

ZENIA ZURAIQ

I am a Ph.D. student and Prime Minister's Research Fellow at the Department of Physics, IISc Bengaluru. I am also an associate member of the Indian Pulsar Timing Array (InPTA) collaboration.

Contact

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Academic Qualifications

PH.D. (THEORETICAL PHYSICS) | 2022 - PRESENT

Indian Institute of Science, Bengaluru
CGPA: 9.1/10 (one year coursework)

M.SC. (PHYSICS) | 2020 - 2022

National Institute of Technology, Tiruchirappalli (NIT-T)
CGPA: 9.79/10 (Gold medalist)
Master's Thesis: "Effects of fermion mass and strong two-body interactions on the mass-radius relationship of non-rotating compact stars"

B.SC. (PHYSICS) | 2017-2020

Stella Maris College, University of Madras
CGPA: 9.31/10 (Silver medalist)

Internships and summer schools

IIA Summer Programme

Indian Institute of Astrophysics, Bengaluru, India | 07/21

Vigyan Vidushi

Tata Institute of Fundamental Research, Mumbai, India | 05-06/2021

Introductory Summer School in Astronomy and Astrophysics

Inter-University Centre for Astronomy and Astrophysics, Pune, India | 05/21

National Institute on Undergraduate Sciences (NIUS) Camp (15.1)

Tata Institute of Fundamental Research, Mumbai, India | 06/18

Summer Intern

IIUCNN, Mahatma Gandhi University, Kottayam, India | 05/18

Skills

Programming Languages: Python, C++, MATLAB, Mathematica

Tools/Codes: LaTeX, MS Office, MESA, Cambridge STARS

OS: Linux, Windows, macOS

Publications

- **Zuraiq, Z.**, Mukhopadhyay, B. and Weber, F., 'Massive neutron stars as mass gap candidates: Exploring equation of state and magnetic field', Phys. Rev. D 109 (2024) 2, 023027, arXiv: [2311.02169](https://arxiv.org/abs/2311.02169)
- Rana, P. et. al. (47 authors including **Zuraiq, Z.**), 'The Indian Pulsar Timing Array Data Release 2: I. Dataset and Timing Analysis', Publ. Astron. Soc. Aust. 42 (2025), p. e108, arXiv: [2506.16769](https://arxiv.org/abs/2506.16769)
- Bhutani, A.*, Raj, N.*, **Zuraiq, Z.***, 'Dark, deep, deconfining: Phase transitions in neutron stars as powerful probes of hidden sectors' (submitted, 2025), arXiv: [2507.08076](https://arxiv.org/abs/2507.08076)
- **Zuraiq, Z.** et. al., 'Evolution of magnetized main-sequence stars to super-Chandrasekhar white dwarfs by STARS simulation' (submitted, 2025)
- Mukhopadhyay, B., Roy, N., **Zuraiq, Z.** et. al., 'Is PSR J0901-4046 truly an ultraslowly rotating neutron star or a white dwarf?' (submitted, 2025)

*equal contribution of authors

Conference proceedings and white papers

- **Zuraiq, Z.**, Mukhopadhyay, B. and Weber, F., 'Exploring massive neutron stars towards the mass gap: Constraining the high-density nuclear equation of state', Astron. Rep. 67 (2023) Suppl 2, S199-S206
- **Zuraiq, Z.** et. al., 'Simulating super-Chandrasekhar white dwarfs', Astrophysics and Space science proceedings, Springer (accepted, 2024), *to appear in the special volume published as part of the International Symposium on Recent Developments in Relativistic Astrophysics*, arXiv: [2411.18692](https://arxiv.org/abs/2411.18692)
- **Zuraiq, Z.**, Kumar, A., Hackett, A. J. and Mukhopadhyay, B., 'Simulating magnetized white dwarfs by time evolution: Chandrasekhar limit and beyond', World Scientific (accepted, 2024), *to appear in the proceedings of the "Massive white dwarfs and related phenomena" parallel session of the 17th Marcel Grossmann meeting*
- Adhikari, P. et. al. (61 authors including **Zuraiq, Z.**), 'Strongly interacting matter in extreme magnetic fields', Progress in Particle and Nuclear Physics (accepted, 2024), *to appear as part of the White Paper on "QCD in Strong Magnetic Fields", compiled as part of the ECT* workshop, "Strongly interacting matter in extreme magnetic fields"*, arXiv: [2412.18632](https://arxiv.org/abs/2412.18632)

Awards & Scholarships

- Prime Minister's Research Fellowship (Direct Entry, Cycle 9)
- AIR 36 (JRF), CSIR-NET 2021 (out of 28135 candidates)
- AIR 51, GATE-PH 2022 (out of 19375 candidates)
- AIR 198, JEST 2022 (96.12 Percentile)
- AIR 669, IIT-JAM 2020 (out of 16379 candidates)

Conferences attended

Brainstorming workshop on neutron stars

IMSc, Chennai, India | 11/08/25 - 14/08/25

International Pulsar Timing Array (IPTA) Meeting 2025: Student Workshop and Conference

California Institute of Technology, Pasadena, USA | 15/02/25 - 19/02/25

43rd annual meeting of the Astronomical Society of India (ASI)

NIT Rourkela, Rourkela, India | 15/02/25 - 19/02/25

4th Symposium of the BRICS Association on Gravity, Astrophysics and Cosmology

SGT University, Gurgaon, India | 17/12/24 - 19/12/24

Conference on Classical and Quantum Gravity

CUSAT, Cochin, India | 05/11/24 - 07/11/24

17th Marcel Grossmann meeting

Pescara, Italy | 07/07/24 - 12/07/24

PMRF Annual Symposium, 2024

IIT Indore, Indore, India | 03/03/24 - 04/03/24

Meeting on Pulsar Timing Array Experiments: Present and Future of Indian Collaboration

IMSc, Chennai, India | 05/02/24 - 09/02/24

42nd annual meeting of the Astronomical Society of India (ASI)

IISc, Bengaluru, India | 31/01/24 - 04/02/24

International Symposium on Recent Developments in Relativistic Astrophysics

SRM Sikkim, Gangtok, India | 11/12/23 - 13/12/23

10th International Conference on Gravitation and Cosmology (ICGC)

IIT Guwahati, Guwahati, India | 06/12/23 - 09/12/23

3rd Conference on Plasma Simulations

Raman Science Center, IIA, Leh, India | 13/07/23 - 15/07/23

Fifth Zeldovich meeting

Yerevan, Armenia | 12/06/23 - 16/06/23

Teaching

- Teaching tutorials for the course “Mechanics and Waves II”, Azim Premji University, Bengaluru | 08/25 - 09/25
- PMRF teaching assistant for the NPTEL course: "The Joy of Computing using Python" | 07/25-10/25
- PMRF teaching assistant for the NPTEL course: "Programming, Data Structures And Algorithms Using Python" | 01/25-03/25
- Teaching assistant for the course, UP202L: Intermediate Mechanics (Lab), IISc | 08/23 - 12/23
- PMRF teaching assistant for the NPTEL course: "The Joy of Computing using Python" | 07/24-10/24
- Taught value-added course on Introductory Astronomy and Astrophysics, M.S. Ramaiah University of Applied Sciences, Bengaluru | 04/24 - 06/24
- PMRF teaching assistant for the NPTEL course Nuclear Astrophysics | 01/24 - 03/24
- Teaching assistant for the course, UP101T: Introductory Mechanics, IISc (*Best TA Award*) | 08/23 - 12/23
- Taught Introductory Astronomy for students of classes VI-X, SPARC Public School | 08/23 - 12/23
- Taught class XI students NCERT physics, Kendriya Vidyalaya (IISc) | 01/23 - 06/23

Outreach

- Talk: “Looking out at the universe: multi-wavelength astronomy”, SERB outreach program for class X students, IISc | 10/24
- Volunteer at 42nd annual meeting of the Astronomical Society of India, Bengaluru, India | 02/24
- Involved in organization of activities at IISc Open Day. Took part in activities like conducting a quiz, giving public talk on The Sun and Solar System | 2023, 2024
- PMRF outreach talk: Overview of fermionic compact stars: Non-interacting stars and white dwarfs, Christ University, Bengaluru | 02/23
- PMRF outreach talk: Overview of fermionic compact stars: Introducing interactions, Christ University, Bengaluru | 04/23
- External expert for Q/A session at “National Workshop on physical sciences for CSIR-UGC NET and GATE aspirants”, conducted by NIT-T | 05/23

Talks

Anisotropic neutron stars as mass gap candidates

Brainstorming workshop on neutron stars, IMSc, Chennai | 14/08/25

Addressing fundamental puzzles with the neutron star EOS

University of California, Riverside | 25/06/25

Explaining unusual observations using magnetized white dwarfs

IPTA Meeting 2025, California Institute of Technology | 24/06/25

Simulating magnetized white dwarfs: Chandrasekhar limit and beyond

GW Paleontology group meeting, University of California, San Diego | 13/06/25

Explaining unusual observations using magnetized white dwarfs

43rd Meeting of the Astronomical Society of India, NIT Rourkela, Odisha | 18/02/25

Simulating magnetized white dwarfs by time evolution: Chandrasekhar limit and beyond

4th Symposium of the BRICS Association on Gravity, Astrophysics and Cosmology (invited) | 18/12/24

Anisotropic neutron stars as mass gap candidates

Conference on Classical and Quantum Gravity | 05/11/24

A journey towards compact star physics... and beyond!

Stella Maris College Research Day talk (invited) | 02/09/24

Massive, magnetized neutron stars as mass gap objects

Parallel session: Galactic and extragalactic magnetars: recent observations and theoretical progress, 17th

Marcel Grossmann meeting | 11/07/24

Simulating magnetized white dwarfs by time evolution: Chandrasekhar limit and beyond

Parallel session: Massive white dwarfs and related phenomena,

17th Marcel Grossmann meeting | 08/07/24

Simulating super-Chandrasekhar white dwarfs

International Symposium on Recent Development in Relativistic Astrophysics | 12/12/23

Massive, magnetized compact stars: Theory and Simulation

10th International Conference on Gravitation and Cosmology | 09/12/23

Massive neutron stars: Effect of EOS vs magnetic field

London-Oldenburg Relativity Seminar (invited, online) | 18/10/23

Massive neutron stars: effects of EOSs and magnetic field

ECT* workshop: Strongly interacting matter in extreme magnetic fields (online) | 27/09/23

Exploring massive neutron stars towards the mass gap: Constraining the high density nuclear equation of state

Fifth Zeldovich Meeting | 15/06/23

Posters

Explaining unusual observations using magnetized white dwarfs

In-House Symposium, Department of Physics, IISc | 29/11/24-30/11/24

Massive neutron stars as mass gap candidates

PMRF Annual Symposium 2024 (invited) | 04/03/24

Simulating super-Chandrasekhar white dwarf from main sequence star: Exploring stellar evolution codes STARS and MESA

Parallel session: Stars, Interstellar Medium, and Astrochemistry in Milky Way

42nd annual meeting of the Astronomical Society of India | 01/02/24 - 02/02/24

Massive neutron stars as mass gap candidates | *Best poster award*

In-House Symposium, Department of Physics, IISc | 09/11/23-10/11/23

Simulating magnetised super-Chandrasekhar white dwarfs using STARS

3rd Conference on Plasma Simulations | 13/07/23 - 15/07/23

Research visits

University of California, Riverside | Riverside, USA, 25/06/25

University of California, San Diego | San Diego, USA, 12/06/25 - 13/06/25

Department of Physics, San Diego State University | San Diego, USA, 09/06/25 - 11/06/25

University of Wroclaw | Wroclaw, Poland, 15/07/24 - 20/07/24

University of Warsaw| Warsaw, Poland, 13/07/24 - 14/07/24

ICRANet-Ferrara, University of Ferrara| Ferrara, Italy | 24/06/24 - 04/07/24

Selected short-term research projects

Study of the magnetised cataclysmic variable (CV) system, BY Cam

Guide: Dr. Vikram Rana (Raman Research Institute) | 01/23 - 04/23

Observation of 21cm line using custom made radio telescope from Milky Way galactic plane

Guide: Dr. R. Justin Joseyphus (NIT-T) | 01/22 - 08/22

Effects of fermion mass and strong two-body interactions on the mass-radius relationship of non-rotating compact stars (M.Sc. Thesis)

Guide: Dr. Somnath Mukhopadhyay (NIT-T) | 12/21 - 05/22