

# Francesco Mattiotti

## Curriculum vitae et studiorum

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## Education

- 2021 **Ph.D. in Physics**, *cum laude*, February 25<sup>th</sup>, 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 25<sup>th</sup>, 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 16<sup>th</sup>, 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 16<sup>th</sup>, 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).

## Employments

- 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 du Lac.  
The research project was about Cooperative Effects in quantum systems, supervised by Prof. Fausto Borgonovi, Prof. Giuseppe Luca Celardo and Prof. Boldizsár Jankó.
- 2017 **Teaching Assistant**, *Quantum Mechanics*, 20 hours of exercises at Università Cattolica del Sacro Cuore (Brescia, Italy).

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.

## 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.

## 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

- [9] 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.
- [8] Francesco Mattiotti, Mohan Sarovar, Giulio G. Giusteri, Fausto Borgonovi, and G. Luca Celardo. Efficient light harvesting and photon sensing via engineered cooperative effects, May 2021. arXiv:2105.07896.
- [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

- August 25<sup>th</sup>, 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 1<sup>st</sup>, 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 25<sup>th</sup>, 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 12<sup>th</sup>, 2021 **Talk**, titled “Thermal decoherence of superradiance in lead halide perovskite nanocrystal superlattices” at the conference “nanoGe Spring Meeting”, online.
- September 4<sup>th</sup>, 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 7<sup>th</sup>, 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 29<sup>th</sup>, 2019 **Poster**, titled “Efficient photo-detection and light harvesting via engineered cooperative effects” at the conference “Quantum Effects in Biological Systems (QuEBS)”, at Benemérita Universidad Autónoma de Puebla (Puebla, Mexico).
- October 29<sup>th</sup>, 2019 **Talk**, titled “Macroscopic coherence as an emergent property in molecular nanotubes” at the conference “Quantum Effects in Biological Systems (QuEBS)”, at Benemérita Universidad Autónoma de Puebla (Puebla, Mexico).
- October 23<sup>rd</sup>, 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 12<sup>th</sup>, 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 27<sup>th</sup>, 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 12<sup>th</sup>, 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 27<sup>th</sup>, 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 21<sup>th</sup>, 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 12<sup>th</sup>, 2017 **Talk**, titled “Cooperativity and scalability of light-harvesting devices by separating absorption from transmission” at Instituto de Física, Benemérita Universidad Autónoma de Puebla (Puebla, Mexico).
- June 29<sup>th</sup>, 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 24<sup>th</sup> - 27<sup>th</sup>, 2021 **Workshop**, 17èmes journées de la matière condensée, online, organized by Société Française de Physique (France).
- July 1<sup>st</sup> - 2<sup>nd</sup>, 2021 **Workshop**, Wave International Networking Event, online, organized by Université Côte d’Azur (Nice, France).
- June 23<sup>rd</sup> - 25<sup>th</sup>, 2021 **Workshop**, I Conference of the Italian Society of Statistical Physics - SIFS, online, organized by Università degli Studi di Parma (Parma, Italy).
- March 8<sup>th</sup> - 12<sup>th</sup>, 2021 **Workshop**, nanoGe, online, organized by Fundació Scito.
- September 2<sup>nd</sup> - 4<sup>th</sup>, 2020 **Workshop**, CMD2020GEFES, online, organized by European Physical Society.
- November 4<sup>th</sup> - 8<sup>th</sup>, 2019 **Workshop**, Non-Hermitian Quantum Systems, at Centro Internacional de Ciencias (Cuernavaca, Morelos, Mexico).
- October 27<sup>th</sup> - 31<sup>st</sup>, 2019 **Workshop**, Quantum Effects in Biological Systems (QuEBS), at Benemérita Universidad Autónoma de Puebla (Puebla, Mexico).
- October 22<sup>nd</sup> - 26<sup>th</sup>, 2018 **Workshop**, Quantum Biology, at Centro Internacional de Ciencias (Cuernavaca, Morelos, Mexico).
- June 4<sup>th</sup> - 22<sup>nd</sup>, 2018 **Workshop**, Chaos, quantum chaos and more, at Centro Internacional de Ciencias (Cuernavaca, Morelos, Mexico).

- February 13<sup>th</sup>, 2018 **PhD Course**, Materials and technologies for high-efficiency solar cells: from standards to nanostructures. Course held 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 5<sup>th</sup> - 8<sup>th</sup>, 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 11<sup>th</sup> - 12<sup>th</sup>, 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 18<sup>th</sup> - October 7<sup>th</sup>, 2017 **Workshop**, Transport at the Nanoscale: Molecules, Graphene and more, at Centro Internacional de Ciencias (Cuernavaca, Morelos, Mexico).
- August 7<sup>th</sup> - October 30<sup>th</sup>, 2017 **PhD Course**, Introduction to Classical and Quantum Chaos. Course held by Prof. Felix M. Izrailev at Instituto de Física, Benemérita Universidad Autónoma de Puebla (Puebla, Mexico).
- June 28<sup>th</sup> - 30<sup>th</sup>, 2017 **Workshop**, XXII National Conference on Statistical Physics and Complex Systems at Università degli Studi di Parma (Parma, Italy).
- June 8<sup>th</sup> - 22<sup>nd</sup>, 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 27<sup>th</sup> - July 1<sup>st</sup>, 2016 **Workshop**, IWDS10 - International Workshop on Disordered Systems, at Facoltà di Scienze Matematiche, Fisiche e Naturali - Università Cattolica del Sacro Cuore (Brescia, Italy).
- June 20<sup>th</sup> - 24<sup>th</sup>, 2016 **School**, 2nd School on Scientific Data Analytics and Visualization, at CINECA (Bologna, Italy).