

Diletta Burini

Personal Data

Nationality Italian
Birth September 13th, 1983. Perugia, Italy
email diletta.burini@unipg.it

Research Interests

My initial research focused on the natural continuation of the activity developed in my PhD program, i.e., wave dynamics and inverse problems of interest in mathematical physics. Subsequently, turned to the modeling, qualitative analysis, and simulations of living, i.e. complex, systems by developing and applying theoretical tools from the kinetic theory of active particles. Specifically, on vehicular traffic, collective learning and social dynamics. Special attention has been given to the derivation of models at the macroscopic scale from the underlying description at the microscopic scale provided by the tools of kinetic theory. This line of research, somehow inspired by the sixth Hilbert problem, focused on the derivation of biological tissues from the microscopic dynamics.

An intense activity has been addressed to the multi scale modeling of the epidemics of SARS-CoV-2.

Education

January 15th, 2013 **Ph.D. in *Mathematics and Computer Science for Information and Knowledge treatment XXV PhD cycle*** Università degli Studi di Perugia
July 17th, 2009 **Master Degree in *Mathematics*** Università degli Studi di Perugia
February 22nd, 2007 **Bachelor Degree in *Mathematics*** Università degli Studi di Perugia

Ph.D. Thesis

Title *Nonlinear Models in Fluid Dynamics*
Supervisor Prof. Silvana De Lillo

National Academic Qualification

November 9th, 2020 **Abilitazione a Professore di II Fascia**
S.C. 01/A4 - Fisica Matematica

Open access lectures on the dynamics of complex systems, University of Granada, Spain

2022 *N. Bellomo, D. Burini, D.A. Knopoff, and P. Terna*, “From a Mathematics of Living Systems To Modeling Virus Pandemics”, University of Granada, Spain and Collegio Carlo Alberto, Torino
https://www.youtube.com/@modeling_life

- 2021 *N. Bellomo, D. Burini, D. Knopoff, N. Outada, G. Dosi, P. Terna and M.E. Virgillito*, “What is life? Seven Lectures on Collective Dynamics in Science and Society”, University of Granada, Spain
<https://www.modelingnature.org/training>

Academic Didactic Activity

- A.Y. 2022-23 **Co-Teaching:** *Mathematics course*, degree in Economy, Università degli Studi di Perugia
- A.Y. 2021-22 *Open Access Lectures for Young Researchers*
- A.Y. 2016-18 **Teaching:** *Institutions of Mathematics course*, degree in Primary Education Sciences, Università degli Studi di Perugia
- A.Y. 2015-16 **Co-Teaching:** *Geometry course*, degree in Engineering, Politecnico di Torino
- A.Y. 2012-13 **Tutoring:** *Mathematical Analysis course*, degree in Engineering, Università degli Studi di Perugia
- A.Y. 2011-12 **Tutoring:** *Mathematical Analysis course*, degree in Veterinary Medicine, Università degli Studi di Perugia
- A.Y. 2010-11 **Tutoring:** *Mathematical Analysis course*, degree in Computer Science, Università degli Studi di Perugia
- A.Y. 2009-10 **Tutoring:** *Mathematical Physics and Rational Mechanics courses*, degree in Mathematics, Università degli Studi di Perugia
- A.Y. 2008-09 **Tutoring:** *Mathematical Analysis course*, degree in Geology, Università degli Studi di Perugia
- A.Y. 2007-08 **Tutoring:** *Mathematical Analysis course*, degree in Geology, Università degli Studi di Perugia

Research Fellowships

- November 2015 - **Post-Doc grant** *Qualitative analysis and computational modeling of biological dynamics with mutation and Darwinian selection, with applications to the immune competition*, DISMA, Politecnico di Torino, Projects: PRIN 2012 Mathematical problems in kinetic theory and applications
The Scientific: Prof. Nicola Bellomo
- November 2014 - **Post-Doc grant** *Physico-Mathematical models of polymer chains*, Department of Mathematics, Università degli Studi di Perugia, Projects: PRIN+INSTM(FIRB)
October 2015 The Scientific: Prof. Silvana De Lillo
- April 2013 - **Post-Doc grant** *Study of polymer chains in fluids: propagation of solitary waves*, Department of Mathematics, Università degli Studi di Perugia, Project: PRIN 2010-2011
April 2014 The Scientific: Prof. Silvana De Lillo
- December 2011 - **Research grant** *Physical mathematical models for elastic string description analytical biopolymers and synthetic polymers*, Department of Mathematics, Università degli Studi di Perugia, Project: PRIN 2008
December 2012 The Scientific: Prof. Silvana De Lillo
- October 2010 - **Research grant** *Physical-Mathematical models of biological and synthetic polymers*, Department of Mathematics, Università degli Studi di Perugia
- August 2011 The Scientific: Prof. Silvana De Lillo

Schools, Conferences and Workshops

- October 6th - **Problems in discrete dynamics: from biochemical systems to rare events, networks, clustering and related topics II**, as a speaker
7st, 2017 Arcidosso, Italy
- September **BIOPHYS17**, *Theoretical Physics Tools and Complex Network Physics applied to Biology and Social Systems*, as an invited speaker
25th - 26st, 2017 Pisa, Italy
- October 20th **Kinetic Theory and its neighbours GSSI**
- 21st, 2016 L'Aquila, Italy
- September **SIMAI 2016**, *Società Italiana di Matematica Applicata e Industriale*
13th - 16th, 2016 Milano, Italy
- June 1st - **Biomat 2016**, *Cell Dynamics and Polymerization*
3rd, 2016 Granada, Spain
- January 26th **NAMB 2016**, *Nonlocal Aspect in Mathematical Biology*
- 30th, 2016 Bedlewo, Poland
- November **Complex System Methods in Biology**
5th - 6th, 2015 Torino, Italy
- May 24th - **NEEDS 2015**, *Nonlinear Evolution Equations and Dynamical Systems*, as a speaker
31st, 2015 Santa Margherita di Pula, Italy
- July 7th - **SIMAI 2014**, *Società Italiana di Matematica Applicata e Industriale*
10th, 2014 Taormina, Italy
- June 22nd - **PMNP 2013**, *Physics and Mathematics of Nonlinear Phenomena*, as a speaker
29th, 2013 Gallipoli, Italy
- Sept. 19th - **XXXVI Summer School on Mathematical Physics**
Oct. 1st, 2011 Ravello, Italy
- June 12th - **WASCOM 2011**, *Waves and Stability in Continuous Media*, as a speaker
18th, 2011 Brindisi, Italy
- September **BIOPHYS10**
9th - 11th, 2010 Arcidosso, Italy

Stages

- May, June, **Universidad de Granada**, *Departamento de Matemática Aplicada*
2016 Granada (ES)
- April - June, **University of Colorado**, *Department of Applied Mathematics*
2012 Boulder (CO)

20 Selected Publications

- 1) *G. Bertaglia, A. Bondesan, D. Burini, R. Eftimie, L. Pareschi and G. Toscani, New Trends on the Systems Approach to Modeling SARS-CoV-2 Pandemics in a Globally Connected Planet, Mathematical Models and Methods in Applied Sciences, accepted for publication, 1–61, 2024*

- 2) *D. Burini and D.A. Knopoff*, Epidemics and Society - A Multiscale Vision from the *Small World* to the *Globally Interconnected World*, *Mathematical Models and Methods in Applied Sciences*, 1–30, 34(8), **2024**
published online doi: 10.1142/S0218202524500295
- 3) *N. Bellomo, D. Burini, V. Secchini and P. Terna*, Active Particles Methods: New perspectives in the interaction between mathematics and economics, Cambridge University Press. Series: Cambridge Elements in Complexity and Agent-based Economics, accepted for publication, in press by the production office, **2024**
- 4) *D. Burini and N. Chouhad*, Cross diffusion models in complex frameworks from microscopic to macroscopic, *Mathematical Models and Methods in Applied Sciences*, 33(9), 1909–1928, **2023**
- 5) *D. Burini, N. Chouhad and N. Bellomo*, Waiting for a Mathematical Theory of Living Systems from a Critical Review to Research Perspectives, *Symmetry*, 15(2), 351, **2023**
- 6) *D. Burini and N. Chouhad*, Virus models in complex frameworks: Towards modeling space patterns of SARS-CoV-2 epidemics, *Mathematical Models and Methods in Applied Sciences*, 32(10), 2017–2036, **2022**
- 7) *N. Bellomo, D. Burini and N. Outada*, Pandemics of mutating virus and society: a multi-scale active particles approach, *Philosophical Transactions of the Royal Society A* 380(2224), 20210161, **2022**
- 8) *N. Bellomo, D. Burini and N. Outada*, Multiscale Models of Covid-19 with Mutations and Variants, *Networks Heterogeneous Media*, 17(3), 293–310, **2022**
Highly cited paper by Clarivate WEB of Science
- 9) *N. Bellomo, D. Burini, G. Dosi, L. Gibelli, D. Knopoff, N. Outada, P. Terna and M.E. Virgillito*, What is life? A perspective of the mathematical kinetic theory of active particles, *Mathematical Models and Methods in Applied Sciences* 31(9), 1821–1866, **2021**
Highly cited paper by Clarivate WEB of Science
- 10) *D. Burini and N. Chouhad*, A multiscale view of nonlinear diffusion in biology: From cells to tissues, *Mathematical Models and Methods in Applied Sciences* 29(4), 791–823, **2019**
- 11) *D. Burini and S. De Lillo*, On the Complex Interaction between Collective Learning and Social Dynamics, *Symmetry* 11(8), 967–980, **2019**
- 12) *D. Burini, E. De Angelis and M.Lachowicz*, A continuous-time Markov chain modeling cancer-immune system interactions, *Communications in Applied and Industrial Mathematics* 9(2), 106–118, **2018**
- 13) *D. Burini, S. De Lillo and G. Fioriti*, Nonlinear diffusion in arterial tissues: a free boundary problem, *Acta Mechanica* 229, 4215–4228 **2018**
- 14) *D. Burini, S. De Lillo and G. Fioriti*, Influence of drivers ability in a discrete vehicular traffic model, *International Journal of Modern Physics C* 28(3), 1750030, **2017**
- 15) *D. Burini and N. Chouhad*, Hilbert method toward a multiscale analysis from kinetic to macroscopic models for active particles, *Mathematical Models and Methods in Applied Sciences* 27(7), 1327–1353, **2017**

- 16) *D. Burini, L. Gibelli and N. Outada*, Chapter: A Kinetic Theory Approach to the Modelling of Complex Living Systems
Active Particles, Volume 1, Bellomo et al.(eds.). Modeling and Simulation in Science, Engineering and Technology, 229-258, **2017**.
- 17) *D. Burini, S. De Lillo and L. Gibelli*, Collective Learning Modeling Based on the Kinetic Theory of Active Particles, Physics of Life Reviews 16, 123-139, **2016**
- 18) *D. Burini, S. De Lillo and L. Gibelli*, Learning dynamics towards modeling living systems, Physics of Life Reviews 16, 158-162, **2016**
- 19) *D. Burini, S. De Lillo and G. Fioriti*, On the well posedness of the initial value problem in a kinetic traffic flow model, Journal of Computational and Theoretical Transport 45(7), 528-539, **2016**
- 20) *D. Burini, S. De Lillo and D. Skouteris*, On a Coupled System of Shallow Water Equations Admitting Travelling Wave Solutions, Mathematical Problems in Engineering 2015, Article ID 197978, **2015**