

Giorgio Nicoletti

PH.D. STUDENT

Room 382, Department of Physics and Astronomy, University of Padova, Italy
☎ (+39) 333 6751887 | ✉ giorgio.nicoletti.1@phd.unipd.it | 🏠 giorgionicoletti.github.io

RESEARCH EXPERIENCE

“Self-organization of neuronal networks” group, Tübingen University

Visiting Ph.D. student



TÜBINGEN, GERMANY - SUPERVISOR: PROF. ANNA LEVINA

SEPT 2022 - PRESENT

Worked on projects on the relation between recurrent neural networks, their dynamics and their network structure in the context of reservoir computing, as well as spatial population dynamics in stochastic environments.

Division of Biological Physics, Max Planck Institute for the Physics of Complex Systems

Visiting Ph.D. student



DRESDEN, GERMANY - SUPERVISOR: DR. DANIEL M. BUSIELLO

JUNE 2022 - JULY 2022

Worked on models of sensing in biological systems described by multi-scale Fokker-Planck equations, focusing on dynamical information storage and the emergence of long-term memory through biochemical mechanisms.

EDUCATION

Laboratory of Interdisciplinary Physics, University of Padova

Ph.D. in PHYSICS



SUPERVISOR: PROF. AMOS MARITAN, CO-SUPERVISOR: PROF. SAMIR SUWEIS

OCT 2019 - PRESENT

University of Padova

Master's Degree in PHYSICS



THESIS: *Scaling and Renormalization Group for models of neural activity*

OCT 2017 - JULY 2019

ADVISOR: PROF. AMOS MARITAN, CO-ADVISOR: PROF. SAMIR SUWEIS

Final grade: 110/110 *cum laude*, GPA: 29.93/30

International Master in Physics of Complex System

Erasmus semester



SORBONNE UNIVERSITY, PARIS DIDEROT UNIVERSITY, PARIS-SUD UNIVERSITY

SEPT 2018 - FEB 2019

ECTS GPA: A/A

University of Padova

Bachelor's Degree in PHYSICS



THESIS: *Quantum Mechanics and de Finetti theorem. A Bayesian interpretation of quantum*

OCT 2014 - JULY 2017

probability - ADVISOR: PROF. PIERALBERTO MARCHETTI

Final grade: 110/110 *cum laude*, GPA: 29.19/30

PUBLICATIONS AND PREPRINTS

Mutual information in changing environments: Nonlinear interactions, out-of-equilibrium systems, and continuously varying diffusivities

PHYS. REV. E

2022, 106, 014153 (2022)

GIORGIO NICOLETTI, DANIEL M. BUSIELLO

Information-driven transitions in projections of underdamped dynamics

PHYS. REV. E

2022, 106, 014118 (2022)

GIORGIO NICOLETTI, AMOS MARITAN, DANIEL M. BUSIELLO

Criticality and network structure drive emergent oscillations in a stochastic whole-brain model

J. PHYS. COMPLEX.

2022, 3, 025010 (2022)

GIACOMO BARZON*, GIORGIO NICOLETTI*, BENEDETTA MARIANI, MARCO FORMENTIN, SAMIR SUWEIS (*EQUAL CONTRIBUTION)

Disentangling the critical signatures of neural activity

SCI. REP.

2022, 12, 10770 (2022)

BENEDETTA MARIANI, GIORGIO NICOLETTI, MARTA BISIO, MARTA MASCHIETTO, STEFANO VASSANELLI, SAMIR SUWEIS

Mutual information disentangles interactions from changing environments

PHYS. REV. LETT.

2021, 127, 228301 (2021)

GIORGIO NICOLETTI, DANIEL M. BUSIELLO

The emergence of scale-free fire outbreaks in Australia

ARXIV

2021, 2110.10014 (2021)

GIORGIO NICOLETTI, LEONARDO SARAVIA, FERDINANDO MOMO, AMOS MARITAN, SAMIR SUWEIS

Neuronal avalanches across the rat somatosensory barrel cortex and the effect of single whisker stimulation

BENEDETTA MARIANI, GIORGIO NICOLETTI, MARTA BISIO, MARTA MASCHIETTO, OBOE ROBERTO, ALESSANDRO LEPARULO, SAMIR SUWEIS, STEFANO VASSANELLI

FRONT. SYST. NEUR.

15:709677 (2021)

Scaling and criticality in a phenomenological renormalization group

GIORGIO NICOLETTI, SAMIR SUWEIS, AMOS MARITAN

PHYS. REV. RES.

2, 023144 (2020)

TALKS AND POSTERS

► INVITED

Max Planck Institute for the Physics of Complex Systems

INVITED TALK: INFORMATION THEORY IN STOCHASTIC PROCESSES AND COMPLEX SYSTEMS

Dresden, Germany

13th Jul 2022

BrainNet workshop, KTH Royal Institute of Technology

INVITED TALK: WHAT CAN PHASE TRANSITIONS AND CRITICALITY TEACH US ABOUT BRAIN DYNAMICS?

Stockholm, Sweden

23rd - 24th May 2022

Young Seminars of the Italian Society of Statistical Physics

INVITED TALK: UNFOLDING COMPLEX SYSTEMS WITH INFORMATION THEORY

Online

10th Mar 2022

► CONTRIBUTED

Brain Criticality Meeting 2022

CONTRIBUTED POSTER: CRITICALITY AND NETWORK STRUCTURE DRIVE EMERGENT OSCILLATIONS IN A STOCHASTIC WHOLE-BRAIN MODEL

Bethesda, MD, USA

7th - 9th Nov 2022

Conference on Complex Systems 2022

CONTRIBUTED TALK: CRITICALITY AND NETWORK STRUCTURE DRIVE EMERGENT OSCILLATIONS IN A STOCHASTIC WHOLE-BRAIN MODEL

Palma de Mallorca, Spain

17th - 21st Oct 2022

CONTRIBUTED TALK: INFORMATION-DRIVEN TRANSITIONS IN OPTIMAL PROJECTIONS OF UNDERDAMPED DYNAMICS

Bernstein Conference 2022

CONTRIBUTED POSTER: DISENTANGLING THE CRITICAL SIGNATURES OF NEURAL ACTIVITY: AVALANCHES, SPATIAL CORRELATIONS AND INFORMATION

Berlin, Germany

14th - 16th Sept 2022

Conference on Complex Systems 2021

CONTRIBUTED TALK: DISENTANGLING THE ROLE OF EXTERNAL AND INTRINSIC DYNAMICS ON THE CRITICAL SIGNATURES OF NEURAL ACTIVITY

Lyon, France

25th - 29th Oct 2021

CONTRIBUTED TALK: MODELING THE EMERGENCE OF SCALE-FREE FIRE OUTBREAKS IN AUSTRALIA

CONTRIBUTED POSTER: DISENTANGLING INTERNAL INTERACTIONS FROM NOISY ENVIRONMENTS THROUGH MUTUAL INFORMATION

Stochastic Models and Experiments in Ecology and Biology 2021

CONTRIBUTED POSTER: MODELING THE EMERGENCE OF SCALE-FREE FIRE OUTBREAKS IN AUSTRALIA

Venice, Italy

25th - 29th Oct 2021

Brain Criticality Virtual Meeting

CONTRIBUTED POSTER: WHAT CAN A PHENOMENOLOGICAL RENORMALIZATION GROUP TEACH US ABOUT CRITICALITY IN A NETWORK OF NEURONS?

Online

6th - 9th Oct 2020

Bernstein Conference 2020

CONTRIBUTED POSTER: SCALING AND CRITICALITY IN A PHENOMENOLOGICAL RENORMALIZATION GROUP

Online

29th Sept - 1st Oct 2020

Italian Conference on Complex Systems

CONTRIBUTED POSTER: SCALING AND RENORMALIZATION GROUP FOR THE ACTIVITY OF NEURONS

Trento, Italy

1st - 3rd July 2019

ATTENDED SCHOOLS AND WORKSHOPS

Winter Workshop on Complex Systems 2022

WORKSHOP

Arc-et-Senans, France

24th - 28th Jan 2022

Beg Rohu Summer School 2021

SCHOOL ON "STATISTICAL MECHANICS AND EMERGENT PHENOMENA IN BIOLOGY"

Saint Pierre Quiberon, France

30th May - 12th June 2021

Winter School on Quantitative Systems Biology

SCHOOL ORGANIZED BY THE INTERNATIONAL CENTER FOR THEORETICAL PHYSICS

Online

30th Nov - 18th Dec 2020

ORGANIZED CONFERENCES

Robustness, Adaptability and Critical Transitions in Living Systems

MAIN ORGANIZER

Satellite of the Conference on Complex Systems 2021

Lyon, France

27th Oct 2021

TEACHING EXPERIENCE AND SUPERVISION

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|---------|--|---------------------------|
| 2021/22 | Master's thesis on inference of biophysical models for neural activity , Master's Degree in Physics of Data, University of Padova | <i>Co-supervision</i> |
| 2021/22 | Models of Theoretical Physics , Master's Degree in Physics of Data, University of Padova | <i>Teaching assistant</i> |
| 2021/22 | IT and Bioinformatics , Bachelor's Degree in Molecular Biology, University of Padova | <i>Teaching assistant</i> |
| 2020/21 | IT and Bioinformatics , Bachelor's Degree in Biology, University of Padova | <i>Teaching assistant</i> |
| 2020 | Innovative University Teaching and Learning Physics , University of Padova | <i>Attended workshop</i> |

HONORS AND AWARDS

- Jul 2022 **Winner of the CCS 2022 student grant** funded by the *Complex Systems Society*
- Dec 2021 **Winner of the SECS grant** funded by the *Young Researchers in Complex Systems Society*
- 22nd Nov 2021 **Physical Review Letters Editors' Suggestion, viewpoint in "Physics" magazine and highlight in PRL's weekly tip sheet for reporters** for the article *Mutual information disentangles interactions from changing environments*, Phys. Rev. Lett. 127, 228301 (2021)
- 25th Jun 2021 **Best Poster Award** for the poster "Modeling the emergence of scale-free fire outbreaks in Australia" at *Stochastic Models and Experiments in Ecology and Biology 2021*, ECLT, Venice, Italy. Sponsored by MDPI
- Feb 2020 **Graduate Alumni Award** for the best students who graduated in the academic year 2018/2019, awarded by the University of Padova
- Feb 2017 **Student grant** for the best students enrolled in scientific degrees, granted by University of Padova
- 10th Oct 2014 **Best student award** for the high school students with the highest final grade and honors in Italy, awarded by the Italian Ministry for Education, University and Research

SERVICE AND MEMBERSHIPS

- 2021 - present **Member of the Italian Society of Physics**
- 2021 - present **Member of the Complex Systems Society**
- 2021 - present **Elected representative** in the PhD Program Committee and the Academic Board of the PhD program, Department of Physics and Astronomy, University of Padova

SKILLS

- Programming** ADVANCED KNOWLEDGE: Python, Wolfram Mathematica, LaTeX
BASIC KNOWLEDGE: C++, Matlab, Julia, R
- Web** Web curator and administrator of the website of the Laboratory of Interdisciplinary Physics, University of Padova, and the related academic initiatives (workshops, conferences, etc.)
BASIC KNOWLEDGE: HTML, CSS
- Languages** Italian (native), English (C1, Cambridge English assessment), French (B1-B2, Erasmus OLS language assessment), German (basic knowledge)