

# Lorenzo Fontolan, PhD

## Computational Neuroscientist

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JANELIA RESEARCH CAMPUS - 19700 Helix Dr, Ashburn, VA 20147

### Summary

I am a Computational Neuroscientist with a background in Physics and significant experience in **mathematical and computational modeling, machine learning, problem solving and data analysis**. Currently I am a research scientist in the lab of Dr. Sandro Romani where, in collaboration with the experimental lab of Dr. Karel Svoboda, I investigated the brain mechanisms behind **decision-making and motor preparation**. I am interested in understanding the **neural basis and the evolution of intelligent behavior** in animals and humans, hoping that a better understanding of ourselves will lead to a more compassionate and just society.

### Skills

**Programming Skills:** *Python, Matlab, C, XPP*

**Other:** *Dynamical Systems, Neuroscience, Statistics, Machine Learning, Statistical Physics, Neural networks, Theano, Tensorflow.*

### Research experience

**Janelia Research Campus – HHMI** | Research Scientist [October 2021-present]

**Janelia Research Campus – HHMI** | Research Associate [2015 – September 2021]

- Built **computational models** of short-term memory, challenged long-standing hypotheses on the role of slow neural timescales during decision-making, and established a causal link between the persistent firing of cortical neurons and **short-term memory** (published in **Nature**)
- Trained **artificial neural networks** to reveal how information is transmitted between brain areas. Uncovered the neural mechanisms that allow short-term memories to persist and repel incoming interferences (published in **Nature Neuroscience**)

I presented my work at several leading conferences in the Neuroscience field (Sfn, Cosyne, HHMI) and organized introductory courses to Computational Neuroscience at Janelia Research Campus.

**ENS Paris – University of Geneva** | PhD in Neuroscience [2011 – 2015]

- Developed and tested a state-of-the-art **biophysical model** of speech perception in cortical circuits
- Analyzed **brain recordings** from human patients. Combining both the modelling and the data analysis approaches enabled us to identify the role of brain rhythms in **speech perception**.
- Carried out the **mathematical analysis** of a simplified spiking neuron model

Published in: **Nature Communications**, **eLife**, **Trends in Neuroscience** and **Journal of Mathematical Neuroscience**.

**Center for Theoretical Neuroscience – Columbia University** | Exchange student [2009 – 2010]

- Employed computational and mathematical tools to study how to efficiently store and retrieve **correlated memories** in Hopfield networks (M.Sc. thesis work: "*Learning of hierarchical memories with binary synapses*")

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**PhD in Neuroscience (2011 - 2015, University of Geneva)**

Advisors: Prof. Anne-Lise Giraud and Prof. Boris Gutkin - **Graduation Mark: 6/6**

**M. Sc. in Physics (2008-2011, La Sapienza University of Rome)**

Concentration: Dynamical systems and statistical physics. Advisors: Prof. Stefano Fusi (Columbia University of New York), Prof. Enzo Marinari - **Graduation Mark: 110/110 cum laude**

**B. Sc. in Physics (2004-2007, La Sapienza University of Rome)**

Concentration: Condensed matter physics. **Graduation Mark: 109/110**

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## Education

Google scholar page: <https://scholar.google.com/citations?user=01jqYoAAAAJ&hl=en>  
h-index = 7, i-index = 7

1. Neural algorithms and circuits for motor planning. **Annu. Rev. Neurosci.** (in press)
  2. Attractor dynamics gate cortical information flow during decision-making. **Nat. Neurosci.** (2021)
  3. Discrete attractor dynamics underlying selective persistent activity. **Nature** (2019)
  4.  $\Theta$ -band and  $\beta$ -band neural activity reflects independent syllable tracking and comprehension of time-compressed speech. **J. Neurosci.** (2018)
  5. Neural cross-frequency coupling: from mechanism to function. **Trends. Neurosci.** (2015)
  6. Speech encoding by coupled cortical theta and gamma oscillations. **eLife** (2015)
  7. The contribution of frequency-specific activity to hierarchical information processing in the human auditory cortex. **Nat. Commun.** (2014)
  8. Analytical insights on theta-gamma coupled neural oscillators. **J. Math. Neurosci.** (2013)
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## Publications

**Talks and seminars:** NYU, Brandeis U., U. of Oregon, Rice Univ., ENS Paris, U. of Marseille, IDIBAPS Barcelona, U. of Geneva, U. of Padova, NJIT, Sfn Annual Meeting Washington DC, ICMN France, Bernstein symposium

**Best PhD thesis in Neuroscience**, Amicitia Excellence Prize 2015 (10,000 CHF)

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## Talks and awards

## Teaching, mentoring & academic services

2021	<b>Organizer</b> , Bernstein symposium "Control mechanisms for contextual computations and behavior"
2021	<b>Mentor</b> , Neuromatch academy 2021
2020	<b>Content Reviewer</b> , Neuromatch academy 2020
2019	<b>Organizer and lecturer</b> , Mathematical Methods for Neuroscience and ML @Janelia
2019	<b>Speaker</b> , Venice Summer School in Computational and Theoretical Models in Neuroscience
2017 – 2019	<b>Lecturer</b> , Introduction to Computational Neuroscience Undergraduate Seminar @Janelia
2018	<b>Invited Lecturer</b> , General Philosophy course (Catholic University of America).
2017	<b>Attendee</b> , Scientists Teaching Science course (NIH)
2017	<b>Co-creator</b> , exhibition on AI and Neuroscience "WHAT? Machines that learn"
2016	<b>Attendee</b> , Methods in computational neuroscience course, MBL, Woods Hole, MA.
2015	<b>Mentor and Thesis Supervisor</b> , "Isomorphism of Hopfield nets and Ising model", B. Sc. in Physics, La Sapienza University of Rome
2006 – 2009	<b>Tutor</b> , college and high school physics and mathematics
<b>Reviewer for:</b>	<i>Nat. Neurosci., Neuron, PNAS, Plos Comp. Biol., Cortex, Commun. Biol., Comput. Biol. Med., Lang., Cogn. Neurosci., Neurons behav. data anal. theory</i>

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## Languages

**Italian, English, French and Spanish.**

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