



DEPARTMENT OF PHYSICAL SCIENCES,
IISER KOLKATA



**A DECADE OF
EXCELLENCE**

Get ready to learn, explore, and be amazed!





People

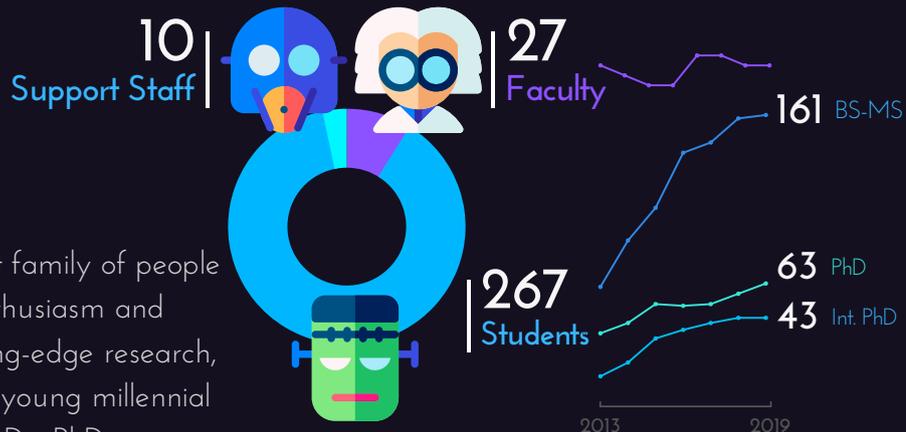
Click on stuff to find out more!



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PS is a close-knit family of people bubbling with enthusiasm and raring to do cutting-edge research, ranging from the young millennial BS-MS, to the IPhDs, PhDs,

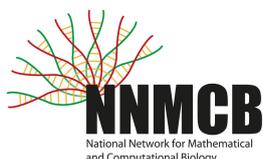
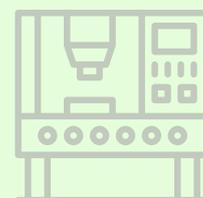
PostDocs, as well as faculty who have 'been there, done that' and are doing much more now - guiding young scholars and channelling their boundless energy in the correct direction! Our efforts are wonderfully supported by skilled support staff. These are the people who constitute the rich human resource pool of DPS- its pride, its strength!



Over the years, DPS faculty have contributed to the creation of various centres of excellence like the **Centre of Excellence in Space Sciences, India (CESSI)**, **National Centre for High Pressure Studies (NCHPS)** and the **National Network for Mathematical and Computational Biology**. The range of research at DPS quite matches the range of Physics itself - from the smallest sub-atomic scales to the largest scales of the Universe! A lot of our research is aimed at using Physics to impact society in a positive way. We have, over the years, also learnt to leverage our research strengths by collaborating with one another. Come, let us take a look at all the cool research happening at DPS, IISER Kolkata.



Centres of Excellence



The value of college education is not the learning of many facts, but the training of the mind to think

Albert Einstein





SUN SCIENCE

At **CESSI**, come learn why the Sun keeps hurling space storms and hot plasma at us, and how we can protect our technologies in space! Their coronal structure prediction work during **The Great American Solar Eclipse** of 21st August, 2017, as also their Solar Cycle 25 prediction, was featured extensively in leading news media. Also, be a part of the team working on India's first Solar Space Mission Aditya-L1!

GRAVITATIONAL WAVES

Or why not dive deep into the 'waves' and 'ripples' created by gravity in the Spacetime Lab? By working with people who are a part of the LIGO collaboration (the team which made the first direct detection of gravitational waves predicted by Einstein a century ago, leading to the award of the 2017 Physics Nobel), you're sure to ride the wave successfully!

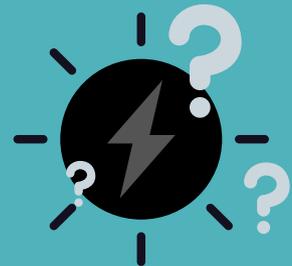


QUANTUM GRAVITY

What does space-time look like at the Planck scale? Find out by joining our efforts towards reconciling General Relativity and Quantum Theory in order to formulate a 'Quantum theory of gravity' at extreme densities, where the otherwise highly successful theory of General Relativity fails!

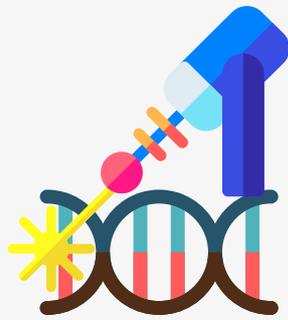
DARK ENERGY AND BLACK HOLES

Have your own theory of what dark energy is? Why not build and test your theory here @ DPS? Or test your curiosity about getting trapped in the mysterious black hole, which imprisons even light within itself?



LIGHT AND MATTER

Talking of light, why not catch up with the latest 2018 Physics Nobel? Come to the Light Matter Lab (where 'light matters'!), and see with your own eyes how to use light to move things! Or learn how you can make patterns using bubbles - this lab's very own indigenous discovery, which got coverage in leading news media platforms in India. Find out how this discovery is being translated to fabricating chips having diverse industrial applications ranging from electronic circuits to bio-sensing!

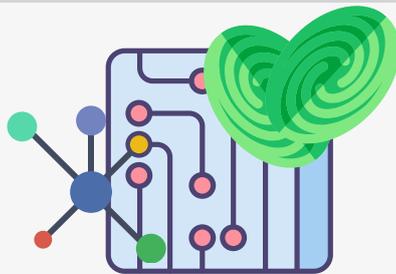


WHEN WEAK IS POWERFUL!

We use classical light to perform quantum weak measurement that enables faithful amplification of extremely tiny effects, offers dramatic control over resonance phenomena, and opens up novel route towards development of spin-photonic metadevices. Novel polarization optical techniques for probing biological systems have also led to a promising new model for precancer detection in the Bio-optics and Nano-Photonics (BioNap) lab!

LASER MEETS NANO

Most materials on earth have characteristic absorption in THz regime. Why not try your hands at THz spectroscopy of materials and investigate novel THz generation, detection and imaging techniques? Watch out: things happen here faster than the blink of an eye!

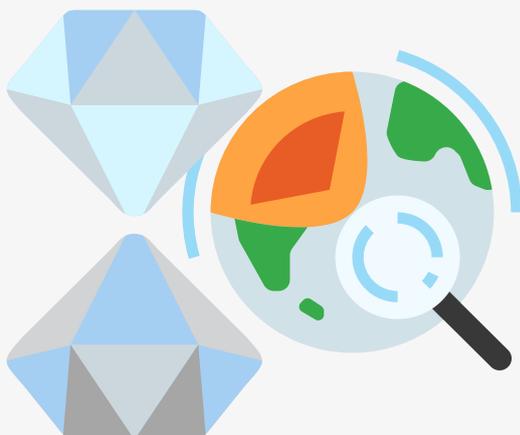


CHAOS AND COMPLEXITY

Tune into the complex world of nonlinear dynamical systems such as switching electronic circuits, power grids, iterated maps and their bifurcations with the Non-linear Dynamics group.

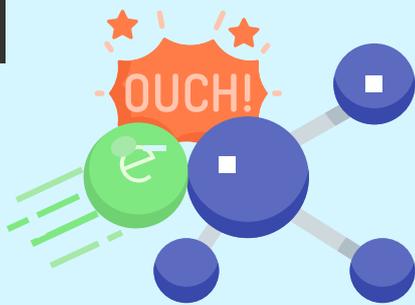
CONDENSED MATTER IN THE EXTREME

Interested in finding out how matter behaves under extreme conditions (e.g., low temperatures, high magnetic fields, high pressure)? Snoop on it with the Condensed Matter Experimental group! Our labs boast of some of the finest experimental facilities in the country, capable of studying a wide range of materials of current interest. You could well make tomorrow's great technology happen in the lab today!



A MATTER OF PRESSURE

Understand the novel phase transitions and structural changes occurring in both natural and artificially designed materials during various geological processes by simulating their extreme conditions at **NCHPS**. The centre has facilities to achieve megabar pressures and very high temperatures using **Laser Heated Diamond Anvil Cell (LHDAC)**, and to study the changes in physical properties of materials in-situ using Raman Spectroscopy and electrical transport studies. A beautiful blend of Physics, Material Sciences and Geosciences!

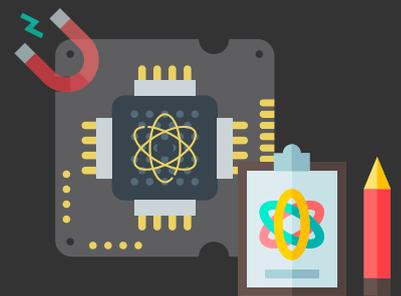


MOLECULAR PHYSICS

Study low energy electron-molecule collision dynamics using indigenously developed state-of-the-art velocity slice imaging spectroscopic technique with the Molecular Physics team who are pioneers in this sophisticated technique!

QUANTUM MAGNETISM

Come learn what Quantum magnetism is all about and discover its possible applications in Quantum computing! The Magnetism group uses sensitive magnetometers and other world-class magneto-optic experimental facilities in exploring this fascinating frontier.

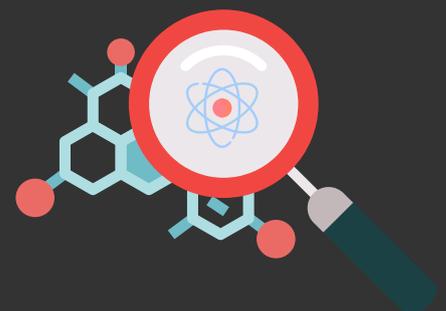


THE STUFF OF EMERGENCE

Join in the hunt for novel emergent states of matter with our theorists. Find out how complex interplay of inter-particle interactions and intrinsic disorder in condensed phases of matter leads to intriguing emergent phenomena! Or search for the elusive Majorana fermion (and then use it to build the topological quantum computer!). Or even probe the nature of many-body localisation in cold atomic gases.

SOLID STATE PHYSICS

Come learn the technique of Angle-Resolved Photo-Emission Spectroscopy (ARPES) from the experts! ARPES is an indispensable tool being used in the Solid State Physics Laboratory to study electronic structures of materials, and study optical, magnetic and electronic properties as well as crystal structures of newly synthesized bulk and nano materials.





BIOPHYSICS

Use tools of Physics like computational modelling, statistical physics, nonlinear dynamics and soft condensed matter physics to attack problems in Biology with the Biophysics group! Ponder over concepts like active matter, biological oscillations, wound healing, flocking, pattern formation and gene networks from a Physicist's viewpoint!

EVOLUTIONARY DYNAMICS

If you are intrigued by questions pertaining to the origin of life, evolution of cooperation, and wealth inequality, join the ROC group. Find out what "life" was like on this planet 4 billion years ago. Learn about how your decisions to be altruistic or selfish are shaped by your local social network neighbourhood. Explore these questions that take you beyond conventional boundaries of Physics by developing mathematical models and computer simulations.

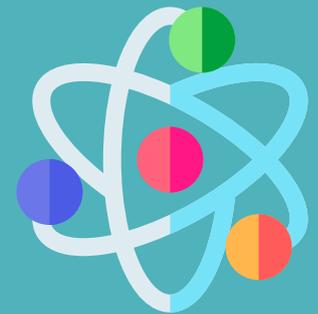


QUANTUM DYNAMICS

How does a quantum system evolve when one drives it, particularly if the system is connected to a thermal reservoir? SpinLab strives to answer this apparently simple question from a new perspective. We've shown that the stronger drives lead to faster decay: a quantum version of everyday "wear and tear" principle! From quantum computing to building a model of a thermal bath, SpinLab applies the above principle to a variety of situations!

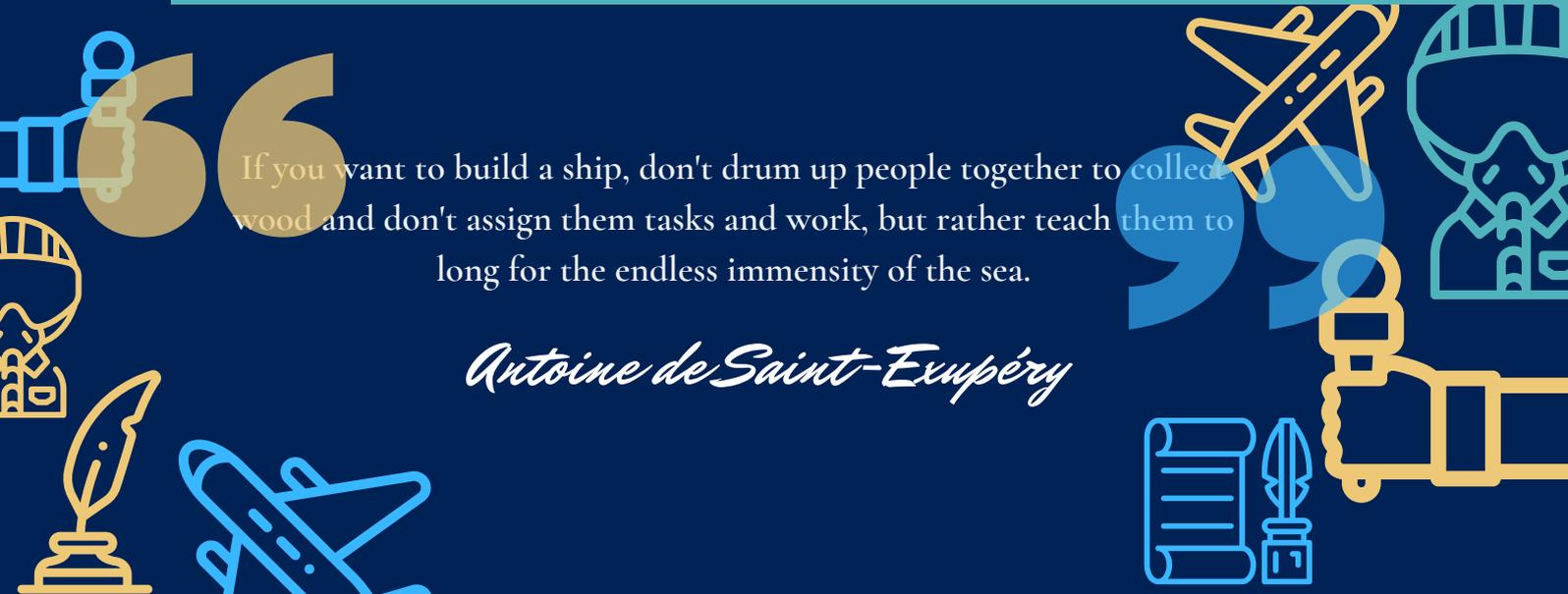
HIGH ENERGY PHYSICS

The standard model of particle physics at the Large Hadron Collider is the best tested model yet. Still, it fails to answer some fundamental questions. Discover physics beyond the standard model, and find out how the cool new field of machine learning is being used to study the simulations of the Electromagnetic Calorimeter detector at the Large Hadron Collider (CERN) right here on our campus!



If you want to build a ship, don't drum up people together to collect wood and don't assign them tasks and work, but rather teach them to long for the endless immensity of the sea.

Antoine de Saint-Exupéry





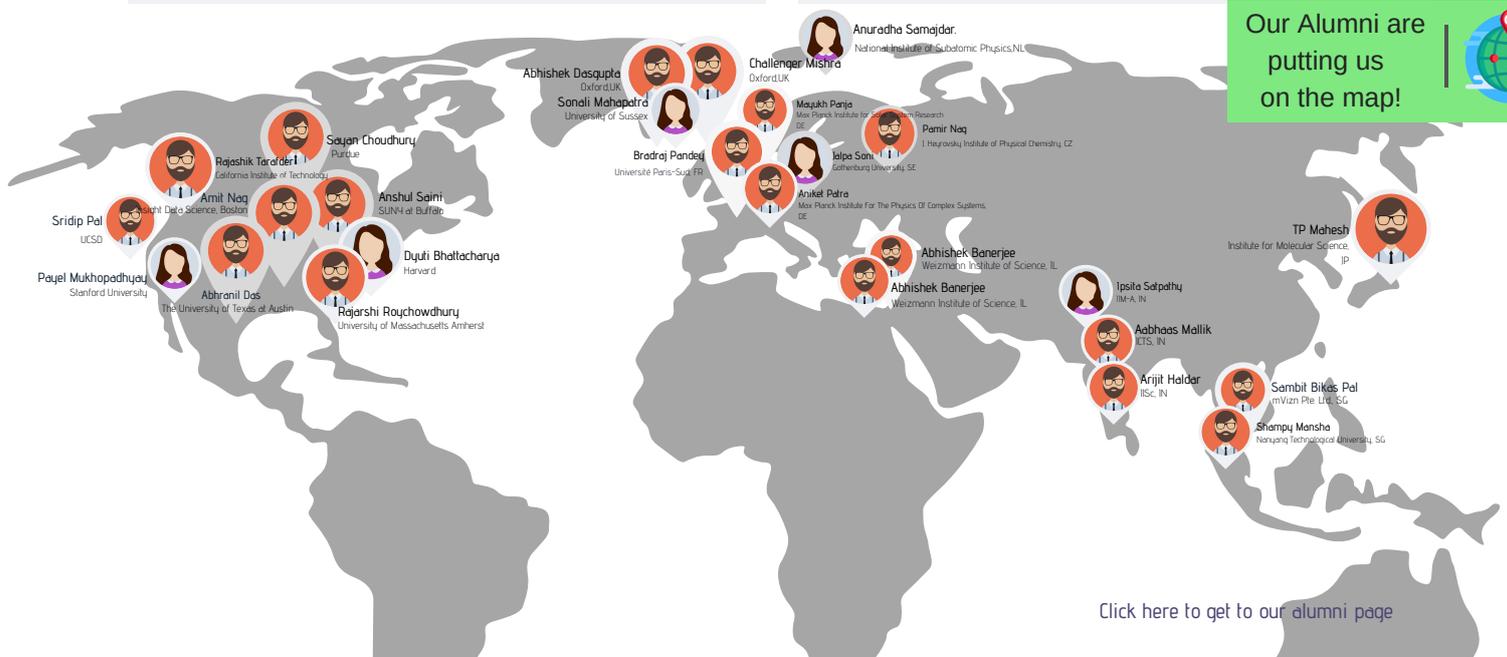
With faculty who are recipients of the Harvey Prize of the American Astronomical Society, the Modali Award of the Astronomical Society of India, Special Breakthrough Prize in Fundamental Physics, Gruber Foundation Cosmology Prize, Fellowship of The World Academy of Sciences, Ramanujan National Fellowships, INSA young scientist medals, etc. you can rest assured you'll get to learn from the best that is there! Not only that, but the faculty members at DPS are known to go beyond their call of duty to guide their mentees in every sphere possible! And with IISER Kolkata having ranked 1st among all IISERs in the 2018 NIRF ranking, you simply can't ask for more!

We've had research papers published in various high impact factor journals like Nature, Science, various Nature Index Journals, Physical Review Letters, Astrophysical Journal, etc. Apart from that, research from DPS has been featured in Scientific American and Discovery Magazines, in Reuters, CNN-IBN, All India Radio, Times of India, Telegraph, Hindu, Sky & Telescope, Lok Sabha TV and NASA's Outreach Programs.

For those looking to be job creators rather than job seekers, the coming up of a new 'RISE (Research Innovation and Scientific Entrepreneurship) Foundation' at IISER Kolkata should be music to the ears! As the name suggests, it will encourage innovation and take our science from laboratories to industries, with the intention of creating science and technology-driven start-ups. It is expected to fulfill its purpose of serving as an incubator for research ideas fantastically and we're all looking forward to it!

When DPS students graduate, they have in their arsenal theoretical and experimental tools to take on the challenges of the future! No doubt then, that while BS-MS students from DPS get admission in institutes of global repute like Cornell, Oxford, Rutgers, Maryland, Gottingen, Princeton, Georgia, NUS, Univ. of Chicago, Univ. of Michigan, Univ. of Wisconsin, Stanford Univ., Caltech, IISc, TIFR etc. for their higher studies, the PhDs and PostDocs also land faculty positions in various IITs, NITs and ISRO centres like PRL, etc. Thanks to our emphasis on data analysis and computational modeling as tools for research, some of our students also got placed in ITC Infotech in 2018 as a part of our recent endeavour to increase industrial placements for our students. Not only this, we have also produced Rhodes Scholars, Oxford Clarendon Scholars, Shyama Prasad Mukherjee fellows, Raman-Charpak fellows, SCOSTEP Visiting Scholars at Goddard, NASA, etc. and at least two out of top ten students of CSIR-NET every year are from DPS, IISER Kolkata! When you're in DPS, you can be sure to learn with the best among the best, and yourself be one! No doubt it's a matter of pride for every IISER Kolkata to be a part of the DPS family!

Our Alumni are putting us on the map!



[Click here to get to our alumni page](#)

Our department is relatively young, but what we have achieved over the years is there for all to see. This is, however, just the beginning, and we have miles to go in extending the boundaries of Physics! After all, there's an entire universe to fathom out there! And we need YOU for that- the energetic, untapped youth of our country- to take the research base that DPS has established to higher and higher echelons! So, if you are interested in being a part of the exciting research we do, either as a student or as a collaborator, write to us. What's more, spread the word!

