NIRAJ KUSHWAHA

PHD CANDIDATE

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ABOUT ME

Hello! I am Niraj from India and currently living in Vienna. I am a PhD candidate at the Complexity Science Hub, exploring nature and society from a physics lens. With a background in physics (BSc, MSc), I apply concepts from statistical physics, mathematical modelling, data science, and machine learning to uncover patterns in complex systems—from armed conflicts to internal migration—always aiming for real-world impact. My research, recognized through various awards, publications, and conference participation, bridges fundamental science with societal relevance. I'm passionate about using complexity science for meaningful change and I am always eager to connect with those curious about networks, physics, and innovative approaches to understanding the world.

RESEARCH EXPERIENCE

PHD CANDIDATE
(2021 - Present)

Complexity Science Hub and University of Vienna

- Dual affiliation with Complexity Science Hub and the University of Vienna.
- Working on multiple projects ranging from armed conflict dynamics to internal displacement and migration.
- Good track record of publications with two papers out so far.
- I have demonstrated good communication skills having attended more than 8 conferences so far.
- My research has appeared on multiple media platforms including BBC radio and Austrian Press Agency (APA).

MASTER THESIS
(2019 - 2020)

Indian Institute of Technology (IIT), Indore

- One of the highest-scoring theses from my cohort.
- The project culminated in a publication.
- Worked on implementing machine learning techniques for identifying synchronized vs chimera states in Kuromoto networked systems.
- Other minor side-projects include crop classification using satellite images and credit card fraud detection.

INTERNSHIP
(2018)

Bhabha Atomic Research Center

- Interned at the Astrophysical Sciences Division of Bhabha Atomic Research Center.
- Worked on analytical calculations for synchrotron emission by charged particles in non-uniform magnetic fields such as supernovas.
- Also performed data analysis on radiation data from the Major Atmospheric Cerenkov Experiment Telescope (MACE).

EDUCATION

PHD IN PHYSICS (PURSUING)
(2021-Present)

University of Vienna

MASTER OF SCIENCE IN PHYSICS
(2018 - 2020)

Indian Institute of Technology (IIT), Indore

BACHELOR OF SCIENCE (HONOURS) IN PHYSICS
(2015-2018)

Institute of Science BHU, Varanasi

PUBLICATIONS

- **Kushwaha, Niraj**, et al. "Common indicators hurt armed conflict prediction." arXiv preprint arXiv:2503.00265 (2025). (Link)
- **Kushwaha, Niraj**, and Edward D. Lee. "Discovering the mesoscale for chains of conflict." PNAS nexus 2.7 (2023): pgad228. (Link)
- **Kushwaha, Niraj**, et al. "Machine learning assisted chimera and solitary states in networks." Frontiers in Physics 9 (2021): 513969. (Link)

ACADEMIC ACHIEVEMENTS

AWARDS

- Runner-up winner of the "Bertalanffy Doctoral Student Award 2025" by Complex Systems Society France.
- “Significant Milestone Award of the 2023 Exner Lectures in the category of PhD” by The Exner Foundation.
- Gold medal in National Science Olympiad conducted by All India Science Teacher’s Association.

NATIONAL LEVEL EXAMS

- Top 1% national level topper (All India Rank=66) in National Graduate Physics Examination-2018.
- All India Rank=432 (out of around 14000 applicants) in the national entrance exam for the Indian Institute of Technology in 2018.

TALKS AT CONFERENCES

CONFERENCE ON COMPLEX SYSTEMS (CCS)	(2020)
THE GERMAN PHYSICS SOCIETY CONFERENCE	(2022)
CONFERENCE ON COMPLEX SYSTEMS (CCS)	(2022)
THE GERMAN PHYSICS SOCIETY CONFERENCE	(2023)
NETSCI CONFERENCE	(2023)
CONFERENCE ON COMPLEX SYSTEMS (CCS)	(2023)
THE GERMAN PHYSICS SOCIETY CONFERENCE	(2024)
NETSCIX CONFERENCE	(2025)
THE GERMAN PHYSICS SOCIETY CONFERENCE	(2025)
INTERNATIONAL CONFERENCE ON COMPUTATIONAL SOCIAL SCIENCE	(2025)

MEDIA APPEARANCES

ARTICLES

- The Military’s Recruitment of AI Has Already Begun. (Link)
- Forscher beobachten ”Lawinen” bei Ausbreitung bewaffneter Konflikte. (Link)
- Scientists develop method to predict the spread of armed conflicts. (Link)

AUDIO/VIDEO

- I gave a live interview at the BBC newsday radio show. (Link)
- Our paper was featured in Sabine Hossenfelder’s science news. (Link)

OTHER ACTIVITIES

STUDENTS/INTERNS SUPERVISED

- Shlok Shah from Princeton University. (2024)
- Clemens Baldzuhn from TU Berlin. (2024)

POSITIONS OF RESPONSIBILITIES

- PhD representative at the Complexity Science Hub Vienna (one term)
- Climate counsellor appointed by the International Centre for Culture and Education at BHU (one term)
- House captain during school (one year)

VOLUNTEERING WORK

- Volunteered at the Buddy Project, Vielmehr für Alle! in Vienna. Taught refugee high school kids.
- Started a small organization with college friends at BHU to educate underprivileged kids in Varanasi