Contribution to the conference Infinite Analysis 2010: Developments in Quantum Integrable Systems.

19) A. Cavaglià, A. Fring and B. Bagchi, "PT-symmetry breaking in complex nonlinear wave equations and their deformations", Journal of Physics A: Mathematical and Theoretical, Volume 44, Issue 32, 325201 (2011).

20) A. Cavaglià, D. Fioravanti and R. Tateo, "Extended Y-system for the AdS_5/CFT_4 correspondence", Nuclear Physics B 843, 302 (2011).

PhD Thesis

A. Cavaglià, "Nonsemilinear one-dimensional PDEs: analysis of PT deformed models and numerical study of compactons", http://openaccess.city.ac.uk/13074/.

Participation in international projects

- July 2022-present: member of the INFN Specific Initiative "Statistical Field Theory".
- October 2020-June 2022: participation in the ERC Consolidator Grant project "Solving gauge theories in 4D: Exact correlation functions from integrability" (EXACTC). PI: Prof. Nikolay Gromov.
- September 2013-August 2017: member of the INFN Specific Initiative "FT & CP".
- September 2013-August 2017: member of the international research network GATIS+ (GAuge Theory as an Integrable System).

Scientific visits

- 2023: DESY, Hamburg, visit to Dr. Till Bargheer.
- 2023: King's College London, visit to Prof. Nikolay Gromov.
- 2016: King's College London, visit to Prof. Nikolay Gromov.
- 2014: King's College London, visit to Prof. Nikolay Gromov.
- 2013: University of Bologna, visit to Prof. Davide Fioravanti.
- 2012: University of Bologna, visit to Prof. Davide Fioravanti.

Awards and qualifications

- 2023 - Italian National Scientific Habilitation (Abilitazione Scientifica Nazionale) to Associated Professor level (Professore di Seconda Fascia).
- Seal of Excellence for the research project "Integrability for a Holographic CFT: solving the gauge/gravity duality with integrability and conformal bootstrap methods", submitted for the Horizon Europe MSCA Postdoctoral Fellowships 2021.
- IRIDI START 2023 training for "Quality in In-person and Remote Teaching, Evaluation and Inclusion".

Administrative duties

Seminar organisation

- July 2022 - : organisation of weekly seminars of the extended string theory group at UniTo.
- December 2019 - June 2022: organisation of weekly seminars for the London Integrability Journal Club (website: https://integrability-london.weebly.com/).

Departmental life

- 2019 - 2022,: postdoc representative in the Department of Mathematics at King's College London.
- During my PhD I have been representative of PhD students in the Mathematics Department of City University London.

Refereeing

I am referee for the following journals:

- SciPost,
- Journal of Physics A: Mathematical and Theoretical,
- Journal of High Energy Physics.

Seminars/lectures/presentations

- Date: 13/06/2023.
  Event: Departmental seminar, South-Eastern-University, Nanjing. (online)
  Title: "Bootstrability for the Wilson line defect CFT in N=4 SYM".

- Dates: 03/05/2023 - 08/05/2023 - 10/05/2023.
  Event: Series of 3 lectures, DESY, Hamburg.
  Title: "Introduction to the Quantum Spectral Curve method in integrable AdS/CFT dualities".

- Date: 24/04/2023.
  Event: Departmental seminar, DESY, Hamburg.
  Title: "Integrated Correlators from Integrability".

- Date: 20/04/2023.
  Event: Departmental seminar, ETH, Zurich.
  Title: "Quantum Spectral Curve for AdS_3/CFT_2: the proposal at work".

- Date: 28/07/2022.
  Event: conference Integrability in Gauge and String Theory 2022, Wigner Research Centre for Physics, Budapest.
  Title: "Quantum Spectral Curve for AdS_3/CFT_2: a proposal".

- Date: 28/04/2022.
  Event: conference Eurostrings 2022, ENS Lyon.
  Title: "A new Quantum Spectral Curve for AdS_3/CFT_2".

- Date: 02/11/2021.
  Event: Nordic High Energy Theory seminars series (online).
  Title: "Integrability and Conformal Bootstrap: the One Dimensional Defect CFT".

- Date: 19/10/2021.
  Event: seminar for the Quantum Fields and Strings group, Perimeter Institute (online).
  Title: "Integrability and Conformal Bootstrap: the One Dimensional Defect CFT".

- Date: 16/09/2021.
  Event: workshop "Correlators and wave functions in solvable models", IPhT Saclay and ENS, Paris, France.
  Title of talk: "Separation of Variables in the fishnet CFT: the functional method".

- Date: 20/07/2021.
  Event: conference Integrability in Gauge and String Theory 2021, University of Torino, Italy.
  Title of talk: "Integrability and conformal bootstrap for observables beyond the spectrum".

- Date: 18/06/2021.
  Event: seminar at the University of Bologna (online).
  Title: "Looking for the Separation of Variables in a 4D CFT".

- Date: 21/09/2020.
  Event: seminar at King's College London Theoretical Physics group meeting (online).
  Title: "Conformal Field Theory from fishnet diagrams".

- Date: 26/08/2020.
  Event: conference Integrability in Gauge and String Theory 2020, ICFT-SAIFR, Sao Paulo, Brasil (online).
  Title: I led the discussion session "Quantum Spectral Curve and Fishnets".

- Date: 18/10/2019.
  Event: seminar at the University of Durham, UK.
  Title: "What are Colour-Twist Operators and why they are useful for Integrability".

- Date: 11/12/2019.
  Event: worskhop "Symmetries in Physics" of the UK research network Applied Geometric Mechanics, City University London.
  Title of talk: "Twisting symmetries in large-N QFTs".

- Date: 16/07/2019.
  Event: conference Integrability in Gauge and String Theory 2019, Nordita, Stockholm, Sweden.
  Title of talk: "Colour-Twist Fields and Separation of Variables".

- Date: 09/04/2019.
  Event: workshop "$T\bar{T}$ and Other Solvable Deformations of Quantum Field Theories", Simons

Center for Geometry and Physics, Stony Brook, USA.
Title of talk: "From CDD factors to $T\bar{T}$ via Integrability".

- Date: February 2019.
Event: advanced course at the Young Researchers Integrability School and Workshop, Erwin Schrödinger Institute, Vienna, Austria.
Title: "Deformations part II", focusing on $T\bar{T}$-deformations.

- Date: 05/02/2019.
Event: seminar at the University of Surrey, Guildford, UK.
Title: "Towards three-point functions in $\mathcal{N}$=4 Super Yang-Mills theory with the Quantum Spectral Curve".

- Date: 16/01/2019.
Event: seminar at the IGFAE Institute, Santiago de Compostela, Spain. Title: "Towards correlation functions in $\mathcal{N}$=4 Super Yang-Mills theory with the Quantum Spectral Curve".

- Date: 19/12/2018.
Event: lecture at the Avogadro Meeting 2018, University of Roma Tor Vergata, Rome, Italy.
Title: "$T\bar{T}$ deformations".

- Date: September 2018.
Event: workshop "A fresh look at AdS_3/CFT_2", Villa Garbald (facility of ETH Zurich), Castasegna, Switzerland.
Title of talk: "$T\bar{T}$-deformations of 2D quantum field theories".

- Date: 07/08/2018.
Event: workshop "Conformal Field Theories in Higher Dimensions", Independent University of Moscow, Moscow, Russia.
Title of talk: "Quantum Spectral Curve and Correlators in $\mathcal{N}$=4 SYM: Part 2".

- Date: 23/07/2018.
Event: South-East Mathematical Physics Seminars series, University of Oxford (UK).
Title of talk: "Correlators in $\mathcal{N}$=4 SYM via the Quantum Spectral Curve".

- Date: 21/05/2018.
Event: workshop "Correlation Functions in Solvable Models", Nordita, Stockholm, Sweden.
Title of talk: "The $T\bar{T}$-deformation of 2D quantum field theories".

- Date: 11/10/2017.
Event: seminar at King's College London.
Title: "On the exact interpolating function of ABJ theory".

- Date: 25/10/2016.
Event: talk for the event AperiTheory of the Italian Association of Physics Students, Torino, Italy.
Title: "Integrable systems and applications to high-energy physics" (in Italian).

- Date: August 2016.
  Event: poster presented at the conference Integrability in Gauge and String Theory 2016, Humboldt University, Berlin, Germany.
  Title of poster: "Numerical solution of the Quantum Spectral Curve for AdS_4/CFT_3", presented with D. Bombardelli.

- Date: 14/07/2014.
  Event: conference Integrability in Gauge and String Theory 2014, Desy, Hamburg, Germany.
  Title of talk: "The Quantum Spectral Curve for ABJM theory".

- Date: 14/02/2014.
  Event: workshop "Strongly Coupled Gauge Theories", King's College London.
  Title of talk: "The $\mathbf{P}\mu$-system for the ABJM theory".

- Date: 17/12/2012.
  Event: seminar at the University of Bologna.
  Title: "Stable and unstable compacton solutions to an integrable nonlinear evolution equation".

- Date: 26/04/2012.
  Event: conference City University Annual Research Symposium, City University London.
  Title of talk: "Nonlinear dispersive wave equations: compact solitons in integrable and nonintegrable models".