

Claudia Rella

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EDUCATION

Doctor of Philosophy in Mathematical Physics

2020, Oct – present

Department of Theoretical Physics, University of Geneva, Switzerland

Thesis: Supervised by Prof. Marcos Marino.

Affiliations: ERC Synergy Grant ReNewQuantum – National Centre of Competence in Research SwissMAP.

Solvay Doctoral School (2020, Oct – Dec): Type-II String Theory – Superstrings and D-branes – AdS/CFT Correspondence – Modern Methods in Conformal Field Theory – Resurgence and Non-Perturbative Methods in Quantum Field Theory – Quantum Information and Quantum Gravity.

Master of Science in Mathematical and Theoretical Physics – Distinction

2018, Oct – 2019, Jun

Mathematical Institute and Department of Physics, University of Oxford, UK

Thesis: *Motivic Amplitudes*. Supervised by Prof. Francis Brown.

Affiliations: St John's College.

Coursework in Physics: General Relativity – Relativistic Quantum Field Theory – Gauge Field Theory – Symmetries in Particle Physics – The Standard Model and Beyond – Radiative Processes and High-Energy Astrophysics – Bosonic String Theory – Supersymmetry and Supergravity – Topological Quantum Field Theory – Topological Quantum Matter – Topological Quantum Computation.

Coursework in Mathematics: Groups Representations – Algebraic Geometry – Algebraic Topology.

Bachelor of Science in Physics – Summa cum Laude

2015, Oct – 2018, Jun

Department of Physics, University of Rome La Sapienza, Italy

Thesis: *Photonic Bloch Waves*. Supervised by Prof. Fabio Sciarrino.

Coursework in Physics: Classical, Analytical and Relativistic Mechanics – Inorganic Chemistry – Thermodynamics – Non-Relativistic Electromagnetism – Non-Relativistic Quantum Mechanics – Classical and Quantum Statistical Mechanics – Nuclear and Subnuclear Physics – Atomic and Molecular Physics – Optics and Photonics.

Laboratory Coursework: Mechanics – Thermodynamics – Electronics – Signals and Systems – Optics.

Coursework in Informatics: C Programming Language – Numerical Analysis – Algorithms.

Coursework in Mathematics: Linear Algebra – Real Analysis – Complex and Functional Analysis – Probability Calculus. Number Theory ^(*) – Groups, Rings and Fields ^(*) – Numerical Semigroups ^(*) – Galois Theory ^(*) – Modules and Algebras ^(*) – Representation Theory ^(*) – Lie Groups and Lie Algebras ^(*) – Affine and Projective Geometry ^(*) – Differential and Riemannian Geometry ^(*) – General, Algebraic and Differential Topology ^(*) – PDEs ^(*).

^(*) : Extra-curricular coursework at Department of Mathematics.

RESEARCH EXPERIENCE AND INTERNSHIPS

Particle Physics Research Internship in Modelling and Programming

2020, Jul – Sep

NA62 @ CERN, Geneva, Switzerland

Specifics: Contributed to the design of an experimental framework for the detection of Dark Sector particles in proton beam dump experiments. Contributed to the implementation of a specific model to exploit the displaced-vertex signal from the secondary muons of NA62 to probe the parameter space of a theoretically conjectured light exotic scalar generated via muon bremsstrahlung. Produced the predicted sensitivity plot using programming language C++ and data analysis software ROOT. NA62 is a proton-on-target collision experiment recently searching for Beyond Standard Model physics at low energies at the Super Proton Synchrotron.

Master Class in Mathematical Physics

2019, Oct – 2020, Jun

University of Geneva and NCCR SwissMAP, Geneva, Switzerland

Coursework: Random Matrix Theory – Brownian Motion – Stochastic Calculus – Random Growth – Loewner Evolution.

Research: Collaborated with Prof. Francis Brown (University of Oxford) on *Motivic Feynman Integrals*, specifically investigating the motivic Galois coaction and factorisation theorems for scalar Feynman graphs with non-generic kinematics. Collaborated with Prof. Francesco Riva (University of Geneva) on *Effective Field Theory*, specifically investigating the restrictions placed by beyond-positivity bounds on Horndeski theories of modified gravity.

Business Consulting Internship in Big Data and AI

2019, Jul – Aug

Pangea Formazione, Rome, Italy

Specifics: Contributed to a Deep Learning predictive model for preventative maintenance of large infrastructures equipped with alarm nets. Project implemented using Bayesian Neural Networks and programming language R and customized to fit the specific needs of the commissioning telecom company. Pangea Formazione is a Big Data Analytics and AI company providing customised software for management consulting and training.

Particle Physics Research Internship in Simulation and Data Analysis

2017, Sep – Nov

PADME @ INFN – LNF, Frascati, Italy

Specifics: Contributed to the development of a Monte Carlo optical simulation of the Small-Angle Calorimeter of PADME's detector using simulation software Geant4 and programming language C++. Characterised the performance of a single PbF_2 crystal attached to a Hamamatsu R13478UV photomultiplier tube with focus on time and energy resolutions using data analysis software ROOT. PADME (Positron Annihilation into Dark Matter Experiment) is a positron-on-target collision experiment searching for dark photon production at high intensity at the DAFNE Beam Test Facility.

PUBLICATIONS

An Introduction to Motivic Feynman Integrals

2020, Aug

*Submitted to SIGMA, [arXiv:2009.00426](https://arxiv.org/abs/2009.00426)***Characterization and Performance of PADME's Cherenkov-Based Small-Angle Calorimeter**

2019, Mar

With A. Frankenthal et al., Nucl. Instrum. Methods Phys. Res. A 919 (2019) 89-97, [DOI:10.1016/j.nima.2018.12.035](https://doi.org/10.1016/j.nima.2018.12.035)

TALKS

Introduction to Motivic Amplitudes

2019, Nov

*Research Seminar on Lie Groups and Moduli Spaces, University of Geneva, Switzerland***Motivic Scattering Amplitudes**

2019, Aug

*Conference on Representation Theory and Integrable Systems, ETH, Zürich, Switzerland***Monte Carlo Simulation of PADME's Small-Angle Calorimeter**

2017, Dec

PADME Weekly Meeting, INFN – LNF, Frascati, Italy

TEACHING EXPERIENCE

Lecturer on Topological Surfaces

2019, Oct

Master Class in Mathematical Physics – Department of Mathematics, University of Geneva, Switzerland

Topics: Introduction to Topological Spaces – Hausdorff Separation Axiom – Connectedness and Compactness – Abstract Topological Manifolds and Surfaces – Normal Forms for Surfaces – Real Projective Plane \mathbb{RP}^2 in detail.

Lecturer on Riemannian Geometry

2018, Mar – May

Excellence Program in Physics – Department of Mathematics, University of Rome La Sapienza, Italy

Topics: Introduction to Riemannian Geometry – Riemannian Manifolds with Non-Positive Curvature – Jacobi Fields and Conjugate Points – Cartan-Hadamard Theorem – Killing Fields.

ACADEMIC ACHIEVEMENTS AND SCHOLARSHIPS

Excellence Fellowship

2019

*NCCR SwissMAP, Switzerland***Degree Prize for Distinction**

2019

*St. John's College, University of Oxford, UK***Torno Subito Scholarship**

2018

*Department of Education, Research and University, Lazio, Italy***Best Student Award for the Course in Nuclear and Subnuclear Physics**

2018

University of Rome La Sapienza and INFN, Italy

Summer Student Scholarship

2017

*INFN, Italy***Excellence Program**

2016 – 2018

*Department of Physics, University of Rome La Sapienza, Italy***Deserving Student Scholarship**

2015 – 2018

University of Rome La Sapienza, Italy

SKILLS

Italian Language	Native
English Language	Level C2 (CEFRL) - Cambridge ESOL Level 3 Certificate
Programming Languages	C, C++, HTML, Perl, R, Python
Version-control Systems	Git
Data Analysis Software	MATLAB, ROOT, gnuplot
Simulation Software	Geant4

MEMBERSHIPS

Mentee of LeadTheFuture Mentorship Program	2019 – present
Invited Fellow of Italian Physics Society (SIF)	2019 – present