

Pavan Hebbar

Detailed Résumé

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Education

- 2013 – **B.Tech Aerospace Engineering**,
Present *Indian Institute of Technology, Bombay, Grade – 9.61/10.*
- Department Rank 1 among the class of 2017
 - Awarded **AP** grade (for exceptional performance) in Spaceflight Mechanics
 - Minor: Computer Science, Physics
- 2011 – 2013 **Intermediate Examination**,
Srichaitanya Narayana Junior College, Hyderabad, Percentage – 96.7%.
- 2010 – 2011 **Matriculation**,
Atomic Energy Central School, Kaiga, Grade – 10.0/10.0.

Achievements

International Representations

- 2012 **Bronze Medal, International Olympiad on Astronomy and Astrophysics**,
Rio De Janeiro, Brazil.
- 2011 **Silver Medal, International Astronomy Olympiad**,
Almaty, Kazakhstan.
- 2013 **Prof. Harry Messel International Science School**,
University of Sydney, Australia.
One of the 5 students to represent India
- 2012 **IGNOU UNESCO Science Olympiads for SAARC countries.**
Awarded medal for being among the top 40 participants

Other Achievements

- 2010 – 2012 **Olympiad Orientation Cum Selection Camps.**
- Astronomy Camps (2010, 2011 & 2012) among top 30 students in India
 - Awarded **Best Theory** Solution in 2012 and **Best Observer** in 2011 Astronomy Camps
 - Awarded Certificates of Merit in the National Standard Examinations in Astronomy (2010) and Junior Science (2011) for being in top 1% of the participants.
- 2011 **Kishore Vaigyanik Protsahan Yojana Scholarship**,
Indian Institute of Science, Bangalore.
Awarded by Government of India for students interested in research
- 2009 **National Talent Search Examinations, NCERT, Delhi.**
Awarded by Government of India for students interested in research
- 2011 & 2012 **Infosys Award for Olympiad Medalists.**
- 2010 & 2011 **Young Scientist Award.**
Honoured by Education Minister of Karnataka state
- 2013 **Inter IIT Messier Marathon.**
Secured IIT Bombay the second position by putting on board 72 Messier objects including the entire Virgo cluster of galaxies

Research Experience

- May 2015 – **Numerical Simulation of Collisionless Shocks,**
Present *Prof. Bhooshan Paradkar, Centre for Excellence in Basic Sciences, University of Mumbai.*
- Studied the basics of plasma theory and its magnetohydrodynamic relations
 - Used Particle-in-Cell approach through WARP open source code
 - Numerically simulated plasma particles to calculate shock parameters
 - Analysed the variation of shock parameters for different plasma particles
 - Worked on parallel programming to reduce the simulation time
- May 2015 – **Computational Modelling of Hall Thrusters,**
Present *Prof. Kowsik Bodi, Department of Aerospace, Indian Institute of Technology Bombay.*
- Studied different rocket propulsion systems and analysed their efficiency
 - Numerically simulated the motion of plasma particles to calculate the exhaust velocity of the gas
 - Analysed the variation of specific thrust with changing axial electric and radial magnetic fields
 - Optimized the electric and magnetic fields to achieve maximum efficiency
- December 2014 **Using OH Mega-Masers To Verify Galaxy Evolution Theories,**
National Initiative for Undergraduate Science – Physics, Dr. Nissim Kanekar, National Centre for Radio Astronomy.
- Studied the properties of different types of astronomical masers in detail
 - Understood the different aspects related to radio astronomy, interference and synthesis imaging
 - Aimed at analysing variation in number density & mass with redshift to verify evolution theories
- December 2013 **Gamma Ray Detection Through Čerenkov Radiation,**
National Initiative for Undergraduate Science – Astronomy, Dr. K K Yadav, Bhabha Atomic Research Center, Mumbai.
- Studied the various concepts involved in the detection of gamma rays through Čerenkov emission.
 - Designed programs to differentiate between Čerenkov emission shower due to cosmic and gamma rays
 - Analysed data collected from the TACTIC to study the properties of Crab Nebula and MRK 421
- March 2015 **Modelling of QuickSCAT trajectory,**
Prof. Ashok Joshi, Department of Aerospace, Indian Institute of Technology Bombay.
- Studied the various forces acting on a launch vehicles and how to model them
 - Studied the propulsion systems used in different stages to calculate specific thrust.
 - Calculated the trajectory of QuickSCAT satellite from its final parameters and given burn profile
 - Estimated the change in the fuel consumed and the optimum burn profile if the payload is increased

Technical Experience

- 2013 – **Mechanical Subsystem, Pratham – Student Satellite Team of IIT Bombay.**
Present
- Performed Vibrational Analysis, Harmonic Analysis, Modal Analysis, Response Spectrum of the satellite
 - Performed steady-state and transient thermal analysis to determine the temperature distribution
 - Proposed SNAP model to switch the satellite on when it is launched with minimum power
 - Optimized satellite models used for analysis to minimize simulation time and maximize accuracy
 - Implemented ways to access the server remotely and perform parallel processing on ANSYS
 - Worked in the payload subsystem and suggested payloads for the next student satellite
- June 2014 **Sky Teller – Institute Technical Summer Project.**
- Involved in the design of an Android app to show the stars in the given direction
 - Used the data catalogued in Stellarium Planetarium for the position of celestial objects at a given time
 - Used accelerometer of the phone to know the direction being pointed

Work Experience

- June 2015 **Resource Person and Student Facilitator.**
- Selected as a resource person for the Indian Astronomy Olympiad OCSC (Orientation-Cum-Selection Camp) for mentoring students, handling academic arrangements and aiding in evaluations
 - Involved in the selection and training of Indian team which won 3 gold medals and 2 silver medals at International Olympiad for Astronomy and Astrophysics 2015.
- July 2015 **Academic Committee Member – International Physics Olympiad 2015.**
- Selected as a student grader for the theory round of the olympiad
 - Involved in the critical discussion of theory questions
 - Evaluated the answer scripts of students from 89 different countries
- 2014-2015 **Teaching Assistant – Introduction to Quantum Mechanics and Applications.**
- Selected thrice (Autumn 2014, Summer 2015, Autumn 2015) as a teaching assistant for the course
 - Held tutorials where problems and doubts of students were discussed
 - Evaluated the answer scripts of students in various exams.
- March 2015 – **Manager, Kritika – Astronomy Club of IIT Bombay.**
- Present
- Planned a budget of 2.25 lakhs for club activities including lectures, documentary screenings, night-sky observations and workshops, field trips and competitions
 - Organized Institute Technical Summer Project 2015 which had a budget of 8 lakhs
 - Planned and organized the Inter IIT Messier Marathon 2014-15
 - Selected college level teams to participate in intercollegiate events

Research Interests

Astronomy and Astrophysics

Cosmology and large-scale structure of universe
Stellar structure and evolution
Interference and synthesis imaging in radio astronomy
Gamma ray observations and subsequent processing
Analysing stability and evolution of multi-body systems

Aerospace

Plasma flows and applications
Fluid flow across shocks
Structural dynamics and vibrations
Steady state and Transient thermal Analysis

Relevant Skills

- Languages** C/C++, Python, Shell Scripting, Matlab, HTML, \LaTeX
- Software** ANSYS, NASTRAN, OpenFOAM, SolidWorks CAD, AutoCAD, Photoshop
- Packages** Python packages: WARP, NumPy, SciPy and Matplotlib, GNUPlot, Astropy

Relevant Courses Undertaken

- Physics and Maths** The General Theory of Relativity, Quantum Mechanics I, Quantum mechanics and Applications, Electricity and Magnetism, Classical Mechanics, Nonlinear Dynamics, Differential Equations, Linear Algebra, Calculus, Introduction to Numerical Analysis
- Aerospace Engineering** Vibrations and Structural Dynamics, Aerospace Structures, Solid Mechanics, Continuum Mechanics, Compressible and Incompressible Fluid Mechanics, Thermodynamics and Propulsion, Engineering Design Optimisation
- Computer Sciences** Data Structures and Analysis, Logic for Computer Programming, Introduction to Computer Science

Publications

- R. Mishra, S. Shahane, P. Hebbar, S. Thermal, Manmohan
Designing and Analysis Using ANSYS for 'Pratham' Student Satellite IIT Bombay", 65th International Astronautical Congress 2014, Toronto, Canada
- R. Mishra, S. Shahane, P. Hebbar, S. Thermal, Manmohan
"Structural Dynamics-Modeling and Simulation of IITB Student Satellite-Pratham", National Seminar on Aerospace Structures 2014