Atul Kedia

Engineering Physics
Senior Undergraduate (B.Tech)
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Research Interest

I am interested in pursuing a PhD in **theoretical Astrophysics and Cosmology**. I am interested in a wide range of topics like the large-scale structure of the universe, the history of our universe and phases like the cosmological reionization, birth and evolution of galaxies and the role of dark matter in it, and the dynamics of astronomical objects like black holes, neutron stars and AGNs.

Education

2016 **Graduation**, *Indian Institute of Technology Bombay*, Engineering Physics with Honors in Physics, *CPI – 7.81* out of 10.
Expecting graduation by August 2016

2015 **Exchange Semester**, *University of Toronto*, Physics, *GPA – 3.2*.
Spring semester of 2015.

2012 **Intermediate/+2**, *Maharashtra State Board*, Science, *Percentage – 80.50*.

2010 **Matriculation**, *Indian Certificate of Secondary Education*, *Percentage – 92.28*.

Bachelors Thesis & Research Experience

Scale of Homogeneity of the Cosmos using Quasars *(Summer 2014 & Fall 2015 - Ongoing)*

Advisors: Prof. Subhabrata Majumdar & Prof. Vikram Rentala

Tata Institute of Fundamental Research & Indian Institute of Technology Bombay

- Using SDSS-DR10 data for quasars I found out that the universe is consistent with the F-L-R-W metric and obeys the Cosmological Principle, i.e. the universe is homogeneous on a large enough length scale and importantly found the length-scale beyond which the universe is homogeneous.
- The project involves going through various data correction techniques like K-Correction of magnitudes, methods of finding volume limited sample and finding comoving distances. The final calculation of length scale was made using certain fractal dimension definition. Length scale calculation using number counts remains to be performed. Codes developed on MATLAB.
- A Research paper is underway and is expected to be submitted by January 2016. The latest draft can be availed upon request. Bachelors Thesis report can be accessed here.

Stability of non-Relativistic Magnetized Astrophysical Jets *(Summer 2015)*

Advisors: Prof. Dinshaw Balsara and Researchers Jinho Kim and Sudip Garain

University of Notre Dame, United States

- Studied the non-relativistic MagnetoHydrodynamics(MHD) equations and numerically solved them by linearizing for a jet-like structure.
- Jet stability was analysed using different velocity profiles and in both the presence and absence of magnetic field. Jets were assumed to have no net electric current and surface currents. Codes were developed on Mathematica with a colleague.

Course Projects

Hall Effect Experiment *(February-April 2015)*

Advisors: Prof. Stephen Morris and Prof. David Bailey

University of Toronto

Found out the hall coefficients for certain N-type, P-type and un-doped Germanium and Silicon semiconductors using the Van der Pauw method. The majority carrier's sheet density, mobility and the band gap for the laminar semiconductors was also found using this technique. Report of the experiment can be accessed here.

The Coffee-Ring Effect *(August 2013)*

Advisor: Prof. Punit Parmananda

Indian Institute of Technology Bombay

- Studied research papers on the non-linearity of Contact Line Formation, Colloid Deposition, Pattern Formation, dependence of patterns formed on Colloid size, shape and certain other parameters, and the Mathematical Structure used in simulate them.
- Experimented the dependence of Colloidal Deposition on concentration and purity, and presented (in a group of four) the four research papers.

Magnetic Field Detection and Controlling *(September-November 2014)*

Advisor: Prof. Pradeep Sarin & Prof. Tapanendu Kundu

Indian Institute of Technology Bombay

Built a device to measure the geo-magnetic field magnitude and direction in the horizontal plain and to create a field free environment. After measuring through a feedback from Arduino I, in a team of four, tried to control the ambient field using the field generating components; this is an essential requirement of many physical experiments. The project report can be accessed here.

Polarization of Light *(September 2013)*

Advisor: Prof. Parinda Vasa

Indian Institute of Technology Bombay

In a group of five, simulated various lissajous figures observed in polarized light by making an electrical circuit of active and passive components.

Space Odyssey Program *(October-November 2012)*

Advisor: Prof. Abhiram Ranade

Indian Institute of Technology Bombay

Developed a program in C++ in a group of three to simulate a single-player game.
The programming saw extensive use of classes, functions, loops, inheritance and other aspects of C++ programming.

Scholastic Achievements

2015 Studied at the **University of Toronto**, Canada for a semester under the faculty of Arts and Science as one of the two exchange students from IIT Bombay.

2015 Awarded an A+ grade in courses on Groups & Symmetries and Intro to Biological Physics.

2015 Pursuing Honors in Physics under the Department of Physics, IIT Bombay.

2012 Secured an **All India Rank 673** in IIT-Joint Entrance Exam 2012 out of around 500,000 students.

2012 Secured an **All India Rank 842** in All India Engineering Entrance Exam 2012 out of around 1.2 Million students.

2011 Qualified National Standard Examination in Physics (NSEP) 2011, being in the **All India top 1%** among 43,000 students, and appeared for **Indian National Physics Olympiad** (INPhO) 2012 conducted by Homi Bhabha Centre for Science Education (HBCSE).

2011 Appeared for National Standard Examination in Chemistry (NSEC), and was among the **Centre top 10%**.

Standardized test scores

GRE Physics: 990/990.

GRE General: 320/340 (Verbal: 153/170, Quantitative: 167/170 & AWA: 3.0/6.0).

TOEFL: 103/120 (Reading: 22, Listening: 29, Speaking: 24 & Writing: 28).

Work Experience

2015 Took up teaching assistantship for an online course on Engineering Physics run by IIT Bombay for physics teachers at engineering colleges in India.

Relevant Courses

Physics Quantum Mechanics I, II, & III, General Relativity, Groups & Symmetries, Basic Statistical Mechanics, Intro to Nuclear & Particle Physics, Intro to Atomic and Molecular Physics, Continuum Mechanics, Non-Linear Dynamics, Intro to Condensed Matter Physics, Intro to Biological Physics and Advanced Physics Laboratory.

Others Complex Analysis, Real Analysis, Differential equations I & II and Computational Fluid Dynamics and Heat Transfer.

Skill Set

Programming Languages :- C, C++, Python and Arduino.

Software Packages :- MATLAB, Mathematica, and LaTeX.

Operating Systems :- Windows and Ubuntu(Linux).

Languages :- Fluent in English and Hindi. Good working knowledge of French and German.

Extra-curricular Activities

Sports: I am a big fan of football(soccer) and enjoy playing it as well as watching it. I have played at IIT Bombay General Competition and have played and won many intra hostel football competitions. I also enjoy playing badminton, table-tennis and pool at my leisure time.

Music: I am a huge fan of rock and metal music and enjoy listening to them in my free time.

Hiking: I thoroughly enjoy hiking and exploring new places, and have been to some national parks in India and Canada for the same. I also enjoy trekking and have had the opportunity to trek at Kalsubai, the highest peak in Maharashtra.

Geography: I am also a Geography nerd and have a particular taste for learning how geographical factors influences a country's economy.

Reading: I have developed an interest in reading during my undergraduate years with Sir Arthur Conan Doyle's Sherlock Holmes series and Dan Brown's books being my favourites.

Dancing: I am also fond of dancing and am a beginner level Salsa dancer.

References

Prof. Subhabrata Majumdar
Professor of Theoretical Physics, Tata Institute of Fundamental Research, India.
Contact - subha@theory.tifr.res.in

Prof. Dinshaw Balsara
Associate Professor of Physics, University of Notre Dame, USA.
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Prof. Anton Zilman
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Prof. Pradeep Sarin
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