CURRICULUM VITAE – Aayusha Singh

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GitHub: github.com/aayu-sha

Research Gate: ResearchGate-Aayusha Singh
Google Scholar: GoogleScholar-Aayusha Singh
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Research Interests

- **Astrophysics and Cosmology:** Stellar structure and evolution, supernovae, neutron stars, pulsars, magnetars, high-energy astrophysics, dark matter and dark energy interactions, observational cosmology.
- **Computational & Theoretical Astrophysics:** Numerical simulations, machine learning applications in astrophysics, Bayesian inference, gravitational wave analysis, computational fluid dynamics.
- **Space Science & Planetary Physics:** Heliospheric physics, planetary magnetospheres, interstellar medium, spacecraft dynamics, relativistic effects in interstellar travel.
- **Machine Learning & AI:** Deep learning for astrophysical data, predictive modeling, AI-driven data analysis, neural networks in scientific research.
- **Mathematical & Statistical Methods:** Data-driven modeling, statistical inference, complex systems analysis, signal processing in astrophysical observations.

EDUCATION

2024 – 2027 (Expected)	IGNOU, India	Bachelor of Science in Mathematics
2022 – 2026 (Expected)	National Institute of Technology, Srinagar	Bachelor of Technology in Mechanical Engineering
2018 – 2020	Career Launcher, Mumbai	Class 11-12, STEM
2008 – 2018	Ludhani Vidya Mandir, Mumbai	Class 1-10, All Subjects

PROFESSIONAL EXPERIENCE

06/2023 – Present	Research Intern	Indian Institute of Science (IISc), Bangalore
02/2024 - Present	Research Analyst	Empire Space, Texas, USA
04/2024 – Present	Freelancer	Upwork
10/2023 – Present	Founder	Magnetars
01/2023 – 12/2023	Research Intern	Empire Space, Texas, USA
01/2023 – 02/2023	Mechanical Engineering Intern	Kenmark Tech Solutions
06/2020 – 10/2021	Quotation Designer	Home Design Modular

MEMBERSHIPS

2024	International Society for Data Science and Analytics
2024	International Astronomical Search Collaboration
2023	Space Generation Advisory Council
2023	SSPI (Space & Satellite Professionals International) UK
2023	ASME (The American Society of Mechanical Engineers)
2023	National Geographic (Citizen Scientist)
2023	Zooniverse (Citizen Scientist)
2023	NASA (Citizen Scientist)

PAPER PUBLICATION

December 2024 — Influence of Interactions between Dark Energy and Dark Matter on Galaxy Formation; Amrit Roy, **Aayusha Singh**; IJASEAT Volume-12, Issue-4 (October 2024) - DM-DE-paper-PDF

October 2024 — From Stellar Birth to Violent Death: A Review on Supernovae; **Aayusha Singh**, Amrit Roy; IJASEAT Volume-12, Issue-3 (July 2024) - Supernovae-paper-PDF

ARTICLE PUBLICATION

March 2024 — In-depth report on Diversity Ownership in the New York Space Sector Article-link

April 2023 — In-Depth Report on NASA Affiliated Companies Key Part of NY Space Ecosystem Article-Link

PAPER ACCEPTED

March 2025 — Classifying Primary Cosmic Ray Composition using Machine Learning and Deep Learning Models; Amrit Roy, **Aayusha Singh**, RAP 2025, Greece

February 2025 — Formation and Evolution of Galactic Bars: Examining the Influence of Angular Momentum Transfer in Spiral Galaxies; **Aayusha Singh**, Amrit Roy; 56th Division on Dynamical Astronomy Meeting, Atlanta, Georgia, USA

November 2024 — Relativistic Effects on Spacecraft in Interstellar Travel: Examining Time Dilation and Relativistic Energy in Deep Space Missions; **Aayusha Singh**, Amrit Roy, Om Singh, GLEX 2025, India

November 2024 — Investigating the Behavior of Dark Matter-Analogous Particles in Microgravity Environments: A Hypothetical Study; Amrit Roy, **Aayusha Singh**, Om Singh, GLEX 2025, India

ABSTRACT SUBMITTED

March 2025 — A Complete Derivation of the Einstein Field Equations: From Fundamental Geometry to Gravitational Dynamics; Amrit Roy, **Aayusha Singh**, 24th International Conference on General Relativity and Gravitation and 16th Edoardo Amaldi Conference on Gravitational Waves, Scotland

March 2025 — Testing Fuzzball Hypothesis for Black Holes: A Gravitational Wave Analysis; Amrit Roy, **Aayusha Singh**, EAS 2025 Annual Meeting, Ireland

March 2025 — Bayesian Hierarchical Inference of Star Cluster Parameters Using Gaussian Process Regression; **Aayusha Singh**, Amrit Roy, Bridging Scales, Matera, Italy

March 2025 — Probing Strong-Field Gravity with Quasi-Periodic Oscillations (QPOs); **Aayusha Singh**, Amrit Roy, XMM 25th Anniversary Conference, Maryland, USA

February 2025 — Extreme Astrophysical Emissions: Synchrotron, Curvature, and Jet Radiation in Pulsars, Magnetars, and Black Holes, **Aayusha Singh**, Amrit Roy, ICRC 2025, CERN, Switzerland

IN-PREPARATION PAPERS

1. Adaptive Local Means CNN or ALM-CNN model to denoise Retina Images.
2. Dense Residual Paths with Attention to Classify Plant-leaf Disease Using BPLD Dataset.
3. Image Quality Assessment Model

Projects

1. **BPLD (Black Gram Plant Leaf Disease) Classification** *September 2024 – November 2024*
   - Designed a deep learning-based model for plant disease classification.
   - Utilized CNN, DenseNet, NASNet, ResNeXt, TresNet, VGGNet, and Xception architectures.
   - Developed a hybrid model integrating Dense Residual Paths with Attention mechanisms.
2. **Retina Image Enhancement Using Deep Learning and Probabilistic Models** *July 2024 – September 2024*
   - Implemented retinal image enhancement techniques leveraging deep learning and probabilistic modeling.
   - Explored methods including Variational Autoencoders (VAE), Total Variation Denoising (TVD), Spatial Pyramid Pooling Networks (SPP), Auto-Regressive Models, Normalizing Flows, Energy-Based Models (EBM), and Diffusion Models.
   - Developed a hybrid framework combining Adaptive Local Means Denoising with Convolutional Neural Networks (CNN).
3. **Factor of Safety Calculator (Python GUI)** *May 2024 – June 2024*
   - Designed a GUI-based application for mechanical safety calculations.
   - Implemented using Python and Tkinter for user-friendly interaction.
4. **Web Scraping with Machine Learning for Logo Extraction and Replacement** *March 2024 – June 2024*
   - Developed an automated web scraping system using Selenium, BeautifulSoup4, and Scrapy.
   - Processed and analyzed extracted data using Scikit-learn, NumPy, and Pandas.
   - Implemented logo replacement using deep learning models in Keras.
5. **Emotion Detection using Machine Learning** *February 2024 – March 2024*
   - Developed a system to classify human emotions using machine learning.
   - Trained models using Python and deep learning frameworks.
6. **Credit Card Fraud Detection using Machine Learning** *January 2024 – February 2024*
   - Built a fraud detection system leveraging machine learning algorithms.
   - Implemented using Python and Scikit-learn for anomaly detection.

CONFERENCES

September 2024	Paper Presentation (ACN-AASS-GOA-180924-200)
July 2024	Paper Presentation (ACN-AASS-BGLR-140724-6738)

CERTIFICATIONS

December 2023	Space Hackathon 2023 by IISF-ISRO (2024H2S01SIF-SH-P1001723)
November 2023	Silver Honor in International Youth Math Challenge (F-2023-F6A5AD0B389)
June 2023	Silver Honor in International Astronomy and Astrophysics Competition (PF-2023-F4B85BFD94F)
April 2023	Cybersecurity Virtual Experience Program of MasterCard (gLsnH4JxisNkrHPnW)

Skills

Technical Skills

- **Programming:** Python (including GUI development and web scraping), Data Science
- **Astrophysics & Cosmology:** Supernova research, stellar dynamics, cosmological modeling
- **Aerospace Engineering:** Computational Fluid Dynamics (CFD), space engineering simulations
- **Data Science & Analysis:** Statistical modeling, data visualization (Matplotlib, Seaborn, p5.js)
- **Machine Learning:** Predictive modeling with scikit-learn, TensorFlow
- **Web Development & Automation:** HTML, CSS, JavaScript, Bootstrap; task automation with Selenium, Puppeteer
- **Scientific Computing:** Mathematical modeling and simulations using SymPy
- **Version Control & Collaboration:** Proficient in Git and GitHub for open-source contributions

Professional Tools

- **Image Processing:** OpenCV, PIL for image manipulation, inpainting, and visualization
- **Video Editing:** OpenShot, HandBrakeCLI for documentary creation and editing

Soft Skills

- **Research & Analysis:** Experience in astrophysics, space sciences, and aerospace research
- **Project Management:** Successfully managed freelance projects in data automation and scientific research
- **Problem-Solving:** Strong analytical skills demonstrated in competitive programming and data analysis
- **Communication & Collaboration:** Effective in research writing, conference presentations, and interdisciplinary teamwork