europass Curriculum vitae

PERSONAL INFORMATION

Francesco Mambretti

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Gender Male | Date of birth 27/08/1993

Nationality Italian

PRESENT JOB

February 2021 – present

Postdoctoral researcher in Physics

Università degli Studi di Padova, Dipartimento di Fisica e Astronomia, via Marzolo 8, Padova, 35131 - Italia

Postdoctoral Researcher at the Laboratory of Interdisciplinary Physics (`https://www.liphlab.com/`) at the University of Padova, Italy. My research mainly exploits *statistical physics* and *computer simulations* for the study of **single-strand DNA** populations, in an ecological context for investigating **synthetic biodiversity**, under the supervision of dr. S. Suweis and in collaboration with prof. T. Bellini's group in Milan. I am also focusing on supervised and unsupervised **machine learning** methods for dimensionality reduction, RNA folding and image analysis. I am associated to INFN - Padova section. I am currently co-supervising 1 Bachelor thesis. I co-supervised 1 Bachelor thesis.

WORK EXPERIENCES

September 2017-March 2021

PhD student (XXXIII cycle) at the University of Milan, Italy. Tutor: prof. Davide E. Galli. Thesis title: **Emergent phenomena in condensed matter, soft matter and complex systems**. My research activity was focused on:

- simulation and thermodynamic theory of the **crystal growth in supercooled argon-krytpon liquids** (in collaboration with the experimental group of dr. R. Grisenti, Goethe Universität Frankfurt)
- simulation and theory of **emergent properties of one-dimensional and two-dimensional soft matter** systems
- stochastic simulation and analysis of **electric resistor networks** via graph theory and information theory (in collaboration with the CIMaINa laboratories headed by prof. P. Milani, Università degli Studi di Milano)
- simulation of **trivalent soft patchy particles binary mixtures** as a model of DNA nanostars (in collaboration with the Complex Fluids and Molecular Biophysics laboratories headed by prof. T. Bellini, Università degli Studi di Milano)

During PhD, I used and developed **Molecular Dynamics** and classical **Monte Carlo** codes, intensively exploiting High Performance Computing resources. I also applied **Machine Learning** and **Deep Learning** techniques, in particular to image analysis (also in Medical Physics area) and to ill-posed inverse problems. I have been assistant supervisor of 7 Bachelor theses and 5 Master theses (supervisor prof. D. E. Galli).

October 2020 - December 2020; October 2021 - January 2022

tutor of *Measurement of nanoscale interactions in biological systems and data analysis*

for the Master Degree in Quantitative Biology at the Università degli Studi di Milano, teacher prof. A. Podestà. Assistance and frontal lessons with the students, during remote practical sessions (total: 8/12 h). Topics: Python analysis of biological/nanostructured materials datasets.

October 2020 - present; October 2019 - January 2020; October 2018 - January 2019

tutor of *Laboratory for Numerical Treatment of Experimental Data*

for the Bachelor Degree in Physics at the Università degli Studi di Milano, teacher: prof. D. E. Galli. Assistance to the students during practical sessions in laboratory, (tot.: 36 h). Topics: numerically solving integrals and differential equations, Monte Carlo methods, object-oriented programming in C++, usage of ROOT-CERN.

March 2020 - June 2020; March 2019 - June 2019

tutor of *Numerical Simulation Laboratory*

for the Bachelor and Master Degree in Physics at the Università degli Studi di Milano, teacher: prof. D. E. Galli. Assistance to the students during practical sessions in laboratory, (tot.: 36 h). Topics: classical and quantum Monte Carlo methods, Molecular Dynamics, stochastic optimization techniques, parallel computing, machine learning. Usage of Python and C++.

November 2017 - January 2018

tutor of Mathematics

for the Bachelor Degree in Chemistry at the Università degli Studi di Milano, teacher: prof. E. Bonetti. Lessons with exercises (total: 20 h). Topics: mathematical analysis.

November 2017 - January 2018

tutor of Mathematics

for the Bachelor Degree in Industrial Chemistry at the Università degli Studi di Milano, teacher: prof. C. Verdi. Lessons with exercises (total: 20 h). Topics: mathematical analysis.

May 2015 - present

tutor c/o Camplus College - Fondazione CEUR

tutor of Mathematical Analysis, Linear Algebra and Physics at the Camplus CEUR College in Città Studi in Milano for the university students residing in the college. Since 2021, I also collaborate with Camplus Humanitas, Pieve Emanuele (Milano).

September 2009, 2010 and 2011

info point

for italian and foreign visitors in Monza, for the 80°/81°/82° Formula 1 Italy GP.

EDUCATION AND TRAINING

April 2017 - September 2017 and May 2021 - present

Graduate goer

at the Physics Department of the Università degli Studi di Milano, Italy, co-working with the research group of prof. D. E. Galli.

January 2015 - April 2017

Master degree in Physics

Università degli Studi di Milano, Milano - Italy.

Thesis: ***Microscopic study of the structural phase transition in supercooled argon-krypton liquid mixtures***, 110 cum laude/110. Supervisor: prof. D. E. Galli.

September 2011 - December 2014

Bachelor degree in Physics

Università degli Studi di Milano, Milano - Italy.

Thesis title: ***Microscopic characterisation of undercooled argon-krypton liquid mixtures via Molecular Dynamics simulations***, 107/110. Supervisor: prof. D. E. Galli.

September 2006 - June 2011

Classical high school diploma

Liceo "B.Zucchi", Monza (MB) - Italy

Final mark 94/100.

SCIENTIFIC ACTIVITY

Ongoing collaborations

- prof. T. Bellini, Università degli Studi di Milano
- prof. D. E. Galli, Università degli Studi di Milano
- dr. R. Grisenti, Goethe Universität, Frankfurt
- prof. P. Milani, Università degli Studi di Milano
- dr. D. Pini, Università degli Studi di Milano

Society membership

- since 2021, I am a member of the Organizing Committee and of the External Relations committee of the CSS/Italy `https://italy.cssociety.org/`

Publications

ORCID: 0000-0002-3712-3595
arXiv.org: francesco.mambretti

- Mambretti F., Martinelli M. *et al.* ***Low-temperature ordering of the dimer phase of a 2D model of core-softened particles***. Phys. Rev. E (2021). `10.1103/PhysRevE.104.044602`
- Mambretti F., Molinelli S. *et al.* ***Emergence of an Ising critical regime in the clustering of one-dimensional soft matter revealed through string variables***. Phys. Rev. E (2020). `https://doi.org/10.1103/PhysRevE.102.042134`
- Schottelius A., Mambretti F. *et al.* ***Crystal growth rates in supercooled atomic liquid mixtures***. Nat. Mater. (2020). `https://doi.org/10.1038/s41563-020-0613-z`
- Mambretti F. *et al.*, ***Microscopic investigation of the crystallization slowdown in supercooled liquid mixtures***. Contribution to the *Cineca HPC Report 2017*, ISBN 978-88-86037-38-9.
- Bonati L., Mambretti F. ***Esercizi risolti di Struttura della Materia***, Edizioni CUSL - Collana scientifica (2016). (Exercise book for the Structure of Matter 1 course, Physics Department, Università degli Studi di Milano). ISBN 978-88-81327-32-4

Grant

- *December 2018 - September 2019*: PI of an ISCRA C project for the usage of HPC resources at CINECA (IsC67_SOFT-ONE, 225000 core hours on Marconi A2 - equivalent value $\simeq$ 1700 euro)
- *July 2017 - March 2018*: PI of an ISCRA C project for the usage of HPC resources at CINECA (IsC53_GLEMD, 400000 core hours on Marconi A2 - equivalent value $\simeq$ 2700 euro)

Reviewer

I currently serve as a reviewer for Physical Review B and Physical Review Materials

Talks

- *8 September 2021*: talk on ***Machine learning methods in Radiomics: supervised and unsupervised approaches*** at Radiomics Toolbox: workflow & quality management (IRCCS Fondazione Mondino/Facoltà di Ingegneria, Università degli Studi di Pavia)
- *22 July 2021*: talk on ***Crystal growth rates in supercooled atomic liquid mixtures*** at the Liquid Matter Conference 2021 (online conference, Prague university)
- *11 May 2021*: ***Emergence of an Ising critical regime in the clustering of one-dimensional soft matter revealed through string variables***, talk at the International Online Conference MECO46 (Riga Technical University)

- *22 December 2020* and *18 December 2019*: seminar about ***Deep Learning for images in Medical Physics*** for the Master degree course "Imaging techniques for bio-medical applications" (Physics Department, Università degli Studi di Milano).
- *20 February 2020*: invited seminar, Università degli Studi di Padova: ***Crystal growth rates in supercooled atomic liquid mixtures***.
- *25 July 2019*: 5-minutes talk at the DeepLearn2019 summer school, Warsaw: ***Facing analytic continuation via deep neural networks***.
- *15 February 2019*: talk at the III Condensed Matter Highlights Workshop, Università degli Studi di Milano: ***Study of the clustering critical regime of one-dimensional classical soft matter***.
- *22 June 2018*: talk at the XXIII Convegno Nazionale di Fisica Statistica e dei Sistemi Complessi (Università di Parma, Italy): ***Energy-landscape driven crystallization slowdown in supercooled liquid mixtures***.
- *15 August 2017*: invited seminar at the Goethe Universität in Frankfurt: ***Molecular dynamics simulations of the structural phase transition in supercooled argon-krypton liquid mixtures***.

Posters at conferences

- *19-23 July 2021*: poster on "Emergence of an Ising critical regime in the clustering of one-dimensional soft matter revealed through string variable" at the Liquid Matter Conference 2021 (online conference, Prague university)
- *24 June 2021*: poster on "Emergence of an Ising critical regime in the clustering of one-dimensional soft matter revealed through string variable" at the "I Convegno della Società Italiana di Fisica Statistica - SIFS - XXV Convegno Nazionale di Fisica Statistica e dei Sistemi Complessi"
- *11 May 2021*: poster on "Crystal growth rates in supercooled atomic liquid mixtures" at the "International Online Conference MECO46".

Participation into school, conferences and workshops

I participated into the following events:

- *25-29 October 2021*: Conference on Complex Systems, Lyon
- *19-23 July 2021*: Liquid Matter Conference, online edition - Prague university
- *23-25 June 2021*: "I Convegno della Società Italiana di Fisica Statistica - SIFS - XXV Convegno Nazionale di Fisica Statistica e dei Sistemi Complessi" - online event.
- *22-25 June 2021*: "Stochastic Models and Experiments in Ecology and Biology", mixed event, Venezia.
- *11-13 May 2021*: "International Online Conference MECO46" (online, Riga Technical University)
- *30 September 2019*: "Intelligenza artificiale in radiologia: istruzioni per l'uso", E. C. M. meeting, Policlinico San Donato, San Donato Milanese (MI).
- *22-26 July 2019*: "DeepLearn 2019" summer school in Warsaw, organized by IRDTA.
- *24-28 June 2019*: "DS^3 Data science summer school" in Paris, École Polythechnique.
- *7-9 November 2018*: "Introduction to Deep learning and Tensorflow" course organized in Rome by CINECA.
- *22-24 November 2017*: "Introduction to Parallel Computing with MPI and OpenMP" course organized in Milan by CINECA.
- *25-26 October 2017*: "INTEL technical computing and artificial intelligence workshop 2017" in Milan.
- *March 2017*: online course "Supercomputing" distributed by FutureLearn jointly with PRACE.
- *27-28 April 2016*: "INTEL code modernization workshop 2016 on High Performance Computing, Software Development, Intel Xeon & Xeon Phi" in Milan.
- *6-24 July 2015*: CECAM School 2015 (co-organized by SISSA and CNR-IOM DEMOCRITOS) "Summer school on atomistic simulation techniques" in Trieste. Final mark: 27/30.
- *16-18 February 2015*: "Python for computational science" course organized in Milan by CINECA.
- *17-19 November 2014*: "Efficient use of Molecular Dynamics simulation applications in an HPC Environment" course organized in Bologna by CINECA & PRACE.

Computer skills

- OS: MacOS, Linux e Windows
- programming languages: C++, Python, MPI, C, CUDA. Basic knowledge of OpenMP, Fortran, Mathematica, awk and shell scripting.
- Molecular Dynamics (LAMMPS, GROMACS, oxDNA) and Molecular Visualization/Analysis (JMOL, VMD, Ovito) software
- development of classical Monte Carlo, Parallel Tempering, Simulated Annealing and Genetic Algorithm codes
- knowledge of the PBS and SLURM scheduler
- knowledge of LaTeX
- other software/libraries: Gnuplot, Armadillo-C++, NetworkX, Jupyter-Notebook and Google Colab
- usage of Microsoft Office and Apple suites
- basic knowledge of Photoshop and InDesign of the Adobe suite

Since *2015*, I regularly collaborate to ISCRA projects on CINECA supercomputing facilities. In particular, I was involved in a LISA 2016 project, PI: prof. D. E. Galli. I personally was PI of two ISCRA C projects at CINECA.

Laboratory experiences

- *24-28 October 2019*: participation in an experiment of X-ray scattering on argon-krypton liquid microjets c/o EU-Xfel in Hamburg, Germany. Invited by the group of dr. R. Grisenti, Goethe Universität Frankfurt. XCCA (X-ray Cross Correlation Analysis) technique applied in real time to the scattering data. Study of the nucleation process.
- *20-24 March 2019*: participation in an experiment of X-ray scattering on argon-krypton liquid microjets c/o EU-Xfel in Hamburg. Invited by the group of dr. R. Grisenti. XCCA technique applied in real time to the scattering data. User commissioning of the instrument.
- *3-9 May 2018*: participation in an experiment of X-ray scattering on argon-krypton liquid microjets c/o PETRAIII @ DESY in Hamburg. User Photon Science invited by the group of dr. R. Grisenti, in collaboration with a team from XFEL. XCCA technique applied in real time to the scattering data.
- *21-27 June 2016*: participation to an experiment of X-ray scattering on argon-krypton liquid microjets c/o PETRAIII @ DESY in Hamburg. User Photon Science invited by the group of dr. R. Grisenti.
- During beamtimes at PETRAIII: experience with software for real-time images analysis (Fit2D and ImageJ). Direct experience in the usage of the synchrotron source, liquid microjets, cryostats and the vacuum gauge. I also gained basics physics laboratory experience as a student: mechanics, acoustics, optics, modern physics, electronics. Moreover, I had specific experience in laboratory with Physics of Matter and Solid State Physics instruments: UV-VIS spectrometer, vacuum pump, soxhlet machine.

FOREIGN LANGUAGES

Mother tongue Italian

Other languages

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C2	C2	C2	C2	C2

Levels: A1/A2: Basic user - B1/B2: Independent user - C1/C2: Proficient user
Common European Framework of Reference (CEF) level

November 2015 CPE certificate (British Council, European level C2, mark: A – 221/230, november 2015).

OTHER INFORMATION

Charity and volunteering

- *2014 - present*: during August, I work for a whole week as a guide to the scientific/technological exhibition organised in Rimini for the Meeting for Friendship amongst Peoples by Fondazione CEUR and Associazione Euresis. I was one of the curators of the exhibitions in the editions 2015-2018, 2020 (online edition) and 2021 with thousands of visitors every year.
- *March - July 2020*: Temporary Volunteer of Italian Red Cross, in Monza.
- since *2016* I am a member of AVIS (italian association of blood donors)
- *April 2010 - February 2020*: volunteering at the retirement home “Don Angelo Cambiaghi” in Monza.
- *January 2009 - December 2016*: volunteering at the "Cooperativa sociale ONLUS Iride”, Monza.

Relational and artistic skills

- *January 2015 - August 2019*: member of the “Capitano Grandi” choir (Milano)
- individual lessons of classic, acoustic and electric guitar.
- long experience with education of groups of younger students, as a responsible in Catholic associations (Parish “Redentore” in Monza (MB) and “Stand By Me – Associazione per l’educazione alla umana avventura” in Biassono (MB)).

Certificates

- *October 2019 – November 2019*: First Aid basics, practical-theoretical course, Italian Red Cross, Monza (16 hours).
- *March 2019* and *October 2019*: UPEX safety training for EU-Xfel.
- *June 2017 - August 2017*: e-learning course for volunteers and workers, hosted by Fondazione Meeting Rimini and certified by E.BI.GEN. - UGL/CONFIMEA (8 h).

Other scientific/didactic activities

- *23 August 2021*: chairman at the meeting “What is the world made of? Hunting elusive particles", with prof. L. Rossi (Università degli Studi di Milano) and prof. J. J. Cadenas (Donostia International Physics Center, San Sebastian) during the XLII edition of the “Meeting for Friendship amongst People” in Rimini.
- *August 2020*: speaker in the video "The creativity of life between simplicity and complexity" made by Associazione Euresis for the "Meeting for Friendship amongst People” in Rimini - Special Edition 2020.
- *19 August 2019*: chairman at the meeting “Optical illusions: a trick or an opportunity for our brain?”, with prof. A. Farini (INO-CNR, Firenze), during the XL edition of the “Meeting for Friendship amongst People” in Rimini.
- *9 November 2017*: chairman at the conference “From Physics to Neurosciences. The relationship between science and reality” with G. Bellini *et al.*, organized by the Centro Culturale di Milano.
- *14 September 2017*: speaker at the meeting “Artificial intelligence: learning machines?” at the San Pio X parish, Forlì.
- *24 August 2017*: chairman at the meeting “Molecules, life, mankind: which questions from science?", with prof. T. Bellini (Università degli Studi di Milano), during the XXXVIII edition of the “Meeting for Friendship amongst People” in Rimini.
- *10 March 2017*: chairman at the conference "Le frontiere della bioingegneria e della robotica in medicina", with Alessandro Vato (IIT Genova) organized by Centro Culturale Talamoni in Monza.
- Since *September 2015* I am part of the board and of the scientific committee of the *Euresis Association* for the Development of the Scientific Endeavour.
- Since *January 2010* I give informal talks about scientific topics: history of science, astronomy, technology, physics experiments. Typical audience: students and amateurs.

Driving license B

Curriculum updated on 02/01/2022
I authorize the treatment of my personal data according to DL 30/06/2003 n. 196.