Arpit Kottur

Roll No.: 234662
B.Sc (Hons) in Physics
Fergusson College (Autonomous), Pune

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Education

- **Fergusson College (Autonomous), Pune** *2023-2027(expected)*
  B.Sc (Hons) in Physics CGPA: 8.88/10.00
- **Aditya English Medium School** *2021-2023*
  Pre-University Studies Percentage: 63.6%
- **Podar International School** *2011-2021*
  Secondary Studies Percentage: 97.2%

Experience

- **Workshop on Astrophysical Dust Ices** *March 2025*
  Workshop Attendee (Online)
  – Attended the workshop organised by Physical Research Laboratory.
  – Gained insights from recent observations from telescopes.
- **43rd Meeting of the Astronomical Society of India** *February 2025*
  Workshop Attendee (Offline)
  – Attended talks and seminars on the current trends in Indian Astronomy and Astrophysics by eminent scientists.
  – Presented a Research Poster on "A Streamlined Model for Simulating Galactic Rotation Curves with Observational Validation".
- **International Workshop on Mathematical Modelling, Cosmology and Data Science.** *October 2024*
  Workshop Attendee (Online)
  – Learned about the current methods used for Mathematical Modelling and Statistical Analysis.
  – Learned about the current trends in Theoretical Cosmology.
- **Cosmology From Home** *June 2024*
  Workshop Attendee (Online)
  – Attended lectures on various aspects of Cosmological research.
  – Gained hands-on training with various theoretical and computational tools.
- **Frontiers in Physics** *2024, 2025*
  Volunteer and Workshop Attendee (Offline)
  – Incharge of Design, Marketing and Management of the Conference.
  – Attended Lectures on Astrophysics, Cosmology, Particle Physics, Quantum Mechanics and more.
- **IUCAA National Science Day** *2024, 2025*
  Volunteer and Workshop Attendee (Offline)
  – Created and presented a 1:50 scale model of the Southern African Large Telescope.
  – Attended lectures on Astronomy, SETI, Unexplained Mysteries, Solar Physics and attended Q-A sessions with IUCAA's eminent scientists.
- **Workshop on Astronomical Data Analysis** *February 2024*
  Workshop Attendee (Offline)
  – Learned about Python Libraries, NumPy, AstroPy and MatPlotLib.
  – Learned about Data Analysis and Visualisation of Astronomical Data.
- **Astro Club Poster Exhibition** *2024, 2025*
  Volunteer (Offline)
  – Presented Posters and Models on Telescopes and Cosmology.
- **Workshop and Certificate Course on Usefulness of Remote Sensing and GIS** *July 2021*
  Workshop and Course Attendee (Offline)
  – Attended lectures on Remote Sensing and GIS organised by Indian Institute of Remote Sensing and Indian Space Research Organisation.
  – Received the Certificate with an A+ Grade.
- **Eclipse Tour by Hands-On Science Foundation** *December 2019*
  Attendee (Offline)
  – Attended and Studied the Annular Solar Eclipse of 2019.

Projects

- **A First Order Filter for the Detection of Potentially Habitable Exoplanets**
  June 2025- September 2025
  - arXiv:2512.00899
  - Developed a first-order geometric filter for the preliminary identification of potentially habitable exoplanets, benchmarked to Earth–Sun system ratios of orbital distance to stellar diameter and stellar to planetary diameter. The method enables rapid, interpretable prioritization of exoplanet candidates across G, K, and M-type stars, reducing follow-up resource requirements.

- **Interpretable ECG-Based Prediction of Myocardial Infarction Using the PRANALI Pipeline**
  May 2025- October 2025
  - ssrn.5734913
  - Developed a robust and interpretable machine learning pipeline — PRANALI — for detecting myocardial infarction using extracted features from 12-lead ECG signals. The project involved large-scale ECG data preprocessing, statistical and spectral feature engineering, class imbalance handling (SMOTE), and XGBoost-based classification. Model interpretability was achieved using SHAP analysis to identify critical ECG markers associated with myocardial infarction. Achieved a high ROC-AUC score of 0.84, demonstrating clinical relevance.

- **A Dynamical Scalar Field Model for Dark Energy: Addressing the Hubble Tension and Cosmic Evolution**
  January 2025- August 2025
  - arXiv:2511.10317
  - Developed a scalar field dark energy model with a hybrid exponential–power-law potential, enabling dynamic evolution of $\Omega_{\rm DE}(z)$ and $w(z)$ while addressing the Hubble tension. Implemented the model in `hiCLASS` and constrained parameters using *Planck* 2018 CMB, $H(z)$, and SDSS DR7 Matter Power Spectrum data via a two-stage MCMC approach. Achieved strong concordance with observational datasets, accurately reproducing CMB C_ℓ^{TT} and $P(k)$ across redshifts. Results position the model as a viable alternative to ΛCDM, with implications for explaining late-time cosmic acceleration.

- **A Streamlined Framework for Simulating and Fitting Galactic Rotation Curves**
  November 2024 - August 2025
  - ascl:2510.004
  - Developed a Python-based framework for simulating and fitting galactic rotation curves using physically motivated bulge, disk, and halo models (Hernquist, de Vaucouleurs, exponential disk, NFW, Burkert). Implemented three fitting techniques—non-linear least squares, bootstrap resampling, and MCMC—with full uncertainty propagation, diagnostic visualizations, and support for both tabulated and raw FITS data. Designed for modularity, reproducibility, and adaptability, enabling both research applications and pedagogical use in galactic dynamics and dark matter studies.

- **Investigating the Correlation Between Dark Matter Content, Ages, and Mass-to-Light Ratios in Spiral Galaxies**
  December 2023 - July 2025
  - arXiv:2512.00823
  - Analyzed 16 nearby spiral galaxies to investigate links between stellar age, dark matter content, and I-band mass-to-light ratios. Modeled rotation curve data with Hernquist bulge, exponential disk, and NFW halo profiles using Monte Carlo fitting, and identified dark matter–dominated regions to derive masses and luminosities. Found strong correlations between age and both dark matter mass and density, suggesting galaxies with higher dark matter content tend to be older. Results support scenarios where early dark matter build-up shapes long-term galactic evolution.

Skills

Languages: English, Hindi, Marathi, Sanskrit, French
Programming Tools: Python, C, Embedded C, HTML, CSS, LINUX, LaTeX
MS Office: MS Word, MS Excel, MS Powerpoint
Adobe Creative Suite: Adobe Audition, Adobe After Effects, Adobe Illustrator, Adobe Photoshop, Adobe Premiere Pro
Soft Skills: Public Speaking, Diplomacy, Decision Making, Adaptability, Delegation, Analytical Thinking, Critical Thinking, Research
Coursework: Mechanics, Thermodynamics, Optics, Electrodynamics, Nuclear Physics, Astrophysics, Cosmology, Quantum Mechanics, Particle Physics, Nuclear Physics, Mathematical Methods, Numerical Analysis, Atomic and Molecular Physics, Descriptive Statistics, Data Analysis, Data visualisation, Probability, Distribution Theory, Sampling Methods, Hypothesis Testing

Books

- **Mapping the Unseen: The Hunt for Dark Matter** *2025*
  Published via Notionpress (ISBN: 979-8897771967)
- **Unexplained Mysteries of the Universe: Second Edition** *2024*
  Published via Notionpress (ISBN: 979-8893223545)
- **Unexplained Mysteries of the Universe** *2019*
  Published via Kindle Direct Publishing (ISBN: 979-8617267398)
- **The History of Space Exploration** *2017*
  Unpublished

Achievements

- **International Astronomy and Astrophysics Competition** Bronze Honor *2025*
- **2025 Astro Club Annual Poster Exhibition** 2nd Place *2025*
- **Student of the Year 2022-23** *2023*
- **Indian Space Science Olympiad** All India Rank 1 *2022*
- **Young Space Explorer** Title received from Mr. Deepak Kesarkar, State Education Minister *2022*
- **PIS Model United Nations** Best Delegate Award *2019*
- **SSS Exposition of Science Experiments** Gold Medalist *2017, 2018*
- **International Space Olympiad** World Champion (International Rank 1) *2016*
- **Unified Cyber Olympiad** All India Rank 43 *2014*
- **PIS Topper Award** *2011, 2012, 2013*
- **International Mathematics Mental Arithmetic Competition** Fourth runner-up *2011*
- **Various School and College level Olympiad Champion**

Hobbies and Interests

- **Youtube:** Running the Question Mark Channel
- **Podcast:** Co-Hosting The Podium Perspective Podcast
- **Writing:** Short Stories, Poetry, and a Fantasy Series
- **Music:** Singer, Songwriter, Composer for "Inner Horizons"
- **Sports:** Motorsports, Cricket, Badminton, Tennis, Football, Kabaddi
- **Reading:** Science Fiction, Fantasy, Non-Fiction, Self-Improvement