Arpan Dey

Email: arpand2004@gmail.com
ORCID: https://orcid.org/0009-0005-6974-0642
LinkedIn: https://linkedin.com/in/arpand2004
Website: https://arpandey.net/homepage

Summary

Arpan Dey, 20, is an undergraduate physics student and science writer based in India. He is mainly interested in physics (particularly in quantum mechanics, particle physics, quantum gravity, chaos theory, complexity and the philosophy of physics). He has written and edited many science articles (original research as well as review) for different journals and magazines. He has worked on several research projects at different institutes and has also presented some of his papers at his college and beyond. He has published a popular science book on physics, titled Our Physics So Far: A Journey through Spacetime, Consciousness and the Fundamental Nature of Reality, which is available for purchase internationally. He is also the founder of a physics blogging site, The Journal of Young Physicists, where students can submit their physics articles for review and publication.

Experience

Summer Research Fellow, Physical Research Laboratory

Jun 2024 - Jul 2024

I received the Summer Research Fellowship (2024) offered by the Indian Academy of Sciences. As part of the fellowship, I studied the modular group and modular symmetries. More specifically, I investigated the fundamental domain of the modular group, and possible applications of the same in the Standard Model and other areas of theoretical high energy physics. I worked under the supervision of Dr Ketan Patel of the Theoretical Physics division at Physical Research Laboratory, Ahmedabad, India.

Senior Physics Editor, Young Scientists Journal

Jul 2020 - Present

As senior physics editor, I review and manage all physics articles – research and review – that are submitted to the YSJ, as well as coordinate the junior physics editors. Before my appointment as a senior physics editor, I worked as a junior editor of physics, mathematics and astrophysics for the YSJ. I also briefly served as a curriculum developer for YSJ's *reSTEM* project, which is an initiative to set up an international network of research clubs and introduce high-school students to research.

Virtual SOAR Scholar, Emory University Laney Graduate School

Jun 2023 - Aug 2023

I was selected to Emory University's 2023 LGS-SOAR (Laney Graduate School – Summer Opportunity of Academic Research) program, and was recognized by the university upon successful completion of the program.

Editorial Board Member - Pebbles 2024, St. Xavier's College Science Association

Nov 2023 - Apr 2024

I was a member of the editorial board of Pebbles 2024, the annual magazine of the Science Association of St. Xavier's College, Kolkata.

Founder and Contributor, The Journal of Young Physicists
Jul 2020 – Present
I founded a free physics blogging site – The Journal of Young Physicists – for young physics aspirants to get their physics articles reviewed and published. The JYP is committed to popularizing physics and fostering the growth of young physicists.

Author, Notion Press
Jul 2021 - Sep 2022
I have published two books with Notion Press: a popular science book on physics (*Our Physics So Far*) and a Sherlock Holmes adventure (*The Adventure Of The Injured Cabman*).

Young Member of The Junior Academy, The New York Academy of Sciences
Sep 2020 - Jul 2022
The Junior Academy is a STEM program for high-school students, where students from all over the world are put in small groups and given the chance to work on real-life, challenging STEM problems.

Member, American Physical Society
Jun 2023 - Jul 2024
I was an undergraduate student member of the APS. During my membership, I connected with physicists from all over the world and attended interesting and important webinars on the most pressing topics in physics today.

Science communicator and content creator, YouTube
Jun 2019 - Present
I create physics and science videos for my YouTube channel – Arpan D, as well as videos about aviation, travel and life in general. In my free time, I also write songs and produce music. I have collaborated with several vocalists worldwide and released thirteen original songs and an album (*Unsettled Bliss*). All of my songs can be found in my second YouTube channel – Arpan Amplified.

Education

St. Xavier's College (Autonomous), Kolkata
Undergraduate student, Physics (with Mathematics and Computer Science)
Sep 2022 – Present

Delhi Public School, Burdwan
Senior secondary high-school graduate, Science (Physics, Chemistry and Mathematics)
2008 – 2022

Selected Publications

Investigations on the Fundamental Domain of the Modular Group
DOI: 10.5281/zenodo.13915484
https://zenodo.org/records/13915484
This article discusses the modular group and how its fundamental domain is defined. The article also investigates, in detail, the nature of the transformations from any arbitrary point on the upper half of the complex plane into the fundamental domain of the modular group. The upper half complex plane has been divided into appropriate regions and a Python simulation has been run to verify the transformations that maps the points inside the fundamental domain for each region.

Complexity: The Next Big Thing in Physics
DOI: 10.5281/zenodo.13913639
https://zenodo.org/records/13913639
This article aims to give a broad overview of the study of complexity and recent developments in the field. The article starts with a brief discussion on the various approaches to quantify complexity. Then assembly theory – a recent, novel and promising approach to study complex systems – is discussed in some detail. The article also touches upon other new and relevant theories like constructor theory. Then some interesting properties of complex systems – like emergence, self-organization and unpredictability – are discussed. Then the article demonstrates how ordered complexity can arise from randomness and finally, the article discusses consciousness from a complexity perspective.

A Study on Improving Take-Off Efficiency of Airplanes
DOI: 10.5281/zenodo.8284591
https://zenodo.org/records/8284591
This article explores the pros and cons of a movable forward-set split-flap-like structure in the main wing of an airplane, and its effectiveness in improving take-off efficiency and maneuvering capabilities of airplanes.

Can the de Broglie Relation be Modified for Accommodating Relativistic Modifications in the Schrodinger Equation?
DOI: 10.5281/zenodo.8284632
https://zenodo.org/records/8284632
This is a study on using the mass-energy-momentum relation to derive de Broglie's equation, and in turn, Schrodinger's time-independent equation.

Investigations on Isotopic Elements in Terms of Quarks
DOI: 10.5281/zenodo.8284563
https://zenodo.org/records/8284563
This article establishes certain relations, in terms of atomic number, number of up/down quarks in the nucleus (etc.), regarding isotopic elements.

Geometry, Symmetries, and Quantization of Scalar Fields in de-Sitter Spacetime
Coauthors: Riddhiman Bhattacharya, Sanchari Sen
DOI: 10.5281/zenodo.8392574
https://zenodo.org/records/8392574
The paper commences by examining the geometric properties of de-Sitter spacetime, with a specific focus on the isometries generated by killing vectors. It also investigates various metrics that are applicable to specific regions of spacetime, revealing that in the distant future, the symmetries exhibit a similar local structure to that of R3. Furthermore, the classical Klein-Gordon equation is solved within this space-time, leading to the discovery that energy is not conserved. The solutions to the Klein-Gordon equation yield intriguing outcomes that have the potential to enable observations from the early inflationary era. Finally, the primary objective of the paper is to comprehensively examine a quantized scalar field in the de-Sitter background, exploring the solutions for the two-point function and analyzing their behavior during both early and late time periods.

Chaos Theory and Consciousness
https://www.arpandey.net/chaos-theory-and-consciousness
This article introduces chaos theory and discusses the possible link between chaos and consciousness. To illustrate the different aspects of chaos theory, various concepts like logistic map, sensitivity to initial conditions, the Mandelbrot set, the Lorenz attractor, the Sierpinski triangle, fractal dimensions (etc.) have been discussed.

Our Physics So Far: A Journey through Spacetime, Consciousness and the Fundamental Nature of Reality
ISBN: 978-1685090234, ASIN: B0BD8MC5NW
https://www.amazon.com/dp/b0bd8mc5nw
Our Physics So Far – Arpan's debut book – is a popular science book on physics which narrates the journey of physics and science from Newton's days to the present, with interesting discussions on consciousness, chaos theory, deductions, paradoxes and an interview with renowned physicist Edward Witten. The book starts with a discussion on cosmology, then moves on to the development of mathematics and classical physics. Then, the special and the general theories of relativity are discussed. The next part is about the development and interpretations of quantum mechanics. The next part discusses modern particle physics, the information paradox and the hunt for a theory of everything. Then, the book turns to the physics of complexity and chaos theory, following which the question of the nature of consciousness is addressed, with some brief discussion of neuroscience and psychology. Finally, there is a discussion on metaphysics, paradoxes and the fundamental nature of reality. The book has mostly received positive feedback from readers around the world.

Properties and Biomedical Applications of Graphene-based Nanotechnologies (Book chapter)
Book title: *Nanotherapeutic Strategies and New Pharmaceuticals* (Part 1)
Coauthors: Fabeha Shafaat, Roberto Parisi, Nipun Gorantla, Fahad Hassan Shah
Part of DOI: 10.2174/9789815036694121010101
https://benthambooks.com/book/9789815036694/

Emergence and Consciousness
Coauthor: Sanchari Sen
DOI: 10.5281/zenodo.8391483
journalofyoungphysicists.org/post/emergence-and-consciousness-review
This article discusses weak and strong emergence, and the emergent nature of consciousness. This paper was presented by the authors at their college (St. Xavier's College, Kolkata) in *Spectrum 2023*, the annual fest of the college's physics department. The paper won the second prize in the paper presentation event.

Interviews, Features and Podcasts

Young Author Arpan Dey Talks About His Book Our Physics So Far
https://www.theliteraturetimes.com/young-author-arpan-dey-talks-about-his-book-our-physics-so-far-a-journey-through-spacetime-consciousness-and-the-fundamental-nature-of-reality/
In this exclusive interview with The Literature Times, Arpan talks about his book Our Physics So Far.

The Journey of A Young Physicist
https://www.youngscientistsjournal.com/podcast/episode/1aaf8292/episode-15-the-journey-of-a-young-physicist-an-interview-with-arpan-dey
Arpan was featured in this episode of the Young Scientists Journal podcast: STEMz Perspectives. In the podcast, Arpan talks about his journey, science communication, the role environment plays for scientists, how aspiring scientists should start their journey in STEM and the nature of academic research with host Mayank Dora.

Teen Physicist Arpan Explores Consciousness
https://www.globalindian.com/youth/story/global-indian-exclusive/deylight-at-the-end-of-a-quantum-tunnel-as-teen-physicist-arpan-explores-consciousness/
In this special article published in Global Indian, Darshana Ramdev talks about Arpan's journey, and especially his exploration of consciousness alongside physics.

All that matters is physics
https://www.arpandey.net/exclusive-interview-the-first-step
In this exclusive interview with Hasini LakshmiNarayanan, Arpan answers some questions about himself and his experience and works.

Interview with an aspiring physicist

https://youtu.be/x_Zvn9IVOS0?si=JiECxc7YHhp0Smes

In this interview with Aradhana Umesh, Arpan talks about what motivated him to pursue physics, what prompted him to create the Journal of Young Physicists, how he balances his time between physics and music, etc.

A comprehensive discussion on the most exciting topics in physics with Arpan Dey

https://www.journalofyoungphysicists.org/post/a-comprehensive-discussion-on-the-most-exciting-topics-in-physics-with-arpan-dey

In this special article published in the Journal of Young Physicists, Arpan discusses some of the most exciting and commonly asked questions in physics, ranging from questions on cosmology, classical physics and quantum physics to quantum gravity, chaos theory and complexity.

Licenses and Certifications

Summer Research Fellowship Program 2024 – The Three National Science Academies
Indian Academy of Sciences
https://drive.google.com/file/d/1WJL2zSACZ0DBcIqpy0Dv9VhA98y2MTq0/view

Summer Internship Program 2024 – Physical Research Laboratory
Physical Research Laboratory
https://drive.google.com/file/d/1j75TsuS0wD4YXhuV93r1BGIdiSGJmaL9/view

Summer Opportunity for Academic Research 2023 – Laney Graduate School
Emory University
https://drive.google.com/file/d/1FjobvYBJ-EL0oBn30OXWu36sWd6byznP/view

Introduction to Complexity
Santa Fe Institute
https://www.complexityexplorer.org/courses/185-introduction-to-complexity/certificates/4053598210.pdf

Top 100 Innovators – Smartcircuits Student Innovation Challenge 2020
Smartcircuits Innovation Pvt. Ltd.
https://drive.google.com/file/d/1YvspMZ96eQ65Thf8x-zpnJ4YkIs6vTq7/view

The Unknowable and the Counterintuitive: International Exchange Program on Science and Religion 2024
Santa Clara University; St. Xavier's College (Autonomous), Kolkata
https://drive.google.com/file/d/17gJxogT5uOt6qLX1p55A-Vj9p7WZD-LF/view

Particle Physics: An Introduction – University of Geneva
Coursera
https://www.coursera.org/account/accomplishments/certificate/KUFWDBP8AUYY

Young Member – The New York Academy of Sciences
Santa Clara University
https://www.credly.com/badges/cc3a3d4a-6164-4baf-b5dd-09cee1cb8ac1

Understanding Modern Physics I: Relativity and Cosmology – The Hong Kong University of Science and Technology
Coursera
https://www.coursera.org/account/accomplishments/certificate/VDDYH2WPG37N

Understanding Modern Physics II: Quantum Mechanics and Atoms – The Hong Kong University of Science and Technology
Coursera
https://www.coursera.org/account/accomplishments/certificate/A5MW98UAAZC5

Understanding Modern Physics III: Simplicity and Complexity – The Hong Kong University of Science and Technology
Coursera
https://www.coursera.org/account/accomplishments/certificate/LWTTR5323LDJ

Skills

Physics, Theoretical physics, Quantum mechanics, Complex systems, Computational physics, High energy physics, Particle physics, Relativity, Mathematics, Research, LaTeX, Python, Scientific writing, Academic writing, Editing, Science communication, Popular science, Creativity and innovation, Conflict resolution, Team management, Team leadership, Paper presentation, Public speaking

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