

Manoj Aravind

Postdoctoral Fellow

Constructor University
Bremen, Germany

Research Interests

Work Experience

Education

Manoj Aravind, Ph.D.

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Constructor University,
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Application of nonlinearity and emergent phenomena to yield better design.

My PhD work involved using the interplay of noise and nonlinearity to make better logic gates. My first postdoc involved the study of emergent behavior and control of coupled nonlinear systems, using both numerical simulations and table-top experiments. At present I study the dynamics of heteroclinic networks and its potential computational applications.

I'm deeply passionate about *using complexity for efficient computing* and most of my work has revolved around that theme.

Research Associate

With Prof. Hildegard Meyer-Ortmanns.

FEBRUARY 2023 - PRESENT

Constructor University, Bremen, Germany

Institute Postdoctoral Fellow

With Prof. Punit Parmananda.

SEPTEMBER 2020 - SEPTEMBER 2022

Indian Institute of Technology Bombay, India

Project Research Assistant

With Prof. Punit Parmananda.

NOVEMBER 2019 - MARCH 2020

Indian Institute of Technology Bombay, India

Integrated Ph.D. Physics - First Class

"Utilizing Noise to implement Logical operations in Bistable Systems"

Under the guidance of Prof. Sudeshna Sinha

AUGUST 2012 - JANUARY 2020

Indian Institute of Science Education and Research Mohali, India

B.Sc. Physics - First Class

JUNE 2009 - APRIL 2012

Loyola College, Chennai, India

Technical Skills

Computational skills

- **Fluent use of Python for scientific computation**, using open source packages such as NumPy, SciPy, Matplotlib, NetworkX and Pandas.
- **Use of MATLAB for live data analysis and interfacing** with experimental systems.
- **Video analysis using Python** used to study flame oscillation in ethanol lamps.

Experimental skills

- **Design, construction and analysis of nonlinear electronic circuits** that serve as a proof-of-principle experimental platform.
- **Data acquisition and automation** using an external DAQ in electronic circuit experiments.
- **Hands on experience** characterizing and studying flame oscillations in ethanol lamps - *a new table top experimental system*.

Publications

1. On inertia of heteroclinic dynamics

[Manoj Aravind](#) and H. Meyer-Ortmanns (2023)

Submitted to Chaos

2. Noise-aided invertible logic from coupled nonlinear systems

K. Murali, [Manoj Aravind](#), S. Sinha (2023)

Submitted to Physical Review Applied

3. Frequency shuffling promotes onset of synchrony

V. Pachaulee*, [Manoj Aravind](#)*, I. Tiwari and P. Parmananda (2023)

In review at Physical Review Letters

4. Regulating dynamics through intermittent interactions

S. Dixit*, [Manoj Aravind](#)* and P. Parmananda (2022)

Physical Review E 106 (1), 014203

DOI: [10.1103/PhysRevE.106.014203](https://doi.org/10.1103/PhysRevE.106.014203)

5. Ethanol lamp: a simple, tunable flame oscillator and its coupled dynamics.

[M. Aravind](#)*, I. Tiwari*, V. Vasani, J. M. Cruz, D. A. Vasquez and P. Parmananda (2022)

The European Physical Journal Special Topics 231, 179–184

DOI: [10.1140/epjs/s11734-021-00414-4](https://doi.org/10.1140/epjs/s11734-021-00414-4)

6. Emergent noise-aided logic through synchronization

[Manoj Aravind](#), S. Sinha and P. Parmananda (2021)

Physical Review E, 104(6), 064207.

DOI: [10.1103/PhysRevE.104.064207](https://doi.org/10.1103/PhysRevE.104.064207)

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

[Manoj Aravind](#), S. Sinha and P. Parmananda (2021)

Chaos: An Interdisciplinary Journal of Nonlinear Science, 31 (6), 061106.

DOI: [10.1063/5.0056173](https://doi.org/10.1063/5.0056173)

8. Construction of logic gates exploiting resonance phenomena in nonlinear systems

K. Murali, S. Rajasekhar, [Manoj Aravind V](#), V. Kohar, W.L.Ditto and S. Sinha (2020)

Philosophical Transactions of the Royal Society A, 379 (2192), 20200238.

DOI: [10.1098/rsta.2020.0238](https://doi.org/10.1098/rsta.2020.0238)

9. Implementation of Noise-aided Logic Gates with Memristive circuits

[Manoj Aravind V](#), K Murali and Sudeshna Sinha (2020)

Proceedings of the 5th Conference on Perspectives in Nonlinear Dynamics (PNLD) - 2019. ([Permalink](#))

10. Synchronized Hopping induced by interplay of Coupling and Noise

[Manoj Aravind V](#), K Murali and Sudeshna Sinha (2020)

In *Nonlinear Dynamics and Control* (pp. 325-334). Springer, Cham.

DOI: [10.1007/978-3-030-34747-5_33](https://doi.org/10.1007/978-3-030-34747-5_33)

11. Coupling induced Logical Stochastic Resonance

[Manoj Aravind V](#), K Murali and Sudeshna Sinha (2018)

Physics Letters A, 382(24), 1581-1585.

DOI: [10.1016/j.physleta.2018.03.043](https://doi.org/10.1016/j.physleta.2018.03.043)

Work Presented

"Emergent Noise-aided logic through synchronization"

Poster Presentation

Dynamics Days Europe (DDEU) 2022, University of Aberdeen, Scotland, United Kingdom.

"Implementation of Noise-aided logic gate in memristive circuits"

Oral Presentation

Complex Dynamical Systems and Applications (CDSA) 2020, Central University of Rajasthan, Jaipur, India.

"Implementation of Noise-aided logic gate in memristive circuits"

Poster Presentation

Conference on Nonlinear Systems and Dynamics (CNSD) 2019, Indian Institute of Technology (IIT), Kanpur, India

"Synchronized hopping induced by interplay of Coupling and Noise"

Oral Presentation

First International Nonlinear Dynamics Conference (NODYCON) 2019, Sapienza University, Rome, Italy.

"Coupling induced Logical Stochastic Resonance"

Poster Presentation

Conference on Nonlinear Systems and Dynamics (CNSD) 2018, Jawaharlal Nehru University, New Delhi, India.

"Synchronized Hopping in coupled bistable systems"

Poster Presentation

Complex Dynamical Systems and Applications (CDSA) 2017,
Indian Institute of Technology (IIT) Guwahati, Assam, India.

"Coupling induced Logical Stochastic Resonance"

Oral Presentation

Physics Scholars Day 2017,
Indian Institute of Science Education Research (IISER) Mohali, Punjab.

**Teaching and
Organization**

Mentored **Mr. Vaibhav Pachaulee** for his **MSc thesis**,
IIT Bombay, January - July 2022

Teaching assistant (TA) in PHY 112 - **Physics Laboratory II
(Electromagnetism)** January - May 2016.

Teaching assistant (TA) in PHY 111 - **Physics Laboratory I (Mechanics)**
August - December, 2015.

Teaching assistant (TA) in PHY 112 - **Physics Laboratory II
(Electromagnetism)** January - May 2015.

Organized **Conference on Nonlinear Systems and Dynamics (CNSD) 2015**
at Indian Institute of Science Education and Research (IISER) Mohali, with
Prof. Sudeshna Sinha.

Conducted **Experimental electronics lab at the DST-SERC School** on
Nonlinear Dynamics 2015 at Panjab University, Chandigarh, with Dr. K.
Murali.

**Conferences and
Schools**

Dynamics Days Europe (DDEU) 2022, **University of Aberdeen,
Scotland, United Kingdom.**

Complex Dynamical Systems and Applications (CDSA) 2020,
Central University of Rajasthan, Jaipur, India.

Conference on Nonlinear Systems and Dynamics (CNSD) 2019,
Indian Institute of Technology (IIT), Kanpur, India.

First International Nonlinear Dynamics Conference (NODYCON) 2019,
Sapienza University, Rome, Italy.

Conference on Nonlinear Systems and Dynamics (CNSD) 2018, Jawaharlal
Nehru University, New Delhi, India.

Complex Dynamical Systems and Applications (CDSA) 2017, Indian
Institute of Technology (IIT) Guwahati, Assam, India.

Santa Fe Institute (SFI) Complex Systems Winter School 2015, Indian
Institute of Science Education and Research (IISER) Mohali, India.

Conference on Nonlinear Systems and Dynamics (CNSD) 2015, Indian
Institute of Science Education and Research (IISER) Mohali, India.

Dynamics Days Asia Pacific 08 (DDAP08) 2014, Indian Institute of
Technology (IIT) Madras, Chennai, India.

Workshop on Nonlinear Dynamics in Biology 2013, Indian Institute of
Science (IISc) Bangalore, India.

Recognition

Ranked among the top 1% in India in National Graduate Physics Examination (NGPE) 2012, conducted by Indian Association of Physics Teachers (IAPT).

Best Physics Student Award from Department of Physics, Loyola College

Qualified **Joint Entrance Screening Test (JEST)** 2012.

Qualified **Joint Admission test for M.Sc. (JAM)** 2012.

References

Prof. Sudeshna Sinha

Department of Physical Sciences,
Indian Institute of Science Education and Research (IISER) Mohali
Sector 81, Knowledge City, SAS Nagar 140 306, Punjab, India.

Email: sudeshna@iisermohali.ac.in

Prof. Punit Parmananda

Department of Physics,
Indian Institute of Technology (IIT) Bombay
Mumbai 400 076, India.

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Prof. K. Murali

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