Curriculum

DUCCIO FANELLI

Address: Dipartimento di Fisica e Astronomia,
University of Florence, via Sansone 1, Sesto
Fiorentino, Florence
Email: duccio.fanelli@unifi.it

RESEARCH POSITIONS
2020 - Director of the Department of Physics and Astronomy University of Florence, Florence, Italy (from 1st November 2020).
2020 - Director of the Centre for the Study of the Complex System (CSDC) University of Florence, Florence, Italy.
2019 - Full Professor in Condensed Matter Physics (permanent job) –
Department of Physics and Astronomy, University of Florence, Florence, Italy.
2019-2020 Awarded the Francqui Chair 2019-2020.
2019 Invited Researcher CNRS (niveau DR)– Marseille, France (1 month).
2017 Invited Researcher – University of Namur, Belgium.
2013 - Associate Professor in Condensed Matter Physics (permanent job) –
Department of Physics and Astronomy, University of Florence, Florence,
Italy.
2013 Invited Professor – Université d' Orleans Lyon, France (1 month).
2008 Invited Professor – Ecole Normale Superieure (ENS) de Lyon, France (2 months).
2007 - 2012 Associate Professor in Condensed Matter Physics (permanent job) –
Department of Energy “S. Stecco”, University of Florence, Florence, Italy.
Three years confirmation stage passed in May 2011.
2006 - 2007 Lecturer in Theoretical Physics (permanent job)– Department of Physics, University of Manchester, UK. Teaching and research position. The research activity is aimed at establishing an independent unit with supervision of postdocs and PhD students.

2006 Senior Researcher – SIDEC technologies AB, Stockholm, Sweden. Home page: www.sidectech.com. Project Leader of a project aimed at developing a simulator for the image formation in a Transmission Electron Microscope. The project involves the Department of Mathematics, Stockholm University, Sweden and the Department of Cell and Molecular Biology, Karolinska Institute, Stockholm, Sweden.
2004 - 2006 Contracted Professor – Department of Energetic “S. Stecco”, University of Florence, Florence, Italy. Position sponsored by the Italian research council within the framework of the “Rientro dei Cervelli” program.
2004 - 2006 Researcher – Department of Cell and Molecular Biology, Medical Nobel Institute, Karolinska Institute, Stockholm, Sweden.
2002-2004 Postdoc – Department of Cell and Molecular Biology, Medical Nobel Institute, Karolinska Institute, Stockholm, Sweden.
2002-2004 Researcher - SIDEC technologies AB, Stockholm, Sweden. Molecular imaging.
1999 Visiting Researcher – Observatoire de Nice, Nice, France (3 months).

EDUCATION

1997-2002 Ph.D. in Numerical Analysis and Computer Science, Royal Institute of Technology (KTH) and University of Stockholm, Sweden: “Self-gravitating Systems and Beam Dynamics in a Storage Ring”. Supervisor: Erik Aurell (Stockholm).

1997-2002 Licentiate Philosopie in Numerical Analysis and Computer Science, University of Stockholm, Sweden: “On the dynamics of self-gravitating systems and a new interpretation of the resonance theory for betatron motion”. Supervisor: Erik Aurell (Stockholm). Recognised as a pre-doctoral degree: it is equal to completion of the coursework required for a doctorate and a dissertation which is formally equivalent to half of a doctoral dissertation.

1989-1996 Laurea in Physics, University of Florence, Italy: “Regime non lineare della interazione plasma-fascio caldo di elettroni (Non linear warm beam - plasma instability)”. Supervisors: Yves Elskens (Marseille) and Stefano Ruffo (Florence). Thesis work carried out at the University of Marseille (France).

1993-1994 Course of Maitrise, European Erasmus exchange, University of Provence, Marseille, France.

HABILITATION

2017 Italian scientific habilitation (ASN) to full professor for section 02/A2 – Theoretical physics of fundamental interactions.

2017 Italian scientific habilitation (ASN) to full professor for section 02/B2 – Theoretical physics of condensed matter.

MAIN RESEARCH INTERESTS

Application of statistical mechanics and non linear physics to biology and life sciences in general. Stochastic models, simulations (Gillespie) and analytical techniques (van Kampen and Kramers-Moyal expansion). Patterns formation in biology. Statistical mechanics and out-of-equilibrium dynamics in systems subject to long-range forces. Vlasov equation, kinetic theory and plasma physics. Dynamics of Free Electron Laser.

SUPERVISOR AND LECTURING TRACK RECORDS

Postdocs: Francesca Di Patti (2013-2018); Joseph Daniel Challenger (2013-2014).

PhD thesis:

■ Andrea Antoniazzi: “Dynamics of systems with long-range interactions: from FEL physics to the HMF model”, Non-linear dynamics and complex systems, 2003-2006 (jointly with S. Ruffo, Florence).

■ Andrea Guazzini: “Opinion dynamics through agents models” Non-linear dynamics and complex systems 2005- 2008 (jointly with F. Bagnoli).

■ Francesca Di Patti : "Finite size effects in stochastic models of population dynamics: applications to biomedicine and biology", Non-linear dynamics and complex systems, 2005- 2008. Winner of the award for the best PhD thesis at the University of Florence 2008.

■ Antonia Ciani: “Dilution, finite size effects and out-of-equilibrium dynamics in mean field models” Physics, 2005- 2009.

■ Pasquale Laise: “Stochastic models in tumor dynamics” Non-linear dynamics and complex systems , 2009-2012 (jointly with A. Arcangeli).

■ Alessio Turchi: “Dynamics and statistical mechanics of systems with long range

interactions". Non Linear dynamics and complex systems, 2009-2012 (co-tutelle, Universitè de Provence Marseille, France).
■ Claudia Cianci: "Finite size effects in stochastic biological models". Non-Linear dynamics and complex systems, 2011-2014.
■ Malbor Asslani: "Stochastic Turing patterns and wave propagation on a Network". Applied Mathematics, 2011-2014.

■ Marta Galanti: "Molecular diffusion under crowded conditions". Non-Linear dynamics and complex systems, 2012-2015 (co-tutelle, Universitè de Orleans, France).
■ Clement Zankoc: "The role of external and endogenous noise in neural network dynamics and statistics", Physics 2015-2018 (jointly with Roberto Livi).
■ Giulia Cencetti: "Dynamics on complex networks: modeling the form to shape the substance", Non-Linear dynamics and complex systems, 2015-2018 (jointly with Franco Bagnoli, Luigi Chisci, Giorgio Battistelli).
■ Maxime Lucas: "Synchronization and stability in nonautonomous oscillatory systems", Physics 2015 - 2018 (jointly with Aneta Stefanovska, University of Lancaster).
■ Sara Nicoletti: "Neuromorphic computing", Non-Linear dynamics and complex systems, 2017 -
■ Adam Ihusan: "Reaction diffusion on network", Non-Linear dynamics and complex systems, 2017 - [special grant awarded by the Dean to foster interdisciplinary activities] (jointly with Giacomo Innocenti).
■ Lorenzo Buffoni: "Quantum Random Walks", Non-Linear dynamics and complex systems, 2017 (jointly with Luigi Chisci, Giorgio Battistelli, Filippo Caruso).
MSc thesis:
Romain Bachelard, "An attempt to control the Free Electron Laser dynamics", Physics at the Université de Provence, France (2005); Pietro De Anna, "Collective dynamics in a protocell model: analytical and numerical study", Laurea in Physics, Università di Firenze (2009); Tommaso Biancalani, "Turing instability in stochastic models of populaton dynamics", Laurea Magistrale in Physics, Università di Firenze (2010); Claudia Cianci, "Stochastic dynamics and finite size corrections in a scheme of autocatalytic reactions", Laurea Magistrale in Mathematics, Università di Firenze (2010); Malbor Asllani, "Quasi-Stationary States and the Lynden-Bell theory of violent relaxation", Laurea Magistrale in Mathematical Engineering, Università di Firenze (2011); Caterina Borgiotti, "Solitons and the method of harmonic balance", Laurea Magistrale in Automatic Engineering, Università di Firenze (2011) Winner of "Piero Ciullini" award for the best Laurea Thesis in Engineering (Ordine degli Ingegneri della Provincia di Firenze); Giulio Pompili "Diffusion in a crowded environment: theory and experiments", Laurea Magistrale in Automatic Engineering, Università di Firenze (2011); Laura Cantini "Stochastic dynamics of calcium channels: a-spatial model", Laurea Magistrale in Mathematics (2012); Emma Massi "Stochastic dynamics of calcium channels: spatial model", Laurea Magistrale in Mathematics (2012); Gwendoline Planchon "Reaction diffusion dynamics on complex networks", Applied Mathematics, Universitè de Namur, Belgium (2014) Awarded as the Best Thesis of the University of Namur; Florent Cottier, "Reaction diffusion models on long range networks" Universitè de Provence, Marseille, France (2014); Daniel Maria Busiello "Pattern formation in multiplex" Università di Pisa (2014); Silvia Contemori "Multiple scale theory of

reaction-diffusion systems on directed networks", Applied Mathematics (2015); Filippo Miele "Pattern formation from limit cycles: a multiple time scale approach" Laurea Magistrale in Physics (2015); Laura Lavacchi "Deterministic and stochastic patterns in a cyanobacterium model" Laurea Magistrale in Physics (2016); Niccolò Zagli "Noise driven neuromorphic tuned amplifier" Laurea Magistrale in Physics (2017) Winner of the "Bardazzi award" for the best technological thesis of the University of Florence (2018); Riccardo Muolo "Turing pattern and non normal network topology" Laurea Magistrale in Mathematics (2018) Award among the best thesis of the Department of Mathematics 2018; Lorenzo Tinacci "Stochastic Michaelis Menten reactions" Laurea Magistrale in Chemistry (2019); Valentina Buonfiglio "Circadian rythms in Anabaena: model vs. experiments" Laurea Magistrale in Physics, (2019); Lorenzo Chicchi "Inverse problems for neuroscience applications", Laurea Magistrale in Physics of Complex Systems (Torino) (2019); Giacomo Chiti, "Interacting random walkers on a lattice: dynamical absorbing traps" Laurea Magistrale in Physics, (2020); Walter Nocentini "Optimization procedures for projective classifications", Laurea Magistrale in Physics, (2020); Lorenzo Giambagli, "Spectral machine learning", Laurea Magistrale in Physics, (2020).

Bachelor thesis:

Leonardo Miele "Stochastic Oscillations in a prey-predator model", Laurea Triennale in Fisica e Astrofisica (2014); Lorenzo Maffi "Trophic systems and bifurcations", Laurea Triennale in Fisica e Astrofisica (2014); Riccardo Muolo "Turing Instability on continuum and discrete support" Laurea Triennale in Fisica e Astrofisica (2015); Lorenzo Chicchi "Stochastic dynamic of Cape Rodney-Okakari Point marine ecosystem", Laurea Triennale in Fisica e Astrofisica (2017); Alessio Focardi "One-dimensional self-gravitating systems in an expanding medium", Laurea Triennale in Fisica e Astrofisica (2017); Lorenzo Giambagli "A diffusive model for visual hallucination" Laurea Triennale in Fisica e Astrofisica (2018); Claudio Pereti "Ginzburg Landau equation on a time varying networks" Laurea Triennale in Fisica e Astrofisica (2018); Luca Tolve "Fluttuazioni di energia in un sistema classico fuori dall'equilibrio" Laurea Triennale in Fisica e Astrofisica (2019) (jointly with Michele Campisi); Luca Governini "Modelli macroscopici esatti di popolazioni neurali interagenti" Laurea Triennale in Fisica e Astrofisica (2019) (jointly with Simona Olmi).

I taught graduate and undergraduate courses in Classical Physics, Statistical Mechaniscs, Theory of Stochastic Systems, Chaos, Non-linear Physics, Numerical Analysis, Molecular Imaging.

During my stay in Manchester as staff lecturer (2006-2007) I taught a course on Plasma Physics (24 hours/semester) and gave Tutorials (3 hours/week both semesters) on Quantum Mechanics, Atomic Physics and Statistical Mechanics.