

MANAOJ ARAVIND, Ph.D.

Researcher in Nonlinear Dynamics and Physical Computing

NONLINEAR DYNAMICS · STOCHASTIC SYSTEMS · PHYSICAL COMPUTING · DATA-DRIVEN MODELLING

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RESEARCH PROFILE

I investigate how noise, coupling, and nonlinear dynamics can be exploited for computation and used to model complex physical and biological systems. My work combines analytical and numerical modelling with nonlinear-electronic experiments and data-driven system identification. I aim to develop experimentally grounded approaches to physical computing and the design, inference, and control of complex systems.

RESEARCH APPOINTMENTS

Senior Postdoctoral Researcher, CNRS | July 2024 - July 2025

FEMTO-ST Institute, Besançon, France

Research group of Dr Jean-Julien Aucouturier. Continued to collaborate as a Guest Researcher through July 2025 - April 2026.

Postdoctoral Research Associate | February 2023 - February 2024

Constructor University, Bremen, Germany

Research group of Prof. Hildegard Meyer-Ortmanns. Continued to work as Adjunct Researcher, February 2023 - February 2024.

Institute Postdoctoral Fellow | September 2020 - September 2022

Indian Institute of Technology Bombay, India

Research group of Prof. Punit Parmananda.

Project Research Assistant | November 2019 - March 2020

Indian Institute of Technology Bombay, India

Research group of Prof. Punit Parmananda.

EDUCATION

Integrated MS-PhD in Physics, First Class | August 2012 - January 2020

Indian Institute of Science Education and Research Mohali, India

Thesis: 'Utilizing Noise to Implement Logical Operations in Bistable Systems' · Supervisor: Prof. Sudeshna Sinha

BSc in Physics, First Class | June 2009 - April 2012

Loyola College, Chennai, India

COMPETITIVE DISTINCTIONS

- European Commission Seal of Excellence, Marie Skłodowska-Curie Actions Postdoctoral Fellowships 2024, for ARCADYA: Learning the Cortical Dynamics of Consciousness in Sleep and Coma.
- Ranked second, Chaire de Professeur Junior, SUPMICROTECH / FEMTO-ST, France 2025: 'Explainable and physics-informed artificial intelligence for data-driven modelling of complex dynamical systems'.

RESEARCH MENTORING

- Contributed to the mentoring of Zhenxing Hu during part of his PhD research at FEMTO-ST (2024-2025); co-authored the resulting article in PLOS Computational Biology.
- Mentored Vaibhav Pachalee's MSc thesis at IIT Bombay (January-July 2022); co-authored the resulting article in Physical Review E.

PEER-REVIEWED JOURNAL ARTICLES

Learning the bistable cortical dynamics of the sleep-onset period

Zhenxing Hu, **Manoj Aravind**, Xu Lei, J. Nathan Kutz, and Jean-Julien Aucouturier
PLOS Computational Biology 22(4), e1014246 (2026). [DOI](#)

Synchronization through frequency shuffling

Manoj Aravind*, V. Pachaulee*, M. Sarkar*, I. Tiwari, Shamik Gupta, and P. Parmananda
Physical Review E 109, L052302 (2024). [DOI](#)

On relaxation times of heteroclinic dynamics

Manoj Aravind and H. Meyer-Ortmanns
Chaos: An Interdisciplinary Journal of Nonlinear Science 33, 103138 (2023). [DOI](#)

Noise-aided invertible logic from coupled nonlinear systems

K. Murali, **Manoj Aravind**, and S. Sinha
Physical Review Applied 20, 034041 (2023). [DOI](#)

Regulating dynamics through intermittent interactions

S. Dixit*, **Manoj Aravind***, and P. Parmananda
Physical Review E 106, 014203 (2022). [DOI](#)

Ethanol lamp: A simple, tunable flame oscillator and its coupled dynamics

Manoj Aravind*, I. Tiwari*, V. Vasani, J. M. Cruz, D. A. Vasquez, and P. Parmananda
The European Physical Journal Special Topics 231, 179-184 (2022). [DOI](#)

Emergent noise-aided logic through synchronization

Manoj Aravind, P. Parmananda, and S. Sinha
Physical Review E 104, 064207 (2021). [DOI](#)

Competitive interplay of repulsive coupling and cross-correlated noises in bistable systems

Manoj Aravind, S. Sinha, and P. Parmananda
Chaos: An Interdisciplinary Journal of Nonlinear Science 31, 061106 (2021). [DOI](#)

Construction of logic gates exploiting resonance phenomena in nonlinear systems

K. Murali, S. Rajasekar, **Manoj Aravind**, V. Kohar, W. L. Ditto, and S. Sinha
Philosophical Transactions of the Royal Society A 379, 20200238 (2021). [DOI](#)

Coupling-induced logical stochastic resonance

Manoj Aravind, K. Murali, and S. Sinha
Physics Letters A 382, 1581-1585 (2018). [DOI](#)

* Equal contribution.

BOOK CHAPTER AND PROCEEDINGS

Implementation of noise-aided logic gates with memristive circuits

Manoj Aravind, K. Murali, and S. Sinha
Proceedings of the 5th Conference on Perspectives in Nonlinear Dynamics (2019; published 2020). [DOI](#)

Synchronized hopping induced by the interplay of coupling and noise

Manoj Aravind, K. Murali, and S. Sinha
In Nonlinear Dynamics and Control, pp. 325-334, Springer (2020). [DOI](#)

RESEARCH METHODS AND TECHNICAL EXPERTISE

COMPUTATIONAL AND DATA-DRIVEN METHODS

- Scientific computing and dynamical-systems modelling in Python and MATLAB.
- Numerical simulation, analysis, and visualization using NumPy, SciPy, Matplotlib, pandas, and NetworkX.
- Data-driven system identification and reduced-order modelling using SINDy, HAVOK, and SHRED.

EXPERIMENTAL METHODS

- Design, construction, and characterization of nonlinear electronic circuits.
- Experimental automation and data acquisition.
- Design and analysis of coupled tabletop oscillators, including electronic and flame-oscillator platforms.

TEACHING EXPERIENCE

- Teaching Assistant, undergraduate Physics Laboratory I: Mechanics, IISER Mohali (August-December 2015).
- Teaching Assistant, undergraduate Physics Laboratory II: Electromagnetism, IISER Mohali (January-May 2015 and January-May 2016).
- Taught experimental nonlinear electronics at the DST-SERC School on Nonlinear Dynamics, Panjab University (2015).

SELECTED PRESENTATIONS

Modelling the bistable cortical dynamics of the sleep-onset period | **Poster · June 2025**
International Conference on Mathematical Neuroscience, Centre de Recerca Matemàtica, Barcelona, Spain

Synchronization through shuffling | **Oral presentation · 2022**
Conference on Nonlinear Systems and Dynamics, IISER Pune, India

Emergent noise-aided logic through synchronization | **Poster · 2022**
Dynamics Days Europe, University of Aberdeen, United Kingdom

Synchronized hopping induced by the interplay of coupling and noise | **Oral presentation · 2019**
First International Nonlinear Dynamics Conference, Sapienza University of Rome, Italy

SELECTED ADVANCED SCHOOLS AND WORKSHOPS

Nonlinear Data Analysis and Modeling: Advances, Applications, Perspectives | **2023**
Potsdam Institute for Climate Impact Research, Germany

Santa Fe Institute Complex Systems Winter School | **2015**
IISER Mohali, India

ACADEMIC LEADERSHIP AND SERVICE

- Co-organizer, Learning and Dynamics Seminar Series, FEMTO-ST Institute (2024-2025).
- Peer reviewer for Physical Review E; Chaos; Applied Physics Letters; Nonlinear Dynamics; Proceedings of the Royal Society A; Scientific Reports; and Nonlinear Science.

REFERENCES

Dr Jean-Julien Aucouturier · Directeur de Recherche, CNRS · FEMTO-ST Institute · aucouturier@gmail.com

Prof. Sudeshna Sinha · Department of Physical Sciences · IISER Mohali · sudeshna@iisermohali.ac.in

Prof. Hildegard Meyer-Ortmanns · School of Science · Constructor University · hortmanns@constructor.university

Prof. Punit Parmananda · Department of Physics · IIT Bombay · punit@phy.iitb.ac.in