ARASH DEV AHLAWAT

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EDUCATION

Degree	University/Board	Institute/School	Year	CPI / %
B. Tech in **Engineering Physics**	IIT Bombay	IIT Bombay	2027	8.13
Intermediate	CBSE	Delhi Public School, Karnal	2023	93.80%
Matriculation	CBSE	St. Theresa's Convent School, Karnal	2021	96.80%

Pursuing a Minor in **Artificial Intelligence and Data Science** at the Centre for Machine Intelligence and Data Science with **CPI: 10.00**

SCHOLASTIC ACHIEVEMENTS

- Secured **99.90** percentile in the Joint Entrance Examination (JEE) - Main among **1.1 million+** candidates [2023]
- Attained AIR **1655** in the Joint Entrance Examination (JEE) - Advanced among **0.18 million+** candidates [2023]
- Secured an AIR of **426** in the **Kishor Vaigyanik Protsahan Yojana (KVPY)** Scholarship, out of **50k+** students [2022]
- Achieved an AIR of **111** in the esteemed **IISER** Aptitude Test **(IAT)**, among over **34k+** candidates nationwide [2023]
- Received a **Certificate of Merit** in the prestigious Indian Olympian Qualifier in Mathematics **(IOQM)** [2022-23]
- Awarded Certificate of Merit for ranking **top 1%** statewide in the National Standard Examination in Physics **(NSEP)** [2022]

KEY PROJECTS

Binary Black Holes from Scratch [May 2024 - Jul 2024]

Krittika Summer Project | Krittika - The Astronomy Club, IIT Bombay

- Analyzed binary system interactions such as **Roche lobe overflow**, stellar mergers and **common envelope evolution**
- Simulated **100,000+** stellar structures and **Compact Binary Objects**(binary black holes/neutron stars) using Compact Object Mergers: Population Astrophysics and Statistics **(COMPAS)** a rapid stellar/binary population synthesis code
- Parallelized simulations by splitting runs through batch processing via **bash** scripting, reducing large-scale runtime by **90%**
- Illustrated stellar evolution and compact object formation using scatter plots, **HR diagrams**, and **chirp mass** distribution
- Investigated the evolution of **gravitational wave** emissions from binary systems, rigorously comparing simulated data to real observations, and iteratively adjusting parameters to achieve a **29%** match with observational data from **LIGO-Virgo**

How to Train Your Dinosaur [Nov 2024 - Dec 2024]

Course Project | PH227: AI and Data Science | Guide: ***Prof. Alok Shukla***

- Developed a clone of the Chrome T-Rex game using **Pygame** ,incorporating personalized hand-drawn sprite animations
- Collected gameplay data by logging 6 key features (e.g., time, object distance, object height) in **CSV** as training data
- Trained a **Convolutional Neural Network (CNN)** on the collected data and integrated it with a **Reinforcement Learning** system using Fitness function and **Genetic Algorithms**, evolving over **50** generations to achieve a peak score of **40,000+**
- Managed a collaborative **GitHub** repository for version control and seamless coordination across the development team

RAVEDM 4X4X4 [Programmable LED Cube with Dynamic Visualizations] [Apr 2025 - May 2025]

Course Project | PH222: Digital Electronics and Microprocessors | Guide: ***Prof. Pradeep Sarin***

- Designed and built a fully-functional 4x4x4 LED cube using **shift registers, Arduino MEGA** , and a layered circuit design
- Engineered visually dynamic and interactive 3D light animations using the **Arduino IDE**, including **firefly synchronization** through the **Kuramoto model**, and wave propagation effects based on distance-dependent mathematical functions
- Implemented efficient **state-machine logic** and **multiplexing** using Pulse Width Modulation (**PWM**) for smooth animation
- Achieved smooth 3D animations of up to **80 FPS** using **70 μs** per-LED PWM and real-time multiplexing across **64** LEDs
- Integrated **microphone input** to perform real-time audio visualization, with **beat detection** and amplitude control

Song Classification using Machine Learning [Oct 2024 - Nov 2024]

Course Project | DS203: Programming in Data Science | Guide: ***Prof. Vinay Kulkarni***

- Built a **CNN-RNN** based audio classifier using the **PyTorch** library to identify song patterns from their feature vectors
- Reconstructed Mel-frequency cepstral coefficient **MFCC** files into **.wav** audio for manual classification and validation
- Analyzed **116** MFCC samples using heatmaps, **PCA**, scatter plots, and elbow curves to study feature distribution
- Constructed a custom-labeled dataset of **180** external songs, achieving a model training accuracy of over **90%**
- Trained the model using **Adam optimizer** and **Cross-Entropy** loss functions and achieved testing accuracy of over **50%**

POSITIONS OF RESPONSIBILITY

Convener | *Krittika - The Astronomy Club* | *IIT Bombay* [Apr 2024 - Mar 2025]

Selected among **8** out of **150+** applicants to promote **Astronomy** among a strong community of over **12,000** students and staff

- Developed proficiency in processing astrophotographs using **Siril**, and **GIMP**, gained hands-on experience to use **Dobsonian** and **Equatorial** Telescopes and created a detailed inventory for the astronomical observatory under construction
- Planned and led a **2-day** astronomy trip to **Udaipur** and **Mount Abu**, visiting the **PRL** Solar and Infrared Observatories; also organized a stargazing camp to **Bhandardara**, successfully managing **50+** participants across both events
- Coordinated a **3-day** Astrophotography Exhibition on **National Space Day 2024**, promoting public engagement in astronomy; also conducted an **Introduction to Astrophotography Workshop** during **PG Tech Week**
- Ideated, planned and organized **Astromania** - The Annual Astronomy Quiz, which was attended by **150+** students
- Headed the design team, responsible for creating designs for **club merchandise** such as t-shirts and hoodies through software like **Illustrator** and **Figma**; created one of the most viewed posts on the official club page with **10k+** views

Observation Round Evaluator | *International Olympiad of Astronomy and Astrophysics (**IOAA**)* [Aug 2025]
Selected as a member of the **Academic Team** of **IOAA 2025**, conducted from August 10th-21st in Mumbai by **HBCSE**

- Invited aa a member of a panel that assessed the observation skills of **300+ students** representing **63+ countries**
- Evaluated proficiency in **telescope operations**, **instrument handling** in the observation component of the olympiad

Football Coordinator | *Aavhan - Sports Fest* | *IIT Bombay* [Feb 2023 - Mar 2023]

- Experienced organizing a large-scale tournament overseeing schedules, team **coordination**, and match **logistics**
- Improved **communication** and **negotiation skills** by securing multiple college participation throughout **Maharashtra**
- Enhanced **leadership** by coordinating volunteers to ensure smooth execution while fostering a competitive environment

OTHER PROJECTS

Customised Linux Desktop Configuration [May 2025 - Jul 2025]
Self Project | | *Custom Dotfile Configuration for Personalised Experience*

- Configured an **Arch Linux** environment with **Hyprland compositor**, tailored for performance and aesthetic consistency
- Implemented **dynamic theming** using **pywal**, integrating it across terminal, VS Code, Firefox, Eww bar, and **Glava**
- Customized window management behavior, gaps, animations, and keybindings for an efficient tiling experience
- Automated environment setup using **shell scripts and dotfile versioning** with Git for seamless portability
- Integrated media tools like **spotify-player**, and real-time audio visualizations with **GLava** synced to system theming

Personal Website Development [May 2025 - Aug 2025]
Self Project | *Front-End Development with a creative UI design*

- Created a personal website using **GitHub Pages** to display my portfolio and projects with an **artsy**, street-inspired design
- Employed **HTML**, **CSS**, and **JavaScript** for developing interactive features and achieving **mobile-responsive** functionality
- Customized an **interactive UI** reflecting personal branding while balancing between **creative expression** and usability
- Integrated version control using **Git**, organized code for modularity and enhanced site efficiency using **code refactoring**

MCMC Fitting of Isochrones to Determine the Age of a Primordial Cluster Pair [Sept 2025 - Nov 2025]
Course Project | *PH556: Astrophysics* | *Guide: **Prof. Varun Bhalerao***

- Used **MCMC-based isochrone fitting** on open clusters **ASCC 19** and **ASCC 21** to determine cluster age and metallicity
- Stacked and observed **20 exposures** (**30 s** each) of the star clusters across **g** and **i** bands, ensuring complete spatial coverage and adequate photometric depth within the Growth India Telescope's (GIT) **0.7°** × **0.7°** field of view
- Modeled **HR diagrams** and implemented both **least-squares** and **Markov Chain Monte Carlo (MCMC)** fitting routines to estimate cluster age and [Fe/H], performing convergence checks and benchmarking results against **Gaia DR3** parameters
- Compared derived parameters (**age ≈ 10 Myr**, **metallicity ≈ 0.75 $Z_{\odot}$**) to validate the **primordial cluster pair** hypothesis

Neuronal Dynamics [Sept 2025 - Oct 2025]
Course Project | *PH567: Non-linear Dynamics* | *Guide: **Prof. Punit Parmananda, Department of Physics, IIT Bombay***

- Modeled neurons using a simplified **Hodgkin-Huxley** model, analyzing feedback-driven dynamics across **0-50 pA** input
- Created **30-60s Manim** animations, to demonstrate **Saddle-node**, **SNIC**, supercritical and subcritical **Hopf bifurcations**
- Simulated threshold manifolds and frequency preference **(100-1000 Hz)** using **MATLAB**, illustrating temporal response curves and the distinction between **Class 1** and **Class 2** excitability, and visualizing **integrator-resonator** transitions
- Connected observed bifurcation dynamics to their implications in **neuromorphic computation** and spiking neural models

Universal Testing Machine [Sep 2023 - Nov 2023]
Course Project | *MS101: Introduction to MakerSpace* | *Guide: **Prof. Joseph John, Prof. Krishna Jonnalagadda***

- Worked in a team of 6 to build a **Universal Testing Machine**, measuring **tensile strength** of material using an **Arduino**
- Used tools such as **dremel**, **lathe** to create a fully-functional semi-automated machine after designing through AutoCAD
- Utilized software such as **Fracktory**, and **LaserCAD** in order to optimise the project and ensure high-end performance
- Designed a **horizontal UTM** system, recognized as one of the best designs for its **minimalist** approach and **efficiency**

Dynamic Obstacle-Avoiding Gesture-Guided Operator 1.0 (DOGGO 1.0) [Dec 2024 - Feb 2025]
Electronics and Robotics Club | *IIT Bombay*

- Designed a quadruped robots mechanical structure with dog-like leg geometry using **SolidWorks**
- Simulated motion and leg coordination using **ROS Gazebo**, refining inverse kinematics and locomotion strategies
- Implemented a camera-based gesture recognition system using **OpenCV** to interpret human hand gestures in real-time
- Developed **reinforcement learning algorithms** enabling the robot to **autonomously** adapt to navigate dynamic terrain
- Manufactured and Assembled **3D-printed parts**, electrical components, connected **actuators** and sensors for control and implemented basic coding for standing and walking, ensuring motor control and sensor feedback are functional

Remote Controlled Bot XLR8 [Sep 2023]
Electronics and Robotics Club | *Institute Technical Council*

- Collaborated in a four-member team to design an RC bot and successfully navigate a competition-grade obstacle course
- Built a wireless **gyroscopic controller** using the **MPU-6050** and connected it to the bot via **ESP-32 microcontroller**
- Integrated **L298N motor driver** with bot's drive system using **PWM-based speed control** for precise maneuvering

Stop-Motion Animation [Mar 2023 - Apr 2023]
Course Project | *DE109: Introduction to Design* | *Guide: **Swati Agarwal***

- Created a stop motion animation by illustrating over **50 detailed sketches**, showcasing strong artistic skills
- Utilized a range of software tools, including **Adobe Premiere Pro**, along with various online resources, to compile, edit, and refine the animation, showcasing advanced proficiency in **video editing** and post-production workflows

TECHNICAL SKILLS

Programming Languages	Python (NumPy, Matplotlib, Scikit-learn, SciPy, PyTorch, Pygame), C/C++, HTML, CSS, JS
Softwares	Git, SolidWorks, AutoCAD, Hyprland, VS Code, Illustrator, GIMP, Siril, ROS, OpenCV, LaTeX
Others	Adobe Fresco, Figma, Fractory, Op-Amps, Digital Storage Oscilloscopes, MOSFETs, Krita

KEY COURSES

Physics	Classical Mechanics, Thermal Physics, Oscillations and Waves, Physics Lab, Statistical Mechanics, Quantum Mechanics, Electromagnetic Theory, General Physics Lab, Astrophysics*, Non-Linear Dynamics*, Condensed Matter Physics*, Nuclear Physics Lab*
Computer Science	Computer Programming, Programming for Data Science, AI and Data Science, Numerical Analysis*
Electronics	Analog Electronics, Digital Electronics and Microprocessors, Electronics System Design*
Mathematics	Calculus, Linear Algebra, Differential Equations, Complex Analysis and Integral Transforms
Miscellaneous	Makerspace, Introduction to Design, Introduction to Psychology, Economics, Biology, Design Thinking, Computational Multinomics, Decision Analyisis & Game Theory

* To be completed in Nov 2025

EXTRA-CURRICULAR ACTIVITIES

Sports/ Football	• Secured the **Silver Medal** in the **Institute Football League 2023-24** with **100+** participants	[2024]
	• Won the **Gold Medal** with **Hostel 16A** in the **Freshiesta Football Tournament 2023**	[2023]
	• Represented **Hostel 5** as a core team member in the **Inter-Hostel General Championship**	[2025]
	• Emerged as **Champion** in the institute-wide **FIFA Open**, competing against **30+** participants	[2025]
	• Completed a year-long intermediate football course under the **National Sports Organization**	[2024]
	• Participated in the Aavhan Half Marathon, completing **21 KM** in less than **150 minutes**	[2023]
	• Underwent one year of training with the **Karnal District Football Team**	[2019]