

General information

Full Name: Silvia Morlacchi

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Research Activities

Passive scalar advection by stochastic velocity field.

Statistical mechanics of point vortex system.

Dissipation properties of turbulent small scales in 2D fluids, modeled by multiplicative transport noise (advection by stochastic velocity field) and their effect on instabilities.

Markovian models of interacting particle systems and mean field limits.

Work experience

Post-doc grant (*Assegno di ricerca*) at Pisa University on the research theme “Stochastic reaction network dynamics ” starting the 01/02/2025.

Teaching experience

Ph.D. course Mathematical aspects of statistical mechanics, together with Chiara Boccato, to be held from 11/2026 to 1/2027, University of Pisa ([[list of Ph.D. courses](#)] including this one).

Supplementary teaching activities (*didattica integrativa*), Mathematical Analysis 2, Biomedical Engineering (2026).

Tutor, Scuola Normale Superiore (2022)

Tutor, University of Pisa, (29/05/2018 – 30/06/2019)

Education

Winner of a PhD grant at Scuola Normale Superiore, Pisa, Italy
(01/11/2020 - 31/01/2025, dissertation defense 06/02/2026, *esito positivo con lode*)

Phd in Computational methods and mathematical models for sciences and finance

Supervisor: Prof. Franco Flandoli

Subject: dissipation properties of turbulent small scales, modeled using a transport noise, and their effect on instabilities. 2D fluids, numerical framework of point vortices.

Master degree in Physics (110/110), University of Pisa, Italy (10/2016 – 09/12/2019), curriculum: Theoretical Physics

Thesis: Flux tubes and string breaking in $SU(2)$ gauge theory.

Supervisor: Prof. Claudio Bonati

Publications and preprints

Published papers

1. M. Leocata, G. Livieri, S. Morlacchi, F. Flandoli, F. Corvino, A. Pirni *Understanding the household solar panel consumer: a Markovian Model and its Societal implications* Technological Forecasting and Social Change **225**, 124555 (2026) [[arXiv:2304.11213](#)].
Topics: Green Energy Transition, Solar Photovoltaic, Individual based modeling, Markovian models of interacting particle systems
Methodology: time-dependent infinitesimal generators for Markovian models, Montecarlo method (to simulate agent based model), least square method (for calibration of the model).
2. F. Flandoli, F. Corvino, M. Leocata, G. Livieri, S. Morlacchi, A. Pirni *Structural properties in the diffusion of the solar photovoltaic in Italy: individual people/householder vs firms* Decisions in Economics and Finance (2025) [[arXiv:2212.01329](#)].
Topics: Green Energy Transition, Solar Photovoltaic, Individual based modeling, Mean Field Games (mean-field model for a continuous-time dynamic game), Markovian models of interacting particle systems.
Methodology: time-dependent infinitesimal generators for Markovian models, shooting method (to simulate forward-backward mean field system).
3. F. Grotto, S. Morlacchi *Decay of Time Correlations in Point Vortex Systems* Physica D **463**, 134169 (2024) [[arXiv:2311.06963v2](#)].
Topics: large point vortex system dynamics, decay of time correlations, equilibrium statistical mechanics.
Methodology: standard Pearson estimator for correlations, Montecarlo method to compute expectation values of observables, independent sampling, Runge-Kutta method for numerical integration of coupled ODES, confidence intervals estimated by means of bootstrap.
4. C. Bonati, M. Caselle, S. Morlacchi *The unreasonable effectiveness of effective string theory: the case of the 3d $SU(2)$ Higgs model* Phys. Rev. D **104**, 054501 (2021) [[arXiv:2106.08784](#)].
Topics: lattice gauge field theory, 3D non abelian $SU(2)$ Higgs model, static potential, string breaking, flux tube, color confinement.
Methodology: Markov Chain Montecarlo methods (to estimate expectation values of observables), stochastically exact methods of error reduction (multihit and multilevel), jackknife and bootstrap (to estimate confidence intervals), OpenMP for shared memory parallelism.
5. C. Bonati, S. Morlacchi *Flux tubes and string breaking in three dimensional $SU(2)$ Yang-Mills theory* Phys. Rev. D **101**, 094506 (2020) [[arXiv:2003.07244](#)].
Topics: lattice gauge field theory, 3D non abelian $SU(2)$ Yang-Mills, static potential, string breaking, flux tube, color confinement.
Methodology: Markov Chain Montecarlo methods (to estimate expectation values of observables), stochastically exact methods of error reduction (multihit and multilevel), jackknife and bootstrap (to estimate confidence intervals), OpenMP for shared memory parallelism.

Proceedings

1. F. Flandoli, S. Morlacchi, A. Papini *Effect of Transport Noise on Kelvin–Helmholtz Instability*.
In: Chapron, B., Crisan, D., Holm, D., Mémin, E., Radomska, A. (eds) STUOD 2022, Mathematics of Planet Earth, vol **11**, Springer, Cham. (2024)
Topics: Kelvin–Helmholtz instability, dissipation properties of turbulent small scales in 2D incompressible fluids, modeled by multiplicative transport noise (advection by stochastic velocity field).
Methodology: Lagrangian approach (point vortex method), Heun method to numerically solve $N = 10000$ coupled SDE, with additive noise and transport noise.

Preprints

1. F. Butori, A. Mayorcas, S. Morlacchi *Homogenisation of a Passive Scalar Transported by Locally Supported White Noise* [[arXiv:2509.06878](#)]. Submitted to Nonlinearity, currently under review.

Talks and conferences contributions

1. Conference Nonlinear systems with noise, Münster (21/09/2026 – 25/09/2026)
talk *Two-point motion in time-correlated stochastic velocity field*, to be given in the week 21-25/09
2. PiBe workshop, Pisa (22/06/2026 - 24/06/2026)
talk *Two-point motion in time-correlated stochastic velocity field*
3. Workshop Stochastic Navier-Stokes equations, Essen (15/06/2026 - 18/06/2026)
talk *Two-point motion in time-correlated stochastic velocity field*
4. 2nd European Fluid Dynamics Conference, Dublin (26/08/2025 - 29/08/2025)
talk *Decay of time correlations in point vortex systems*.
5. Stochastic bridges: From Avon to Arno, Pisa (Italy) (25/06/2025 - 26/06/2025)
talk *Two-point motion in time-correlated stochastic velocity field*.
6. Physics and Mathematics of hydrodynamic and wave turbulence, CIRM (Centre International de Rencontres Mathématiques), Marseille, France (26/05/2025 - 30/05/2025),
talk *Decay of time correlations in point vortex systems*.
7. Mathematical Fluid Mechanics In 2024, Prague (19/08/2024 - 23/08/2024),
talk *Decay of time correlations in point vortex systems*.
8. 4th Italian Meeting on Probability and Mathematical Statistics, Roma (10/06/2024 - 14/06/2024),
talk *Transport Noise effect on Kelvin-Helmholtz instability*, in contributed session *Stochastic Geophysical Fluid Dynamics*.
9. Workshop Stochastics in Fluids, Prague (21/08/2023 - 25/08/2023),
poster *Effect of Transport Noise on Kelvin-Helmholtz Instability*.
10. Summer school 100 years of turbulent cascades, Nizza and Porquerolles, (26/06/2023 - 07/07/2023),
talk *Effect of Transport Noise on Kelvin-Helmholtz Instability*.
11. SPASS Seminar, Pisa, (16/05/2023) *Effect of Transport Noise on Kelvin-Helmholtz Instability*.

Conference organization

1. Stochastic Bridges: From Avon to Arno, Pisa (Italy)
(25/06/2025 - 26/06/2025)
[<https://sites.google.com/unipi.it/stochasticfata>].
2. Turbulence on the banks of the Arno, Pisa (Italy)
(28/04/2025 - 30/04/2025)
[<https://indico.sns.it/e/tuba>].
Invited speakers: Theodore Drivas, Alexei Mailybaev.
3. Turbulence on the banks of the Arno, Pisa (Italy)
(31/01/2024 - 02/02/2024)
[<https://indico.sns.it/event/62/page/8-past-events>].
Invited speakers: Jeremie Bec, Michele Coti Zelati.

Funding Information

1. Participant to project *Fluidodinamica stocastica: irregolarità, trasporto e fenomeni di regolarizzazione* (01/01/2026 - 31/12/2026), funded (2600 euros) by GNAMPA (Istituto Nazionale Di Alta Matematica).
PI: Antonio Agresti
Other participants: Luigi Amedeo Bianchi, Michele Coghi, Lucio Galeati, Mario Maurelli.
2. Participant to project *Modelli stocastici in Fluidodinamica e Turbolenza* (01/01/2025 - 31/12/2025), funded (3500 euros) by GNAMPA (Istituto Nazionale Di Alta Matematica).
PI: Lucio Galeati
Other participants: Luigi Amedeo Bianchi, Michele Coghi, Mario Maurelli, Marco Bagnara, Giulia Lombardi, Francesco Triggiano.

3. Participant to PRIN PNRR 2022 *Some mathematical approaches to climate change and its impacts*.

Coordinator: Cannarsa Piermarco

Research Unit coordinator: Franco Flandoli

University: Scuola Normale Superiore

Digital Skills

Programming in C (also with OpenMP), C++, Fortran, Python, Bash, and MATLAB in Linux environments.