Francesco Mattiotti

Curriculum vitae et studiorum

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Education

2021 **Ph.D. in Physics**, *cum laude*, February 25th, 2021, at Department of Physics - University of Notre Dame (USA)

With a thesis on Cooperative effects in quantum systems: superradiance and long-range interactions. Advisors: Fausto Borgonovi, Giuseppe Luca Celardo and Boldizsár Jankó.

2021 **Ph.D. in Science**, *cum laude*, February 25th, 2021, at Facoltà di Scienze Matematiche, Fisiche e Naturali - Università Cattolica del Sacro Cuore (Brescia, Italy)

With a thesis on Cooperative effects in quantum systems: superradiance and long-range interactions. Advisors: Fausto Borgonovi, Giuseppe Luca Celardo and Boldizsár Jankó.

2016 **Master's degree in Physics**, *cum laude*, February 16th, 2016, at Facoltà di Scienze Matematiche, Fisiche e Naturali - Università Cattolica del Sacro Cuore (Brescia, Italy)

With a thesis on the interplay of cooperativity and noise, from light-harvesting complexes to quantum transport. Advisor: Giuseppe Luca Celardo. Co-advisor: Fausto Borgonovi.

2013 **Bachelor's degree in Physics**, *cum laude*, December 16th, 2013, at Facoltà di Scienze Matematiche, Fisiche e Naturali - Università Cattolica del Sacro Cuore (Brescia, Italy)

With a thesis on the non-Hermitian Hamiltonian approach to quantum transport. Advisor: Giuseppe Luca Celardo. Co-advisor: Giulio Giuseppe Giusteri.

2010 **High school diploma**, *(classical studies)*, at Liceo "G. Bagatta", Desenzano del Garda (Brescia, Italy)

Positions

2021-now **Post-doc**, *University of Strasbourg*, in the Quantum Matter Theory group lead by Guido Pupillo at Institut de Science et d'Ingénierie Supramoléculaires

2017-2021 **Ph.D. Student with scholarship**, *International PhD in Science*, on a joint research project between Università Cattolica del Sacro Cuore and University of Notre Dame

The research project was about Cooperative Effects in quantum systems, supervised by Prof. Fausto Borgonovi, Prof. Giuseppe Luca Celardo and Prof. Boldizsár Jankó.

2016 **Research Assistant**, at Facoltà di Scienze Matematiche, Fisiche e Naturali - Università Cattolica del Sacro Cuore (Brescia, Italy)

On a project about quantum transport in nanostructured systems with applications to biosystems, coordinated by Prof. Fausto Borgonovi. The project is financed by Fondazione EULO.

Visiting Positions

September 24th, 2018 - December 20th, 2019 — **UND visiting Ph.D. student**, *University of Notre Dame (Indiana, USA)*, at Faculty of Physics, in the framework of the International Doctoral Program in Science, for a scientific collaboration with Prof. Boldizsár Jankó and Prof. Masaru Kuno.

May 2nd - September 4th, 2018 — **BUAP visiting position**, *Benemérita Universitád Autónoma de Puebla (Puebla, Mexico)*, at Instituto de Física, for a scientific collaboration with Prof. Felix M. Izrailev and Prof. G. Luca Celardo.

April 16th - 19th, 2018 — **INFN scientific mission**, *Heriot-Watt University (Edinburgh, United Kingdom)*, for a scientific collaboration with Prof. Erik Gauger.

August 2nd - November 3rd, 2017 — **BUAP visiting position**, *Benemérita Universitád Autónoma de Puebla (Puebla, Mexico)*, at Instituto de Física, for a scientific collaboration with Prof. Felix M. Izrailev and Prof. G. Luca Celardo.

Grants

June 1st, 2020 - May 31st, 2023 — **National Science Foundation (NSA), USA**, *NSF DMR1952841 (Title: realizing robust superfluorescence from nanocrystal superlattices)*, Role: collaborator. PI: Prof. Masaru Kuno, Co-PI: Prof. Boldizsár Jankó (University of Notre Dame, USA), Financial Support: 500,877 USD.

2016 - 2020 — **Istituto Nazionale di Fisica Nucleare (INFN), Italy**, *Affiliation with travel grant, DynSysMath project, Title: Cooperative effects in quantum systems: superradiance and long-range interactions*, Role: Ph.D. student. PI: Prof. Fausto Borgonovi (Università Cattolica del Sacro Cuore, Italy), Financial Support: 6,000 EUR.

June 22nd, 2016 — **Fondazione EULO, Italy**, *Title: Quantum transport in nanostructures devices with application to bio-systems*, Role: collaborator. PI: Prof. G. Luca Celardo, Co-PI: Prof. Fausto Borgonovi (Università Cattolica del Sacro Cuore, Italy), Financial Support: 12,000 EUR.

Awards

September 13th, 2019 — **University of Notre Dame, USA**, *Graduate School Professional Development Award*, Downes Memorial Fund to support a travel to Benemérita Universitád Autónoma de Puebla (Puebla, Mexico) to participate to the QuEBS conference and "Non-Hermitian Quantum Systems" workshop, Financial Support: 650 USD.

May 28th, 2019 — **University of Notre Dame, USA**, *Graduate School Professional Development Award*, Zahm Research Travel Grant Fund to support a travel to Sandia National Laboratories (Livermore, California) for a scientific collaboration with Mohan Sarovar, Financial Support: 2,100 USD.

July 11th, 2013 — **Istituto G. Toniolo, Italy**, *Master scholarship*, Financial Support: 3,500 EUR.

Teaching experience

2017 **Teaching Assistant**, *Quantum Mechanics*, 20 hours of exercises at Università Cattolica del Sacro Cuore (Brescia, Italy)

Transferable skills

Group work and tutoring: I had international collaborations with experienced researchers and with other PhD students. I also trained and tutored undergraduate and graduate students.

Communication skills: I have given various oral presentations to international conferences/gatherings. I have written papers that were published on peer-reviewed journals.

Language skills

Italian: native speaker.

English: professional working proficiency; *IELTS - Academic score: 7.0/9 (CEFR level: C1).*

Spanish: basic proficiency.

French: basic proficiency.

Technical skills

Operating systems: Good knowledge of GNU/Linux and Microsoft Windows environments.

Programming: I currently use FORTRAN77, Python and Julia for scientific computing. I'm familiar with the libraries: LAPACK, BLAS, Numpy, Matplotlib, Julia QuantumOptics.

Software: I use Grace and Gnuplot for data visualization, LaTeX for scientific typing.

Publications and preprints

[11] Sushrut Ghonge, David Engel, Francesco Mattiotti, G. Luca Celardo, Masaru Kuno, and Boldizsár Jankó. Enhanced robustness and dimensional crossover of superradiance in cuboidal nanocrystal superlattices. *arXiv:2209.10943*, 2022.

[10] Nick Sauerwein, Francesca Orsi, Philipp Uhrich, Soumik Bandyopadhyay, Francesco Mattiotti, Tigrane Cantat-Moltrecht, Guido Pupillo, Philipp Hauke, and Jean-Philippe Brantut. Engineering random spin models with atoms in a high-finesse cavity. *arXiv:2208.09421*, 2022.

[9] Francesco Mattiotti, Mohan Sarovar, Giulio Giuseppe Giusteri, Fausto Borgonovi, and Giuseppe L Celardo. Efficient light harvesting and photon sensing via engineered cooperative effects. *New J. Phys.*, 24(1):013027, jan 2022.

[8] Francesco Mattiotti, William M Brown, Nicola Piovella, Stefano Olivares, Erik M Gauger, and G. Luca Celardo. Bio-inspired natural sunlight-pumped lasers. *New J. Phys.*, 23(10):103015, oct 2021.

[7] Nahum C. Chávez, Francesco Mattiotti, J. A. Méndez-Bermúdez, Fausto Borgonovi, and G. Luca Celardo. Disorder-enhanced and disorder-independent transport with long-range hopping: Application to molecular chains in optical cavities. *Phys. Rev. Lett.*, 126:153201, Apr 2021.

[6] Francesco Mattiotti, Masaru Kuno, Fausto Borgonovi, Boldizsár Jankó, and G. Luca Celardo. Thermal decoherence of superradiance in lead halide perovskite nanocrystal superlattices. *Nano Lett.*, 20(10):7382–7388, 2020.

[5] Nahum C. Chávez, Francesco Mattiotti, J. A. Méndez-Bermúdez, Fausto Borgonovi, and G. Luca Celardo. Real and imaginary energy gaps: a comparison between single excitation superradiance and superconductivity and robustness to disorder. *Eur. Phys. J. B*, 92(7):144, Jul 2019.

[4] Marco Gullì, Alessia Valzelli, Francesco Mattiotti, Mattia Angeli, Fausto Borgonovi, and Giuseppe Luca Celardo. Macroscopic coherence as an emergent property in molecular nanotubes. *New J. Phys.*, 21(1):013019, 2019.

[3] Fausto Borgonovi, Francesco Mattiotti, and Felix M. Izrailev. Temperature of a single chaotic eigenstate. *Phys. Rev. E*, 95:042135, Apr 2017.

[2] Giulio G. Giusteri, Francesco Mattiotti, and G. Luca Celardo. Non-hermitian hamiltonian approach to quantum transport in disordered networks with sinks: Validity and effectiveness. *Phys. Rev. B*, 91:094301, Mar 2015.

[1] G. L. Celardo, A. Biella, G. G. Giusteri, F. Mattiotti, Y. Zhang, and L. Kaplan. Superradiance, disorder, and the non-hermitian hamiltonian in open quantum systems. *AIP Conf. Proc.*, 1619(1):64–72, 2014.

Scientific communications

June 16th, 2022 — **Talk**, titled "Cooperative effects in quantum systems: robustness to disorder and long-range interactions" at Laboratoire de Physique et Chimie Théoriques - Université de Lorraine (Nancy, France)

August 25th, 2021 — **Talk**, titled "Disorder-Enhanced and Disorder-Independent Transport with long range hopping: application to molecular chains in optical cavities" at the conference "17èmes journées de la matière condensée", online

July 1st, 2021 — **Poster**, titled "Disorder-Enhanced and Disorder-Independent Transport with Long-Range Hopping: Application to Molecular Chains in Optical Cavities" at the conference "Wave International Networking Event", online

June 25th, 2021 — **Poster**, titled "Disorder-Enhanced and Disorder-Independent Transport with Long-Range Hopping: Application to Molecular Chains in Optical Cavities" at the conference "I Conference of the Italian Society of Statistical Physics - SIFS", online

March 12th, 2021 — **Talk**, titled "Thermal decoherence of superradiance in lead halide perovskite nanocrystal superlattices" at the conference "nanoGe Spring Meeting", online

September 4th, 2020 — **Talk**, titled "Disorder-Enhanced and Disorder-Independent Transport with long range hopping: application to molecular chains in optical cavities" at the conference "CMD2020GEFES", online

November 7th, 2019 — **Talk**, titled "Interplay of cooperativity and functionality: from light-harvesting nanotubes to efficient photon-sensors" at the conference "Non-Hermitian Quantum Systems", at Centro Internacional de Ciencias (Cuernavaca, Morelos, Mexico)

October 29th, 2019 **Poster**, titled "Efficient photo-detection and light harvesting via engineered cooperative effects" at the conference "Quantum Effects in Biological Systems (QuEBS)", at Benemérita Universitád Autónoma de Puebla (Puebla, Mexico)

October 29th, 2019 **Talk**, titled "Macroscopic coherence as an emergent property in molecular nanotubes" at the conference "Quantum Effects in Biological Systems (QuEBS)", at Benemérita Universitád Autónoma de Puebla (Puebla, Mexico)

October 23rd, 2018 **Talk**, titled "Non-Hermitian Hamiltonian approach to quantum transport in disordered networks with sinks: Validity and effectiveness" at the conference "Quantum Biology", at Centro Internacional de Ciencias (Cuernavaca, Morelos, Mexico)

June 12th, 2018 **Poster**, titled "Temperature of a single chaotic eigenstate" at the conference "Chaos, quantum chaos and more", at Centro Internacional de Ciencias (Cuernavaca, Morelos, Mexico)

March 27th, 2018 **Talk**, titled "Superabsorption of light: from Dicke to quantum engineering" at Facoltà di Scienze Matematiche, Fisiche e Naturali - Università Cattolica del Sacro Cuore (Brescia, Italy)

December 12th, 2017 **Talk**, titled "Cooperative effects in light-harvesting systems" at Facoltà di Scienze Matematiche, Fisiche e Naturali - Università Cattolica del Sacro Cuore (Brescia, Italy)

September 27th, 2017 **Poster**, titled "Cooperativity and scalability of light-harvesting devices by separating absorption from transmission" at the conference "Transport at the Nanoscale: Molecules, Graphene and more", at Centro Internacional de Ciencias (Cuernavaca, Morelos, Mexico)

September 21th, 2017 **Talk**, titled "Cooperativity and scalability of light-harvesting devices by separating absorption from transmission" at the conference "Transport at the Nanoscale: Molecules, Graphene and more", at Centro Internacional de Ciencias (Cuernavaca, Morelos, Mexico)

September 12th, 2017 **Talk**, titled "Cooperativity and scalability of light-harvesting devices by separating absorption from transmission" at Instituto de Física, Benemérita Universitád Autónoma de Puebla (Puebla, Mexico)

June 29th, 2017 **Poster**, titled "Decoupling absorption from transmission in light-harvesting devices" at the conference "XXII National Conference on Statistical Physics and Complex Systems", at Università degli Studi di Parma (Parma, Italy)

Attended Scientific Workshops, Schools and Courses

August 24th - 27th, 2021 **Workshop**, 17èmes journées de la matière condensée, online, organized by Société Française de Physique (France)

July 1st - 2nd, 2021 **Workshop**, Wave International Networking Event, online, organized by Université Côte d'Azur (Nice, France)

June 23rd - 25th, 2021 **Workshop**, I Conference of the Italian Society of Statistical Physics - SIFS, online, organized by Università degli Studi di Parma (Parma, Italy)

March 8th - 12th, 2021 **Workshop**, nanoGe, online, organized by Fundació Scito

September 2nd - 4th, 2020	**Workshop**, CMD2020GEFES, online, organized by European Physical Society
November 4th - 8th, 2019	**Workshop**, Non-Hermitian Quantum Systems, at Centro Internacional de Ciencias (Cuernavaca, Morelos, Mexico)
October 27th - 31st, 2019	**Workshop**, Quantum Effects in Biological Systems (QuEBS), at Benemérita Universitád Autónoma de Puebla (Puebla, Mexico)
October 22nd - 26th, 2018	**Workshop**, Quantum Biology, at Centro Internacional de Ciencias (Cuernavaca, Morelos, Mexico)
June 4th - 22nd, 2018	**Workshop**, Chaos, quantum chaos and more, at Centro Internacional de Ciencias (Cuernavaca, Morelos, Mexico)
February 13th, 2018	**PhD Course**, Materials and technologies for high-efficiency solar cells: from standards to nanostructures. Course held by By Prof. Antonio Terrasi (from Università degli Studi di Catania, Catania, Italy) at Facoltà di Scienze Matematiche, Fisiche e Naturali - Università Cattolica del Sacro Cuore (Brescia, Italy)
February 5th - 8th, 2018	**PhD Course**, Methods of numerical resolution of ODE systems: theory, implementation and applications. Course held by Prof. Adolfo Avella (from Università degli Studi di Salerno, Salerno, Italy) at Facoltà di Scienze Matematiche, Fisiche e Naturali - Università Cattolica del Sacro Cuore (Brescia, Italy)
January 11th - 12th, 2018	**PhD Course**, Understanding materials by molecular dynamics simulations. Course held by Claudia Caddeo, PhD (from IOM-CNR, Cagliari, Italy) at Facoltà di Scienze Matematiche, Fisiche e Naturali - Università Cattolica del Sacro Cuore (Brescia, Italy)
September 18th - October 7th, 2017	**Workshop**, Transport at the Nanoscale: Molecules, Graphene and more, at Centro Internacional de Ciencias (Cuernavaca, Morelos, Mexico)
August 7th - October 30th, 2017	**PhD Course**, Introduction to Classical and Quantum Chaos. Course held by Prof. Felix M. Izrailev at Instituto de Física, Benemérita Universitád Autónoma de Puebla (Puebla, Mexico)
June 28th - 30th, 2017	**Workshop**, XXII National Conference on Statistical Physics and Complex Systems at Università degli Studi di Parma (Parma, Italy)
June 8th - 22nd, 2017	**PhD Course**, Wave processes in random media: physical principles, mathematical methods, and applications. Course held by Prof. Valentin Freilikher (from Bar-Ilan University Ramat-Gan, Israel) at Facoltà di Scienze Matematiche, Fisiche e Naturali - Università Cattolica del Sacro Cuore (Brescia, Italy)
June 27th - July 1st, 2016	**Workshop**, IWDS10 - International Workshop on Disordered Systems, at Facoltà di Scienze Matematiche, Fisiche e Naturali - Università Cattolica del Sacro Cuore (Brescia, Italy)
June 20th - 24th, 2016	**School**, 2nd School on Scientific Data Analytics and Visualization, at CINECA (Bologna, Italy)