

# Utkarsh Patel

Country of Birth: [INDIA](#) Current Nationality: [INDIA](#)  
Linkedin: [Utkarsh Patel - LinkedIn](#)  
Inspire-HEP: [Utkarsh Patel - INSPIRE](#)  
Google Scholar: [Utkarsh Patel- Google Scholar](#)  
Wolfram Repository: [Utkarsh Patel - Wolfram Community](#)



Ph.D. scholar (Dept. of Physics, IIT Bhilai)  
Domain: Theoretical High Energy Physics  
Work Mail ID: [utkarshp@iitbhilai.ac.in](mailto:utkarshp@iitbhilai.ac.in)  
Ph.D. Supervisor: Dr. Sudhanwa Patra

Work Address: Dept. of Physics,  
IIT Bhilai, Kutelabhatha, Durg  
Chhattisgarh, India-491002  
Contact No. +91-8377989296

## ACADEMIC QUALIFICATIONS:

Qualification	Name of Institution	Duration	Degree	Grades
Full-time Ph.D. Scholar	Indian Institute of Technology, Bhilai (India)	2019-2024	Ph.D. in Theoretical High Energy Physics (Domain: Astro-Particle Physics)	PhD thesis submitted on 22.07.2024
Post-Graduation	Hansraj College, University of Delhi (India)	2016-2018	Master of Science with Astrophysics, GTR, and Electronics as electives	62.35 %
Under-Graduation	Motilal Nehru College, University of Delhi (India)	2013-2016	Bachelor of Science (Honors in Physics)	79.60 %

## FIELD OF INTEREST:

As a young researcher in physics, I am committed to learning and contributing with wholehearted effort in my domain. My expertise lies in computational and theoretical astro-particle physics and cosmology. During my PhD, I worked on BSM framework development to incorporate Dark Matter and Leptogenesis candidates in theories and perform their phenomenological analysis using analytical methods and computational tools. I actively engage with the latest books and research articles to stay informed about current developments. In the coming years, my goal is to contribute significantly to the advancement of these fields through dedicated research and collaboration.

## TECHNICAL SKILLS:

**Programming Languages:** Wolfram Mathematica, C, C++, Python, Java, MATLAB.

**High Energy Physics (HEP) Tools and Packages:** SARAH (For HEP model framework development), micrOMEGAs (For Dark Matter analysis), SPheno (Particle Spectrum Generator), ULYSSES (Boltzmann Equation solver).

**Database Tools:** Microsoft SQL Server.

**Other Tools:** Bash Script Writing in LINUX terminal, Microsoft Office, Android Studio, Arduino Programming, Machine learning through Mathematica and Python.

## NON-TECHNICAL SKILLS:

- Proficient in written and spoken English (IELTS Overall Score: 7.5) and fluent communication in Hindi (mother tongue).
- Ability to quickly learn and adapt to new softwares and methodologies as needed (Developed a Wolfram function during WSS 2022).
- Have experience leading initiatives (College event anchoring, journal club coordinator).
- Have experience working in multidisciplinary teams to achieve goals (working with a water department professor on a Physics & ML-based project).
- Touch Typing.

## SCIENTIFIC CONFERENCE PARTICIPATIONS:

- **Outside India**

- Presented a poster of my work titled "[Leptogenesis in a Left-Right Symmetric Model with double seesaw](#)" at the **Neutrino 2024** conference held in Milan, Lombardia, Italy, from 16-22 June 2024.
- Delivered an in-person parallel talk of my work titled "[Leptogenesis in a Left-Right Symmetric Model with double seesaw](#)" at the 22nd Conference on Flavor Physics and CP violation (**FPCP 2024**) held in Bangkok, Thailand, from 25 May to 1 June 2024.
- Delivered an in-person talk titled "[SIDM as a solution to small scale crisis](#)" at the conference **TMEX 2023**, 19th Rencontres du Vietnam, held at Quy Nhon city, Vietnam from 5-11 January 2023.

- **Within India**

- Delivered an in-person talk titled "[SIDM as a solution to small scale crisis](#)" at the conference **ICRTSE-2024**, organized by Govt. V.Y.T. PG College, Durg, Chhattisgarh from 8-11 February 2024.
- Attended a conference titled **IMHEP-II** held at IOP Bhubneshwar, Odisha, from 16-22 February 2023.
- Presented a poster for my work titled "[Numerically analyzing Self-Interacting Dark Matter](#)" at the **DAE-HEP 2022** conference held at IISER Mohali from 12-16 December 2022.
- Delivered an in-person talk at the Indian Institute of Physics, Bhubaneswar, on the topic "[SIDM as a solution to small-scale crisis](#)" on 14<sup>th</sup> March 2022 during an academic visit.

## WORKSHOPS/ SCHOOLS PARTICIPATIONS:

- **Outside India**

- Successfully completed a project titled "[Study of Statistical evolution of a gaseous system as a consequence of iterative simple rule](#)" under "**Wolfram International Summer School 2023 (WSS23)**" held at Illinois-USA in online mode during July 2023.
- Successfully completed a project titled "[Study of Regge Theory using 2-body motion in fractional spacetime](#)" under "**Wolfram International Summer School 2022 (WSS22)**" held at Illinois-USA in online mode during July 2022.
- Attended an online 1-month summer school titled "**Summer School on High Energy Physics**" organized by SPRACE-Brazil from 22 February 2021 to 19 March 2021.

- **Within India**

- Participated and presented my work in a 3-day "**Workshop on Dark Matter and Astroparticle Physics (WDMAP@IoP)**" at the Institute of Physics, Bhubaneswar, from 07th-09th August 2024.
- Participated in a 10-day "**Sangam@HRI: Instructional workshop in Particle Physics**" at Harish-Chandra Research Institute from 07th-16th March 2024.
- Successfully completed a project titled "[Smart backgrounds in simulation data using neural networks](#)" under "**Wolfram India Winter School 2022 (WIS22)**" held from December 2021- January 2022.
- Completed a 5-day workshop on "**ATHENA++ and GWPY simulations**" at **ASTROWIN2019** (Winter School on Astronomy) held at Hyderabad, India in Feb 2019.
- Attended the online workshops on national and international post-doc funding opportunities named "**PRAYOJAN 2023**" on 22-23 April 2023 and "**PRAYOJAN 2024**" on 27-28 April 2024, organized online by INYAS.

## LIST OF JOURNAL PUBLICATIONS & OTHER CONTRIBUTIONS:

- Published a manuscript titled "**Leptogenesis in a Left-Right Symmetric Model with double-seesaw**" in the JHEP journal, DOI: [10.1007/JHEP03\(2024\)029](https://doi.org/10.1007/JHEP03(2024)029).
- Published a manuscript titled "**LHC signatures of sterile neutrinos in a minimal radiative extended seesaw framework**" in the IJMPA journal, DOI: [10.1142/S0217751X21502638](https://doi.org/10.1142/S0217751X21502638).
- Published a Manuscript titled "**Estimating Water Levels through Smartphone-Imaged Gauges: A Comparative Analysis of ANN, DL, and CNN Models**" in Water Resources Management journal, DOI: [10.1007/s11269-024-04038-w](https://doi.org/10.1007/s11269-024-04038-w).
- Published works as part of proceedings for "25th DAE-BRNS High Energy Physics Symposium", DOIs: [10.1007/978-981-97-0289-3\\_227](https://doi.org/10.1007/978-981-97-0289-3_227), [10.1007/978-981-97-0289-3\\_239](https://doi.org/10.1007/978-981-97-0289-3_239) and [10.1007/978-981-97-0289-3\\_226](https://doi.org/10.1007/978-981-97-0289-3_226).
- Published conference article for "FPCP 2024" with DOI: [10.1051/epjconf/202431202008](https://doi.org/10.1051/epjconf/202431202008).
- A poster as a part of "Neutrino 2024" conference proceedings for work titled "**Leptogenesis in a Left-Right Symmetric Model with double-seesaw**", DOI: [10.5281/zenodo.13132814](https://doi.org/10.5281/zenodo.13132814).
- Contributed a Wolfram Project Notebook titled "**Implementing Smart Background in Particle Detectors Simulated Data Using Neural Networks**" ([Notebook Link](#)) during WIS22 to the Wolfram Published Notebook Repository.
- Contributed a Wolfram Project Notebook titled "**Study of Regge Theory Using 2-body Motion in Fractional Spacetime**" ([Notebook Link](#)) during WSS22 to the Wolfram Published Notebook Repository.
- Wrote a Wolfram Community Post titled "**Study of Statistical Evolution of a Gaseous system as a consequence of iterative simple rules**" ([Post Link](#)) during WSS23.
- Wrote a Wolfram function named "**ResourceFunction["CrossNodeGridGraph"]**" by Utkarsh Patel and Simon Fischer in the Wolfram Function Repository, [CrossNodeGridGraph | Wolfram Function Repository](#).
- Wrote a Wolfram Community Post titled "**Scattering cross-section analysis for self-interacting dark matter**" ([Post Link](#)) as a supplementary code file for my results in work [2204.11551](https://arxiv.org/abs/2204.11551) [hep-ph].
- Wrote a Wolfram Community Post titled "**Solutions of Boltzmann equations for the case of thermal leptogenesis in 2 simplified scenarios**" ([Post Link](#)) as a supplementary code file for the results in my works [2211.04722](https://arxiv.org/abs/2211.04722) [hep-ph] and [10.1007/JHEP03\(2024\)029](https://doi.org/10.1007/JHEP03(2024)029).

## LIST OF MANUSCRIPTS UNDER JOURNAL REVIEW:

- A manuscript titled "**Singlet-Doublet fermionic dark matter in gauge theory of baryons**" is under corrections in JHEP. arXiv no. [2408.12424](https://arxiv.org/abs/2408.12424)[hep-ph].
- A manuscript titled "**Multipartite dark matter in a gauge theory of leptons**" is under corrections in JHEP. arXiv no. [2407.06737](https://arxiv.org/abs/2407.06737)[hep-ph].
- A manuscript titled "**Numerically analyzing self-interacting dark matter**" is under corrections in EPJC. arXiv no. [2204.11551](https://arxiv.org/abs/2204.11551) [hep-ph].
- A manuscript titled "**Cogenesis of visible and dark sector asymmetry in a minimal seesaw framework**" has been communicated to JCAP. arXiv no. [2211.04722](https://arxiv.org/abs/2211.04722) [hep-ph].
- A manuscript titled "**Remote sensing and Mathematica-based analysis using net-encoder and deconvolution models for predicting lake surface area changes**" with authors Mohammad Ali Ghorbani, Debu Misra, Celso Augusto Guimarães Santos, Erfan Abdi, **Utkarsh Patel**, Sophia Ghanimeh, Siria Sadeddin, Golmar Golmohammadi, Dongkyun Kim is submitted (on 20 February 2024) and under review in the Journal of Environmental Management.
- A book chapter titled "**Study of Statistical Evolution of a Gaseous system as a consequence of Iterative Simple Rules**" with authors Utkarsh Patel and Jon Lederman is a part of the Wolfram Summer School 2023 Proceedings.

## ONGOING / UPCOMING PROJECT WORKS & CO-CURRICULAR ACTIVITIES:

- Working on a project of my PhD research group to study the dependence of the Leptogenesis scale on the Majorana phases within a class of Left-Right Symmetric Models.
- Working on a collaborative project with Professor Debasish Borah from IIT Guwahati, Zafri Ahmed Borboruah, and Lekhika Malhotra from IIT Bombay in a simple extension of SM to study the origin of Dark Matter, Leptogenesis, neutrino mass via a common interaction and its detection aspects from gravitational wave analysis.
- Working on a collaborative project with Zafri Ahmed Borboruah and Lekhika Malhotra from IIT Bombay on implementing Leptogenesis and a gravitational wave analysis in a universal seesaw extension of the LRSM framework.
- Collaborating with Professor Mohammad Ali Ghorbani, Water Engineering Department, University of Tabriz, in an upcoming project on implementing Lukas-Kanade and machine learning methods for fluid optical flow in river water.

## TRAINING / PROJECTS COMPLETED:

- Successfully completed a project under Dr. Vinay Gupta (University of Delhi) on “**Home automation using gesture control and voice recognition**” using Arduino-operated Bluetooth and radio-frequency transmission as a part of my electronics lab project during the 3rd-4th semester of my Post graduation for the academic session 2016-2018 at Dept. of Physics and Astrophysics, University of Delhi.
- 2-month online course titled “Data-driven Astronomy” by The University of Sydney on Coursera.
- 2-month internship for physics content development at Evelyn Learning Systems as Subject Matter Expert (SME), physics during Feb-March 2019.
- 2-month course in C++ and SQL programming languages from Microvision Technologies Institute, Kanpur, in 2012.
- 3-month Upper-Intermediate Spoken English course from the British Council, New Delhi, for the IELTS exam from March-May 2019.

## POSITIONS OF RESPONSIBILITY:

- Anchoring and Stage management for the conference “ICRTSE-2024” held at IIT Bhilai on 9th February 2024.
- DPGC student representative for the Physics Department in the IIT Bhilai Senate for the academic year 2021-2022.
- Teaching Assistant for the courses- Particle Physics, Numerical Methods in Physics, and for the Physics laboratory during my PhD.
- Physics Journal Club coordinator for the year 2019 during the first year of my PhD.

## DECLARATION:

The Information presented above is correct and valid to the best of my knowledge.

Utkarsh Patel  
December 2024