Chiara Franceschini

Curriculum Vitæ

PERSONAL DATA

Gender & Nationality:	Female, Italian
Date & Place of Birth:	June 10, 1990, Reggio Emilia (RE), Italy
Languages:	Italian, English, Portuguese

WORKING POSITION

January 2022 - current:

Ricercatore a tempo determinato RTD-A at:
Università degli Studi di Modena e Reggio Emilia (Italy)
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August 2021 - December 2021:

Postdoctoral Fellowship at:
Mathematical Sciences Research Institute
Berkeley, California (USA)

January 2019 - July 2021:

Postdoc Fellow for:
Center for Mathematical Analysis, Geometry and Dynamical Systems
Instituto Superior Técnico (Portugal)
Scientific Advisor: Patrícia Gonçalves, ERC Starting Grant
Hydrodynamic Limits and Equilibrium Fluctuations: universality from stochastic systems

ACADEMIC EDUCATION AND DEGREES

- Doctor of Philosophy in Mathematics
  February 2018, Università degli Studi di Ferrara (Italy)
  Thesis Advisor: Prof. Cristian Giardinà
  Thesis title: *Orthogonal stochastic duality from an algebraic point of view*

- Master Degree in Mathematics
  December 2016, University of Wisconsin -Madison (USA)
  Academic Advisor: Prof. Timo Seppäläinen

- Laurea Specialistica in Mathematics
  July 2014, Università degli Studi di Modena e Reggio Emilia (Italy)
  Grade: 110/110 *cum laude*
  Thesis Advisor: Prof. Cristian Giardinà

RESEARCH INTERESTS

My research activity regards probability theory and its application to interacting particle systems and statistical physics. My work and my interests cover the following topics:

- *Duality between stochastic processes.* Duality theory is a powerful technique to investigate properties of Markov processes. It is possible to study a continuous time Markov process through its dual, that is usually simpler. The connection between the two processes is given by a set of functions called duality functions.
- *Interacting particle systems and their scaling limits.* Interacting particles systems are microscopic models for which one is interested to study the macroscopic behavior, i.e. following the time-space evolution of the density field. This evolution is described by the so-called hydrodynamic equation. Following the dual process one can have an heuristic idea of the PDE which arises from the hydrodynamic limit.
- *Non-equilibrium statistical mechanics.* Markov processes studied in the context of an open boundary can be used as models to inspect non-equilibrium properties. Since many phenomenological laws of non-equilibrium are not yet understood at the microscopical level, the study of diffusion processes under a dual point of view, i.e. using the particle system associated by duality, can be convenient.

PUBLICATIONS AND PREPRINT

- P. A. Ferrari, C. Franceschini, D. G. E. Grevino, H. Spohn "Hard Rod Hydrodynamics and the Levy Chentsov Fields". ArXiv:2211.11117 (2022).
- C. Franceschini, R. Frassek, C. Giardinà "Integrable heat conduction model". ArXiv:2210.13627 (2022).
- C. Franceschini, J. Kuan, Z. Zhou "Orthogonal polynomial duality and unitary symmetries of multispecies ASEP(q, θ) and higherspin vertex models via $\star$–bialgebra structure of higher rank quantum groups". ArXiv:2209.03531 (2022).
- C. Franceschini, P. Gonçalves, B. Salvador "Hydrodynamical behavior of generalized symmetric exclusion with open boundary". ArXiv:2201.10241 (2022).
- C. Franceschini, P. Gonçalves, F. Sau "Symmetric inclusion process with slow boundary: hydrodynamics and hydrostatics". *Bernoulli* 28.2: 1340-1381 (2022).
- G. Carinci, C. Franceschini, W. Groenevelt "q-Orthogonal dualities for asymmetric particle systems". *Electronic Journal of Probability* 26: 1-38 (2021).
- R. De Paula, C. Franceschini "Porous medium model: an algebraic perspective and the Fick's law". *From Particle Systems to Partial Differential Equations.* Springer, Cham, 195-225 (2020).
- C. Franceschini, P. Gonçalves "Where Lie algebra meets probability?!", Bulletin CIM - Centro Internacional da Matemtica, 42, 11-21 (2020).
- G. Carinci, C. Franceschini, C. Giardinà, W. Groenevelt, F. Redig "Orthogonal dualities of Markov processes and unitary symmetries". Symmetry, Integrability and Geometry: Methods and Applications (SIGMA) 15, 053 (2019).
- C. Franceschini, C. Giardinà "Stochastic duality and orthogonal polynomials". Soujourns in Probability and Statistical Physics, in honor of the 70^{th} birthday of C. Newman (2019).
- C. Franceschini, C. Giardinà, W. Groenevelt "Self-duality of Markov processes and intertwining functions". Mathematical Physics, Analysis and Geometry 21: 29 (2018).
- C. Franceschini "Energy-exchange stochastic models for non-equilibrium", ArXiv:1410.3661.
- C. Franceschini "Orthogonal stochastic duality from an algebraic point of view". PhD Thesis.

In December 2019 during the conference *Particle Systems and PDE's VIII*, together with Patrícia Gonçalves we interviewed Martin Hairer, Fields medalist. Interview here.

CONFERENCES, WORKSHOPS AND SCHOOLS

June 2023: *Mathematical Physics of Complex Systems*
Cortona - Italy

June 2023: **Invited Speaker** *Séminaire de Probabilités*
University of Lyon - France

April 2023: **Invited Speaker** *Seminário de Probabilidade e Mecânica Estatística*
IMPA -*Available on YouTube*

March 2023: *Scaling limits and generalized hydrodynamics*
Gran Sasso Science Institute, L'Aquila - Italy

February 2023: **Invited Speaker** *Società Italiana di Fisica Statistica*
Young Seminars SIFS -*Available on YouTube*

December 2022: **Invited Speaker** *Recent Developments in Stochastic Duality*
EURANDOM - The Netherlands

November 2022: **Invited Speaker** *Rencontres de Probabilités 2022*
University of Rouen - LMRS - France

October 2022: **Invited Speaker** *Asymmetry in interacting particle systems: microscopic and macroscopic effects*
University of Lille - INRIA - France

September 2022: **Invited Speaker** *Integrable systems, exactly solvable models and algebras*
Centre de Recherches Mathématiques, Montréal - Canada

June 2022: **Invited session** Stochastic Interacting Systems. *IMS Annual Meeting in Probability*
London - UK

June 2022: **Invited speaker** *Population Genetics, Interacting Particle Systems and Stochastic Flows*
Hausdorff Center for Mathematics, Bonn - Germany (*video available)*

June 2022: **Invited Speaker** *Third Italian Meeting on Probability and Mathematical Statistics*
Bologna - Italy

May 2022: *Excursion in integrability*
SISSA, Trieste - Italy

April 2022: **Invited Speaker** *Randomness, Integrability and Universality*
Galileo Galilei Institute, Firenze - Italy (*video available)*

March 2022: **Invited Speaker** *Interacting Particle Systems and Hydrodynamic Limits*
Centre de Recherches Mathématiques, Montréal - Canada

March 2022: **Invited Speaker** *Population Dynamics and Statistical Physics in Synergy*
MFO, Oberwolfach Research Institute for Mathematics - Germany

September 2021: **Invited Speaker** MSRI seminars
MSRI, Berkeley - California, USA (*slides available)*

August 2021: **Short talk** *Young European Probabilists (YEP) XVII*
EURANDOM - Eindhoven (Zoom)

July 2021: **Invited Speaker** *Limits and control of stochastic reaction networks*
AIM San Jose - California, USA (Zoom)

June 2021: **Invited Speaker** DISMA, Eccellenza 2018-2022
Politecnico di Torino (*video available)*

June 2021: **Invited Speaker** Algebraic duality methods in probability
Online (*video available)*

April 2021: **Speaker** for the Seminars in Probability and Finance
Zoom - Università degli studi di Padova

March 2021: **Speaker** for the Probability-Analysis Seminar at Cermade
Zoom - Université Paris-Dauphine

March 2021: **Speaker** for the Purdue Probability Seminar
Zoom - Purdue University, Indiana - USA

November 2019: Northeaster Probability Seminar
CUNY Graduate Center - NYC

July 2020: **Speaker** 3^{rd} Colloquium on Interacting particle Systems
Instituto Superior Técnico - Lisbon

July 2019: 1^{st} Women in Mathematics Meeting
Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa - Caparica

July 2019: **Speaker** 2^{nd} Colloquium on Interacting particle Systems
Instituto Superior Técnico - Lisbon

June 2019: Workshop on Phase Transitions and Particle Systems
Weierstrass Institute (WIAS) - Berlin

June 2019: **Speaker** at the Second Italian Meeting on Probability and Mathematical Statistics
Vietri sul Mare - Salerno

June 2019: Workshop "Nonlinear PDEs in Braga"
University of Minho, Auditorium of the Congregados - Braga

April 2019: Conference "Population Dynamics and Statistical Physics in Synergy II"
Centro De Giorgi - Pisa

November 2018: Conference "Particle Systems and PDE's VII"
University of Palermo - Palermo

September 2018: Conference "Young Women in Mathematical Physics"
University of Bonn - Bonn

April 2018: **Speaker** at the Workshop "Teaching and Learning Statistical Physics"
Sede del Consorzio del Vino Nobile di Montepulciano - Siena. Youtube video here

August 2017: Workshop "Genealogies of Interacting Particle Systems"
Institute for Mathematical Sciences of NUS - Singapore

June 2017: **Contributed talk** for the Workshop "Stochastic dynamic out of equilibrium"
Henri Poincaré Institute- Paris

May 2017: **Speaker** at the assemblea scientifica G.N.F.M.
Montecatini Terme - Pistoia

April 2016: 4^{th} Midwest Women in Mathematics Symposium
University of Illinois at Urbana-Champaign - USA

October 2015: 37^{th} Midwest Probability Colloquium
Northwestern University - USA

March 2015: Workshop "Interacting particles systems and non-equilibrium dynamics"
Henri Poincaré Institute - Paris

January 2015:	Introductory school of the trimester "Disordered systems, random spatial processes and some applications" *Centre International de Rencontres Mathématiques (CIRM)* - Marseille
September 2014:	**Contributed talk** for the XXXIX Summer School on Mathematical Physics Organized by Istituto Nazionale di Alta Matematica - Ravello
August 2014:	Workshop "Population Dynamics and Statistical Physics in Synergy" *Eurandom* - Eindhoven
May 2014:	Training week "Advances in non-equilibrium statistical mechanics" *Galileo Galilei Institute* - Florence

ACTIVITIES ORGANIZED

16/6/2022:	Session organizer "Scaling limits for interacting particle systems" *Third Italian Meeting on Probability and Mathematical Statistics*. Bologna, Italy
5/1/2022:	Colloquium on Interacting Particle System Hybrid event - *here*
12-16/7/2021:	Session organizer "Stochastic duality for Markov processes" *Encontro Nacional da Sociedade Portuguesa de Matemática (SPM)*. Lisbon, Portugal
19-23/7/2021:	Organizer for the Conference *Particle Systems and PDE's IX* University of Minho, Braga
Fall 2020:	Organizer for the cycle of seminars *Probability and Stochastic Analysis (PSA)* All online via Zoom - *here*

AWARDS

- Kovalevskaya grant for ICM, 2022.
- **Uhlenbeck Postdoctoral Fellowship** awarded by the Mathematical Sciences Research Institute (MSRI) in UC-Berkeley. One post-doc per year is selected, 2021.
- IMS New Researcher Travel Award, 2020
- Best Phd Thesis of cycle XXX, awarded by the University of Ferrara, 2018.

CO-SUPERVISION OF STUDENTS

- Beatriz Costa Salvador, Master Degree student at Instituto Superior Técnico. Thesis *Stochastic Duality for Symmetric Simple Exclusion and Inclusion in contact with reservoirs* (December 2021).
- Leonor Botelho de Sousa Barata, Master Degree student at Instituto Superior Técnico.
  Thesis *Neutral population-genetics evolution for Wright-Fisher and Moran models* (December 2019).

TEACHING ACTIVITY

- Fall 2023: University of Modena and Reggio Emilia. Exerciser for *Meccanica Razionale*, Bachelor Degree.
- Spring 2022: University of Modena and Reggio Emilia. Lecturer for *Matematica applicata e statistica*, Bachelor Degree.

- Fall 2019: Instituto Superior Técnico. Exerciser for the course *Teoria das probabilidades*, Master Degree.
- Fall 2018: University of Modena and Reggio Emilia. Lecturer for the course *Obblighi Formativi Aggiuntivi (OFA)*, Bachelor Degree.
- Spring 2018: University of Modena and Reggio Emilia. Exerciser for the course *IG-004 Matematica applicata*, Bachelor Degree. Exerciser for the course *MN1-1037 Probabilitá e statistica*, Bachelor Degree.
- Spring 2017: University of Modena and Reggio Emilia. Exerciser for the course *RM263-009 Modelli probabilistici*, Master Degree.
- Fall 2016: University of Wisconsin - Madison. Lecturer for the course *Math 130 - Mathematics for Teaching: Numbers and Operations*, Bachelor Degree.
- Spring 2016: University of Wisconsin - Madison. Lecturer for the course *Math 132 - Problem solving in Algebra, Probability and Statistics*, Bachelor Degree.
- Fall 2015: University of Wisconsin - Madison. Teaching assistant for the course *Math 221 - Calculus and Analytic Geometry I*, Bachelor Degree.

REFEREE WORK FOR

- Annales de l'Institut Henri Poincaré
- Electronic Communications in Probability
- Electronic Journal of Probability
- Probability Surveys
- The Annals of Probability