Mohammad Tabatabaei

m.tabatabaeikahangi@ph.iut.ac.ir
tabatabaeiphys@gmail.com
+98 930 312 0990
https://www.linkedin.com/in/mohamad-tabatabaei

Research Interests

Currently pursuing a Master's in Physics with a focus on Complex Systems, I study how microscopic interactions drive emergent behaviors in networks. My thesis investigates degree-dependent imitation–exploration dynamics through agent-based simulations and statistical physics. In parallel, I analyze centrality correlations in real and model networks and plan to link them with synchronization patterns in the Kuramoto model, connecting structure to collective dynamics. These projects have deepened my understanding of nonlinear and high-dimensional systems and inspired me to apply data-driven and machine-learning approaches to complex-system analysis. I have also analyzed enzyme networks and explored protein–ligand interactions using molecular-dynamics and quantum-chemistry codes, experience that motivates my current shift toward biophysics and physics-informed machine learning to uncover universal principles of organization in natural and artificial systems.

Education

M.Sc. in Complex Systems, Isfahan University of Technology, Iran Sep 2023 – Nov 2025
Honors: First class Honors
GPA: 17.37/20

- Advanced Statistical Mechanics
- Advanced Quantum mechanics
- Physics of Complex Systems
- Computational Physics
- Electrodynamics
- Physics of Critical Phenomena

B.Sc. in Physics, Shahrekord University, Iran Sep 2017 – Sep 2022
Honors: Second Class Honors
GPA: 15.57/20

- Electromagnetics
- Quantum mechanics
- Nuclear physics
- Thermodynamics
- Optics & Laser
- Solid State
- Nuclear Detectors
- Statistical Mechanics
- Special Relativity
- Crystallography
- Particle Physics
- Vacuum Techniques

Research Experience

Correlations between Centrality Measures in Complex Networks 2025
Studying statistical relationships between centrality metrics in synthetic and real networks. Tools: Python, NetworkX, Pandas.

Impact of Vertex Degree on Exploration-Imitation Dynamics in Complex Systems 2024-2025
Investigating how network topology influences the spread and stability of strategies in agent-based imitation-exploration models. The model incorporates Gaussian exploration and degree-dependent imitation on structured networks.
Tools: Python, NetworkX.

Computational Physics in Drug Discovery 2021
Applied physics-based methods to protein–ligand docking and interaction energies, with exposure to molecular dynamics and quantum mechanical approaches. Developed skills in scientific writing, presenting and interdisciplinary problem-solving.
Tools: Molecular dynamics, quantum chemistry, scientific writing, presentation.

Communication Skills

- Iran Physics Conference 2025, Yasouj University, Yasouj Oct 2025
  Poster: "Modeling the Structure of Enzyme Networks through Centrality Correlations"
- 3rd New Horizons in Physics School (National), **Complex systems modeling**, IUT Sep 2025
  Mentored and designed complex systems workshops and projects (SIR on Watts–Strogatz networks, agent-based modeling) for selected undergraduate students nationwide.
- 30th Annual IASBS Meeting on **Condensed Matter Physics and Quantum Technology** School, Zanjan May 2025
  Poster: "Impact of Vertex Degree on Exploration-Imitation Dynamics in Complex Systems"
- 7-day Online Workshop on **Quantum ESPRESSO** May 2025
  Organized byScidart Academy and Gdańsk University of Technology
- Winter school on **Physics of Complex Fluids** at IPM, Tehran Feb 2025
- Computational Physics Workshop on **Tensor Networks**, IUT Jan 2024
- 28th Physics School, IASBS, Zanjan Jul 2023
- Second Conference on **Quantum Technologies**, IUT Jun 2023
- Educational Workshop on **Quantum Technologies**, Sharif University Mar 2023

Teaching Assistantship

Advanced Statistical mechanics II Workshop (Graduate): 2025
Will serve as teaching assistant; grading and conducting Python-based workshops on stochastic and dynamical models.

Complex Systems Workshop (Graduate): 2025
Instructed students in network features and the analysis of real and model networks using Python, **NetworkX** and related tools.

Skills

Programming Languages:
- Python (2 years)
- Julia (2 months)
- FORTRAN (4 months)

Software Tools:
- Linux (1 year)
- LaTeX (1 year)
- COMSOL (2 months)
- NetLogo (6 months)
- Microsoft Office (10 years)
- Adobe Photoshop (1 years)
- Quantum Espresso (1 month)

Technical Skills:
- Network analysis (2 years)
- Data analysis (3 months)
- ML (3 months)
- Scientific writing (2 years)
- Teaching (1 year)

Languages

- English (C1 - IELTS Certified)
- Persian (C2 - Native)
- Arabic (A1)

Extracurricular Activities

- Swimming
- Licensed Hair Dresser
- Rock Climbing
- Bicycle mechanic
- Cycling
- Robotics (circuit & chassis)