Hosein Gholami

Theoretical Physicist | PhD Candidate at Technical University of Darmstadt

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Education

PhD in Physics
Technical University of Darmstadt, Germany
January 2022 - Present

- **Advisor:** Prof. Michael Buballa
- **Research Focus:** Color Superconductivity in Quark Matter, Neutron Star Mergers
- **Key Achievements:**
  - Published paper on arXiv: *Renormalization-group consistent treatment of color superconductivity in the NJL model* (August 2024).
  - Collaborated with Goethe University and Giessen University on astrophysics and merger simulation projects.

M.Sc. in Physics
Sharif University of Technology, Tehran, Iran
2018 - 2020

- **GPA:** 4/4 (19.79/20)
- **Rank:** 1st among 45 graduates
- **Thesis:** *Vacuum Charge in a Magnetized and Rotating Quark Matter*
  - **Advisor:** Prof. Neda Sadooghi
- **Awards:**
  - Ranked 1st among M.Sc. graduates.
  - Offered direct PhD position at Sharif University (declined to seek broader experiences).

B.Sc. in Physics
Shiraz University, Shiraz, Iran
2014 - 2018

- **GPA:** 4/4 (18.81/20)
- **Rank:** 2nd among 164 graduates
- **Thesis:** *Study of 2D Electron Gas in GaAs Quantum Well*
  - **Advisor:** Dr. Mehdi Pakmehr
- **Awards:**
  - Ranked 2nd among B.Sc. graduates.
  - Winner of School of Science Award for two consecutive years (2017, 2018).

Research Interests

- Quark Matter in Intermediate Densities: Color Superconductivity and Inhomogeneous Phases
- Anomalies and Topological Objects in Quantum Field Theory
- QCD Phase Diagram and Phase Transition

- Effective Models (Nambu-Jona-Lasinio (NJL), Quark Meson Diquark Model)
- Functional Methods: Dyson-Schwinger Equations (DSE)

Research Experience

PhD Research
Technical University of Darmstadt, Germany
January 2022 - Present

- **Focus:** Color Superconductivity in Quark Matter, Neutron Star Mergers
- **Tools:** NJL Model, Quark Meson Diquark Model, Dyson-Schwinger Equations
- **Collaborations:**
  - Goethe University (Astrophysics and Merger Simulations)
  - Giessen University (QMD Model Renormalization, DSE with Christian Fischer's group)
- **Publications:**
  - *Renormalization-group consistent treatment of color superconductivity in the NJL model* (August 2024)

M.Sc. Research
Sharif University of Technology, Tehran, Iran
2018 - 2020

- **Thesis:** *Vacuum Charge in a Magnetized and Rotating Quark Matter*
  - **Advisor:** Prof. Neda Sadooghi

Arduino Project
Personal Project
Early 2021

- Developed a 10-channel radio transmitter using Arduino, applying skills learned from the CDI project.

Work Experience
Shirazfan Company, Shiraz, Iran
August 2020 - February 2021

- Taught basics of electric circuits, math, and geometry to the staff.

Teaching Experience

Technical University of Darmstadt

- **Advanced Quantum Mechanics (October 2023)**
- **Theoretical Particle Physics (Winter Semester 2023/24)**

Sharif University of Technology

- **Electrodynamics (Fall 2020)**
- **Quantum Field Theory (Spring 2020)**
- **Advanced Quantum Mechanics (Fall 2019)**

Shiraz University

- **Mathematical Methods for Physicists 1 & 2 (Fall 2018, Spring 2018)**
- **Modern Physics (Spring 2018)**
- **Astronomy and Astrophysics (Fall 2018)**

- **Special Relativity (Spring 2017)**
- **Fundamental Physics 2 (Spring 2016)**

Supervision

- Supervised a bachelor's student who defended his thesis in November 2023.
- Currently supervising another bachelor's and a master's student.

Conference and Workshop Participation

- **Frühjahrstagung der Deutschen Physikalischen Gesellschaft (March 2023, Dresden):**
  - Talk: *Hybrid Equation of State and Mass-Radius Relation*
- **XQCD 2023 (July 2023, Coimbra, Portugal):**
  - Poster: *Renormalization Group Consistent Treatment of Neutral Color-Superconducting Matter* (Presented by Marco Hofmann)
- **HFHF Theory Retreat 2022 (September 2022, Italy):**
  - Talk: *Color Superconductivity in Neutron Star Mergers*
- **NA7-HF-QGP Workshop (September 2023, Sicily):**
  - Talk: *RG Consistent Treatment of NJL Color-Superconductivity*
- **DPG Frühjahrstagung (March 2024, Giessen):**
  - Talk: *Renormalization Group Consistent Treatment of NJL Color Superconductivity*
- **Machine Learning Workshop (November 2022, Frankfurt):**
  - Focused on Machine Learning tools like scikit-learn, Keras, TensorFlow, and ONNX.

Outreach and Public Engagement

Shiraz Astronomy Society (SHAS):

- **Member Since 2010**
- **Scientific Council Member Since June 2020**
  - Delivered seminars on astrophysics and particle physics topics, including:
    - *Gravitational Waves and Probing the Structure of Neutron Stars* (February 2022)
    - *What Do Gravitational Waves from Neutron Star Mergers Tell Us?* (July 2023)
    - *Smaller than an Atom: A Brief Introduction to Fundamental Particles* (January 2024)
    - *This Special Star: From Merger to Birth!* (June 2024)

Awards and Honors

- **Sharif University of Technology:**
  - Ranked 1st among 45 M.Sc. graduates

    - Winner of National Elite Foundation Award
- **Shiraz University:**
    - Ranked 2nd among 164 B.Sc. graduates
    - Winner of School of Science Award for two consecutive years (2017, 2018)
    - Best Seminar Award from Shiraz Astronomy Society (2017)
- **Other Honors:**
    - Ranked 11th in National M.Sc. Entrance Exam in Physics
    - Member of Exceptional Talent Organization of Sharif University of Technology
    - Former Member of Exceptional Talent Organization of Shiraz University

Skills

- **Programming Languages:**
    - **Advanced:** Mathematica (Diffgeo and Feyncalc libraries), LaTeX, Igor Pro
    - **Intermediate:** C++, Python, Origin
    - **Arduino:** Used for personal and CDI-related projects
- **Languages:**
    - **English:** Fluent
    - **Persian:** Native
    - **German:** Basic (continuing improvement)
- **Soft Skills:**
    - **Leadership and Teamwork:** HGS-HIRe Basic Courses I & II
    - **Effective Communication:** Developed through public outreach and seminars

Personal Interests

- Passionate about linguistics and biology
- Avid PC gamer, skilled in various genres
- Guitar playing as a creative outlet
- Enthusiast of different cultures and societies, enjoys meeting new people despite being introverted