Pavan Hebbar

Detailed Résumé

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Education

2013 – Present **B.Tech Aerospace Engineering**,
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, Banglore.
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 – Present **Numerical Simulation of Collisionless Shocks**,
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 – Present **Computational Modelling of Hall Thrusters**,
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
- Analysed variation in number density & mass of mega-masers 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 though 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 – Present **Mechanical Subsystem, Pratham – Student Satellite Team of IIT Bombay**.

- 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 – Present **Manager, Krittika – Astronomy Club of IIT Bombay**.
- 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 Aplications, 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", 65^{th} 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