Department of Physics & Astrophysics

University of Delhi, Delhi-110007, India

CONTENT

OVERVIEW

The Department of Physics and Astrophysics, University of Delhi (DU), is located in the picturesque and historic Main Campus of the University. Spread across three buildings and with over 800 members, it is possibly the largest science department in our country. The Physics Department of the University of Delhi (later renamed Department of Physics and Astrophysics) was set up in 1922. When the University moved to its present campus, the Physics and Chemistry Departments were allocated space in the former Viceroy's complex, in an elegant pillared building which continues to function as the shared Old Block of the two departments.

The Masters program started in 1942. The Department also housed the National Physical Laboratory when Prof. K.S. Krishnan served as its founder director during 1947-1950 in this building. The Physics Department was one of the first to get the CAS status, for its work in Theoretical Physics as well as experimental work in Low-Temperature Physics. For working at extremely low temperatures, the Department acquired a Helium Plant, which was unusual in Universities then. A telescope tower for a solar observatory, housed in the Department, is still one of the landmarks in the neighborhood. The department is privileged to have Prof. D.S. Kothari was its Head during 1934-48 and 1951-61.

At present, with over 750 M.Sc. students and over 150 Ph.D. students, alongside 51 faculty members, the Department of Physics and Astrophysics is one of the largest Departments in the country. Also it has consistently been the highest ranked University Physics Department in the country (according to the QS ranking system) since many years.

The faculty members of the Department have won numerous honors and awards over the years and served in key strategic positions in the country. Many more have worked in reputed institutes like Indian Academy of Science, INSA and National Academy of Sciences. Many alumni have made their mark abroad while several alumni have branched out into other fields such as economics, molecular biology and education and made notable contributions and several

have served as Indian ambassadors in various countries. A brief list of former faculty/alumni with their achievements is given below:

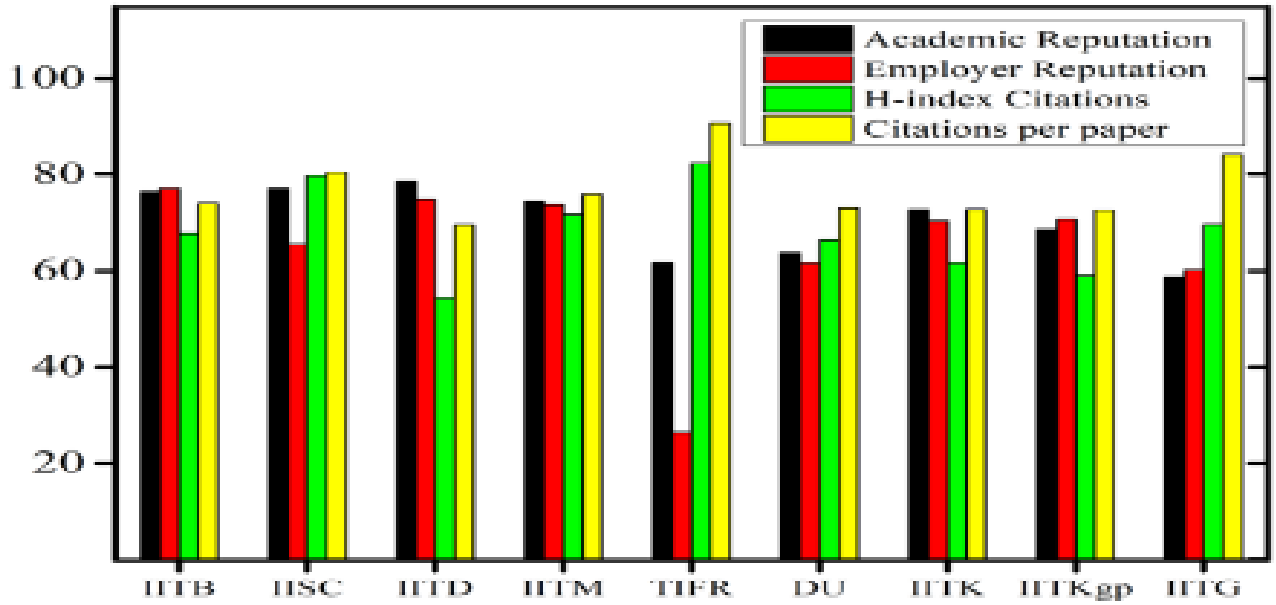
AWARDS AND ACHIEVEMENTS

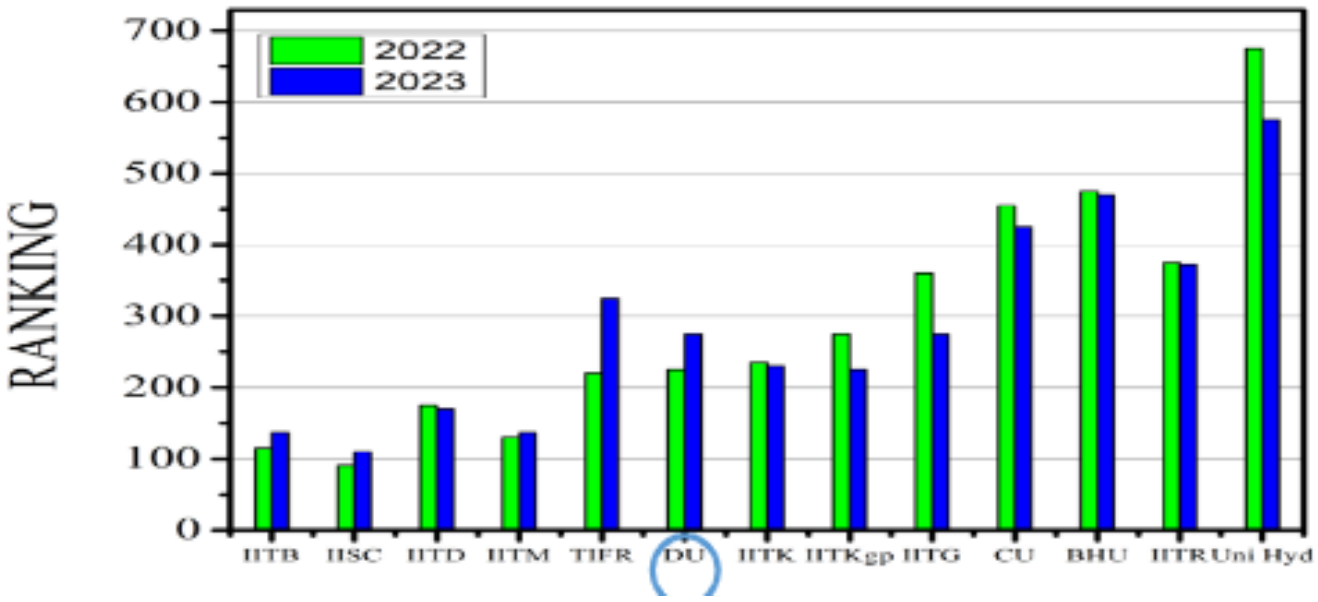
S No.	Name	Served as /Achievement
1.	Prof. D.S. Kothari	Scientific Advisor to Ministry of Defense and Chairman of the University Grants Commission
2.	Prof. A.R. Verma Prof. A.N. Mitra Prof. Kasturi Lal Chopra Prof. Ajoy Kumar Ghatak Prof. Karmeshu Prof. Shasanka Mohan Roy Prof. R. Rajaraman Prof. Deepak Kumar Prof. Amitava Raychaudhuri	Shanti Swaroop Bhatnagar awardees (among former faculty/alumni)
3.	Prof. A.R. Verma	Awarded Padma Bhushan in1982. He is the longest-serving Director of National Physical Laboratory, Delhi.
4.	Prof. P.K. Kichlu	Former Director of NPL, Delhi.
5.	Prof. R. Ramachandran	Former Director, IMSc Chennai
6.	Prof. H. S. Mani	Former Director, Harish-Chandra Research Institute, Allahabad
7.	Prof. Amitava Raychaudhuri	Former Director, Harish-Chandra Research Institute
8.	Prof. Sabyasachi Bhattacharya	Former Director of Tata Institute of Fundamental Research, Mumbai.
9.	Prof. Amit Roy	Former Director, Inter-University Accelerator Centre (IUAC), New Delhi.
10.	Prof. Praveen Chaddah	Director, UGC-DAE Consortium for Scientific Research, Indore.
11.	Prof. Siraj Hasan	Former Director, Indian Institute of Astrophysics, Bangalore
12.	Padma ShriShovana Narayan	Renowned Kathak Dancer
Amongst the present faculty, two are fellows of all three Academies of Science in India while one faculty is the fellow of the Indian Academy of Sciences, Bangalore. One faculty member is a fellow of the Royal Astronomical Society. Some faculties are the members/external faculty/visiting scientist/professors of prestigious foreign institutions like Institute of Advanced Study Princeton, Santa Fe Institute. University of California Santa Barbara (USA), University of Lyon (France), Durham University (UK), University of Alabama (USA), etc.		

DEPARTMENT AT A GLANCE

Degrees offered	M.Sc., Ph.D.
No. of students in M.Sc. Program	> 750
No. of Ph.D.students registered during 2018-23	> 150
No. of Ph.D.degrees awarded during 2018-23	~ 115
No. of Faculty members (as of April 2023, including UGC-FRP & INSPIRE Faculty)	37
Major sources of funding to the Department	DST-FIST, UGC-SAP, XII PLAN, DST-PURSE
Individual sponsored research projects awarded by national funding agencies during 2018-23	89
Research projects awarded by international funding agencies during 2018-23	13
External research grants awarded to the Department and individual faculty members	~ Rs. 73 Crores
National collaborative projects	18
International collaborative projects	11
Research papers published in refereed journals (2018-23)	~1300 (Scopus indexed only)
Citations (to research papers in 2018-23)	~ 20764

RANKING: BASED ON QS





CURRICULAR ASPECTS AND TEACHING

The Department has at present 51 faculty members: 28 Professors, 3 Associate Professors, 15 Assistant Professors, 2 UGC-FRP Assistant Professors and 3 DST-INSPIRE faculty members. All the faculty members are having Ph.D. degrees and almost all of them have post doctoral experience at National/Foreign Universities/Institutes of repute. Moreover, most of them come from Universities other than DU and represent different fields of research/expertise.

The M.Sc. course curriculum in the Department has two components: Core papers and elective papers. A large number of Elective papers allow a student to specialize in both theoretical and experimental physics of their choice. In the first year, there are eight theory core papers and four core experimental Labs. There is a compulsory Computer Programming paper also. In the final year, students can choose from a large number of theory papers in experimental as well as theory specialization.

The teaching has both components of theory teaching and tutorials in the ratio of 3:1. The tutorial classes are based on hands on problem solving for which separate internal assessment tests are taken. The students can opt for dissertation in the fourth semester, in which they get an opportunity to interact closely with the faculty to frame their work and presentation. Different faculty have adopted innovative ways of evaluation in theory and practical courses like multiple choice questions, open book exams, presentations by students, etc. In practical classes they are encouraged to do projects and PPT presentations.

All the courses are very relevant to academic/research/industry at national/international level. The various subjects covered in the Department are as follows:

<table>
<tr><th>Year/ Semester</th><th colspan="4">Courses</th></tr>
<tr><td rowspan="4">M.Sc. (P) Physics Semester I & II</td><td colspan="4">Core Theory Papers:</td></tr>
<tr><td colspan="4">Classical Mechanics
Quantum Mechanics I
Electronics
Mathematical Physics
Quantum Mechanics II
Statistical Physics
Electromagnetic theory & Electrodynamics
Solid State Physics</td></tr>
<tr><td colspan="4">Core Experimental Labs:</td></tr>
<tr><td colspan="4">Electronics
Nuclear Physics
Solid State Physics
Waves & Optics</td></tr>
<tr><td rowspan="3">M.Sc. (F) Physics Semester III & IV</td><td colspan="4">Core Papers:</td></tr>
<tr><td colspan="4">Nuclear and Particle Physics
Computer Programming Lab
Atomic and Molecular Physics</td></tr>
<tr><td>Elective Theoretical Courses:</td><td>Elective Experimental Courses:</td><td>Special Theory Courses:</td><td>Open Elective Courses:</td></tr>
<tr><td>GTR & Cosmology I & II

Astrophysics I & II

Condensed Matter Physics

Plasma Physics I & II

Quantum Field Theory I & II

Advanced Mathematical Physics

Particle Physics I & II</td><td>Physics at the Nanoscale

Advanced Electronics

Advanced Nuclear Physics

Laser and Spectroscopy

Advanced Solid State Physics

Advanced Numerical Techniques</td><td>Nonlinear Dynamics

String Theory

Superconductivity, Superfluidity and Critical Phenomena

Soft Matter Physics

Fluid Dynamics

Nuclear Safety and Security

Applied Physics</td><td>Biological Physics

Physics Education

Complex Systems and Networks

Introduction to Astronomy</td></tr>
</table>

For Ph.D. Course: Compulsory courseworks are

- Research Methodology I (PHYS-601: Statistical methods and Computer applications)
- Research Methodology II (PHYS-602: Literature survey, scientific writing, presentation)
- Research and Publication Ethics (PHYS-603)

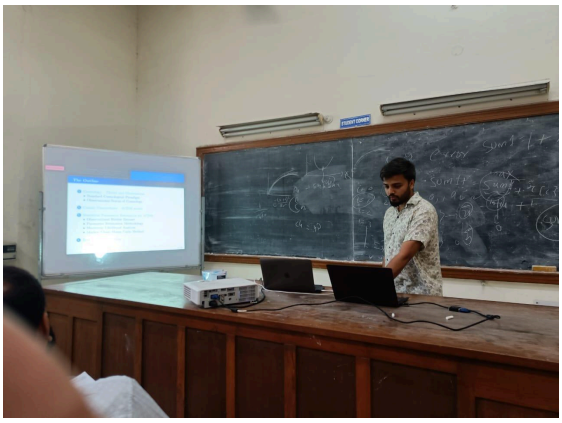
Recently a large variety of PhD courses have been launched.

Highlight of M.Sc. Courses:

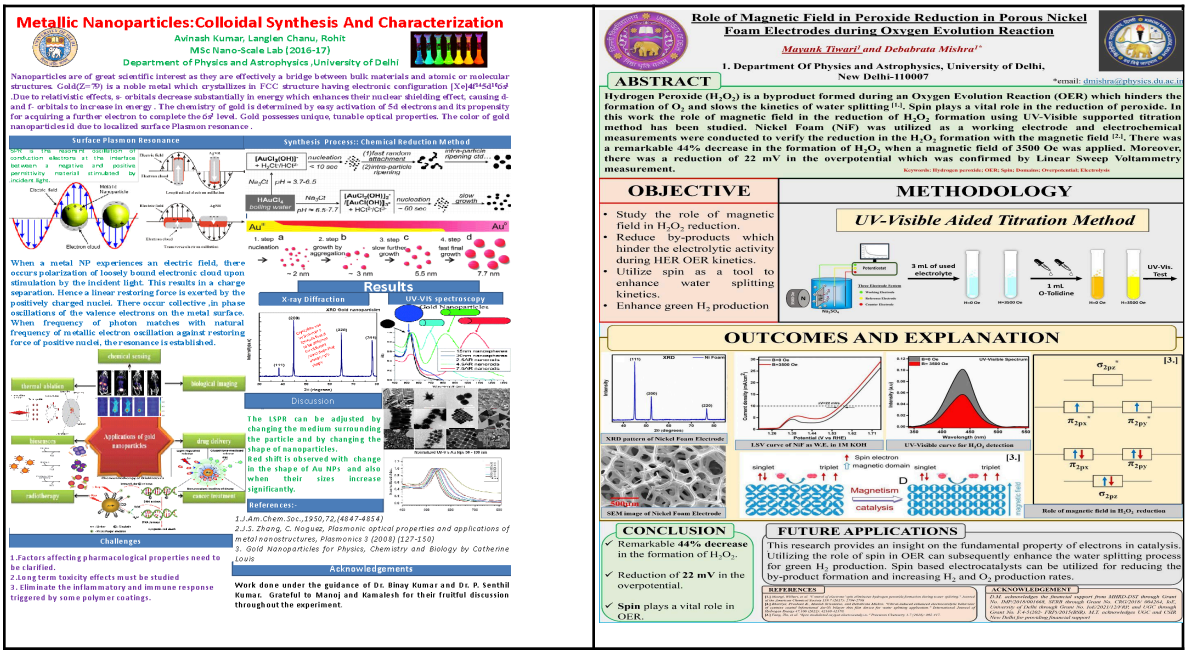
- Number of core papers: 10 Theory + 5 Lab
- Electives: Student can opt for either Experiment or Theory
    - 6 Experimental streams & 7 Theoretical subjects being currently offered
    - 1 Advanced Numerical Techniques Lab
    - Option of dissertation (for selected students)

Important features of teaching courses:

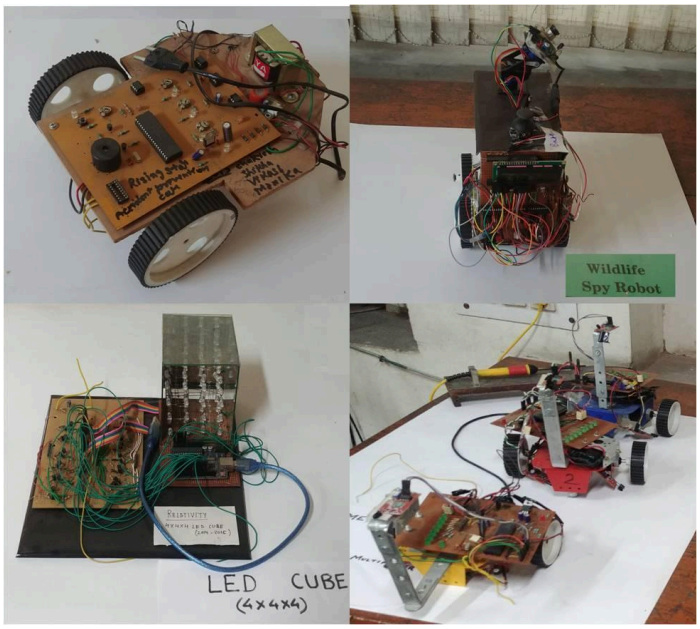
- Flexible structure of M.Sc. program: many choices for students. Further with every passing year the content in theory and tutorial problems are modified/upgraded by the teacher. Also most of the teachers take formal/informal feedback from the students and incorporate the suggestions in their teaching.
- Continuous evaluation in labs to reduce pressure of one final examination. Continuous evaluation takes care of academic achievements, behavior, team work, regularity, leadership quality, etc.
- Project work in a team and oral presentation as part of evaluation in Final year labs.



- Students get the opportunity to work in the research labs of faculty and get motivated to choose a research career. They make posters of their work, presented in conferences and eventually win prizes as well.



- Students are encouraged to utilize their theoretical skills to design and demonstrate their working models.



- Problems given in core theory courses and discussed in tutorials. Students are encouraged to solve problems on the board (student centric method).
- Internal assessment tests provide an opportunity to the students to know their strengths and drawbacks and to overcome shortcomings.
- Department has the facility of an observatory inside the campus for observing celestial objects and events using a telescope of diameter 11 inch.

Fund received during 2018-23

Sr. No.	Fund type	Received	Expenditure (approx..)
1	CAS 2018-23	8,60,000	4,23,859
2	FIST 2022-2027	2,00,00,000	56.44.977
3	UGC grant 2020-21	30,00,000	30,00,000
4	UGC grant Rs.85L+15 L 2022-23	1,00,00,000	99,29,953
5	Lab. Capital Assets, DU 2023-24	1,07,00,000	91,25,909

UGC Grant Rs. 85 Lakhs Expenditure details

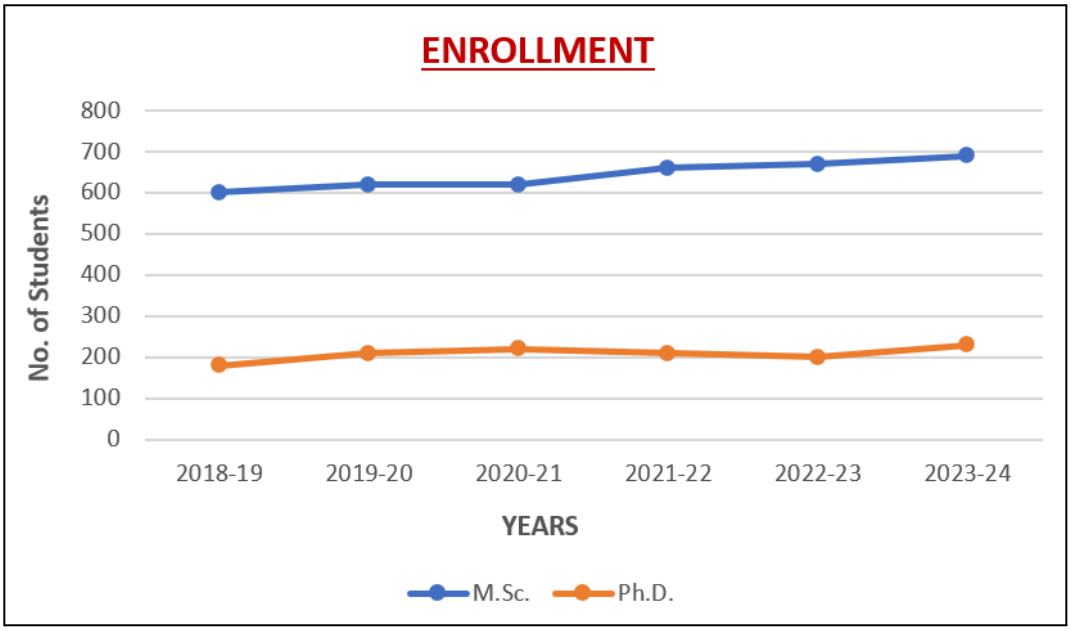
S. No.	Name of the Lab.	Item	Qty	Amount (in Rs.)	Stock Register no.
1.	Computer (F) Lab.	Computer All in one	70 nos.	21.52,500	03/052
2.	M.SC.(F) Elec. Lab.	Function Generator	02 nos.	1,30,000	02/022
3.	Doc. Centre	Desktop Computer	20 nos.	9,90,020	03/052
4.	M.SC.(P) Elect. Lab	Fiber Optic Comm. Trainer	02 nos.	45,000	02/295
5.	M.Sc.(P)Elec. Lab.	Optic Power Supply	04 nos.	42,800	02/132
6.	M.Sc.(P) Elec. Lab.	Function Generator	02 nos.	39,600	02/022
7.	M.Sc.(P) Elec Lab.	DC regulated Power Supply	05 nos.	47,500	02/132
8.	M.Sc.(F) SSP Lab.	Precision Balance	01 no.	49,400	02/42
9	M.Sc.(F) Laser lab.	Printer MHZ	01 no. 01 no.	13,350 2,05,000	03/12 02/22
10.	M.Sc.(F) Elec. Lab.	Function Generator 150 MHZ	01 no.	2,05,000	02/22
11.	M.Sc.(F) Elec Lab.	DSO 100 MHz	01 no.	2,95,000	02/31
12.	M.Sc.(F) Elec Lab.	100 MHz DSO	02 nos.	97,000	02/32
13.	M.Sc.(F) Laser Lab.	Magnetic Stirrer	01 no.	9,000	02/037
14.	M.Sc.(F) Nano Lab.	Magnetic Stirrer	01 no.	9,400	02/37

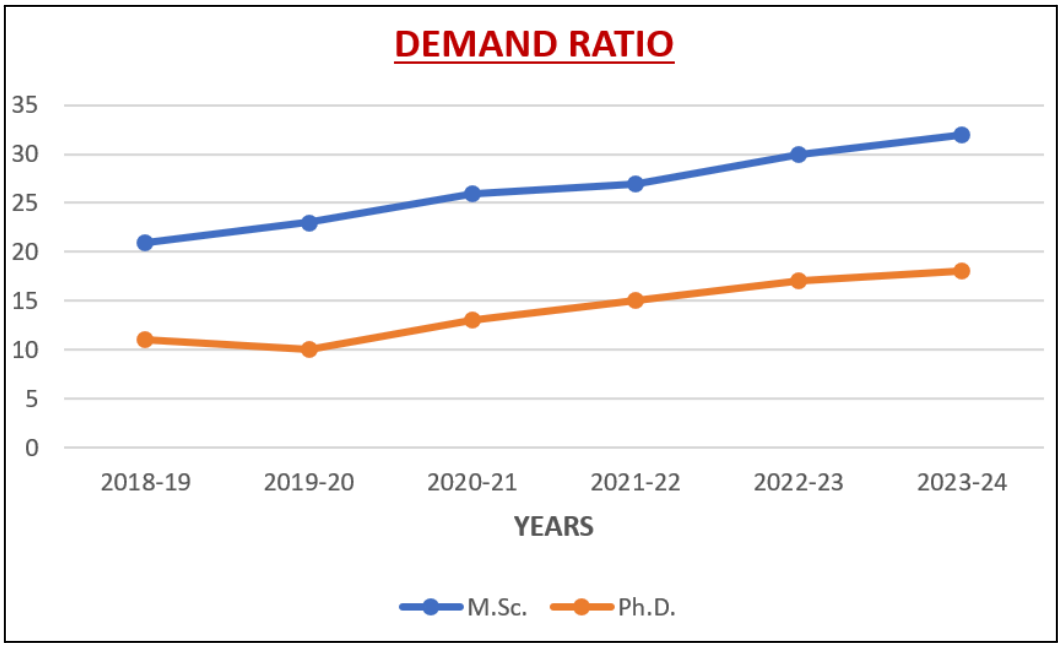
15.	M.Sc.(F) SSP Lab.	50 MHz DSO	01 no.	39,900	02/31
16.	M.Sc.(F) SSP lab.	50 MHz DSO	02 nos.	46,000	02/31
17.	M.SC.(F) Nano Lab.	Furnace	01 no.	49,973	02/271
18.	M.Sc.(F) SSP lab.	Magnetic Stirrer	01 no.	23,500	02/37
19.	M.Sc.(P) Elec. Lab.	DSO 50 MHz	01 no.	23,000	02/32
20.	M.Sc.(F) SSP lab.	Magnetic Stirrer	01 no.	13,600	02/32
21.	M.Sc.(F) Nano	Motherboard	01 no.	1,26,000	02/287
22.	M.Sc.(P) SSP Lab.	Planck's Constant	01 no.	35,000	02/201
23.	M.Sc.(P) SSP lab.	Printer	01 no.	15,390	03/12
24.	M.Sc.(P) SSP lab.	Oscilloscope 30 MHz	02 nos.	48,200	02/32
25.	M.Sc.(F) Nano	Aperture	02 nos.	2,20,762	02/287
26.	M.SC.(F) SSP Lab	UV-Vis spectrometer	01 no.	85,000	02/051
27.	M.Sc.(F) Com. Lab.	5 KVA UPS	02 nos.	1,87,600	03/32
28.	M.Sc.(P) W & O	Planck's Const. Experiment.	03 sets	94,185	02/201
29.	M.Sc.(P) W & O	Frank Hertz Exp.	02 sets	82,688	02/224
30.	M.Sc.(P) W & O	Traveling Microscope	06 nos.	61,740	02/84
31.	M.Sc.(P) SSP Lab.	Resistivity of Semiconductor	02 sets	32,900	02/289

The admission process can be summarized as follows:

A total of ~380 students are admitted every year for M.Sc. course. 50% of the total seats are filled from the DU students on merit basis while for the remaining 50% of seats are filled by a National level written examination with test centers spread over the country. More than 5000 students from all across the country apply for admission in our Department and the demand level is gradually increasing over the years. Thus the department caters to a large diversity of students from different social and economical backgrounds.

For Ph.D. admission, National level written tests and interviews are conducted. While JRF candidates (with fellowships) are interviewed directly, other candidates have to clear written tests before facing interviews.





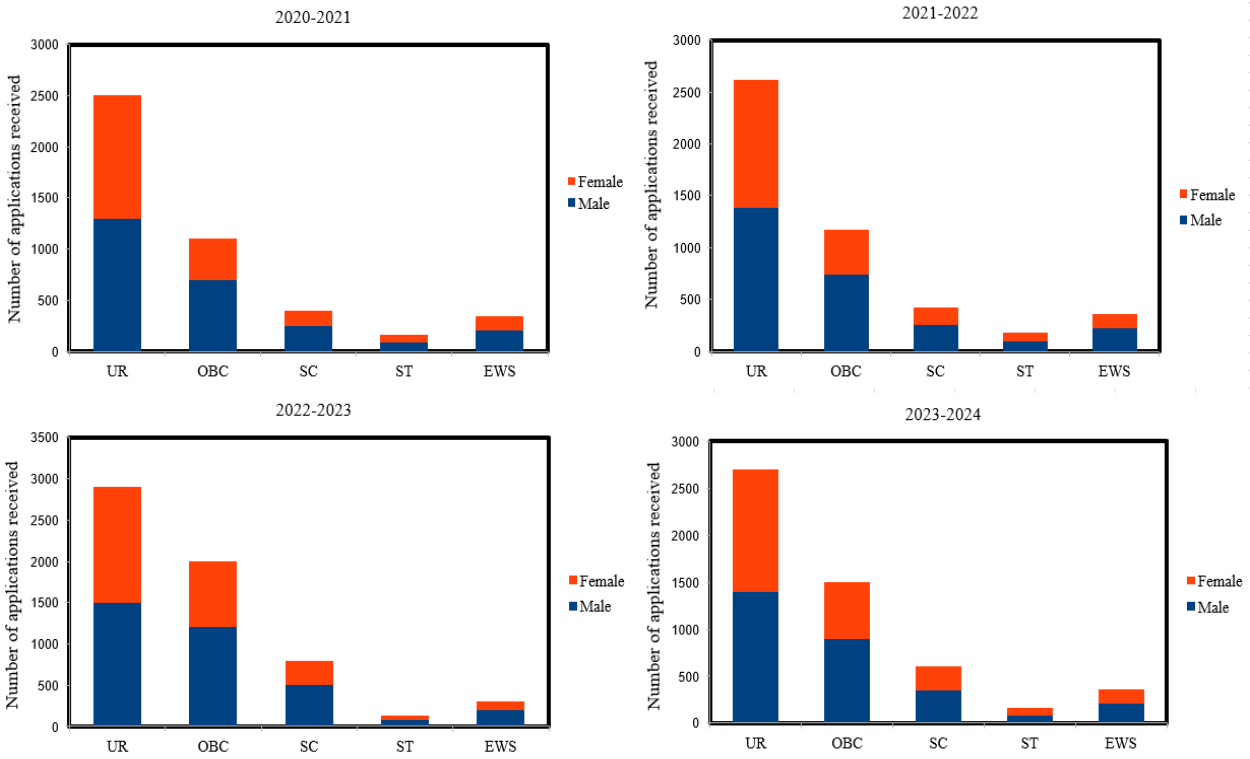
*Number of students competing per seat

During the period 2018-2023:

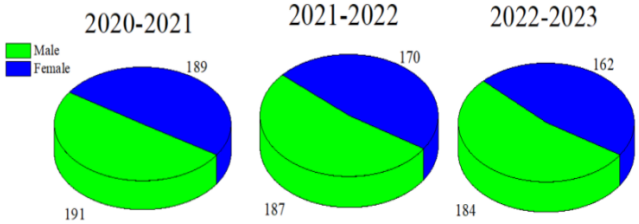
Ph.D. awarded = 115

Ph.D. enrolled = 166

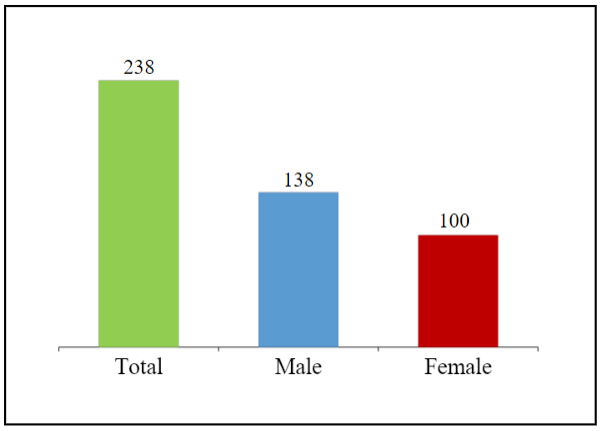
Gender Ratio (category wise): No. of applicants (M.Sc.)

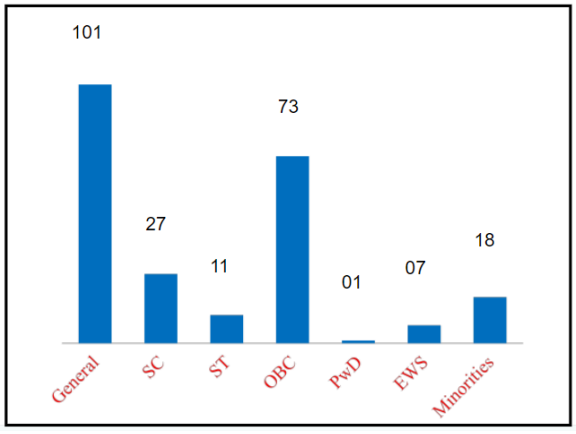


Gender Ratio: No. of students admitted (M.Sc.)



Gender Ratio: Ph.D. Students

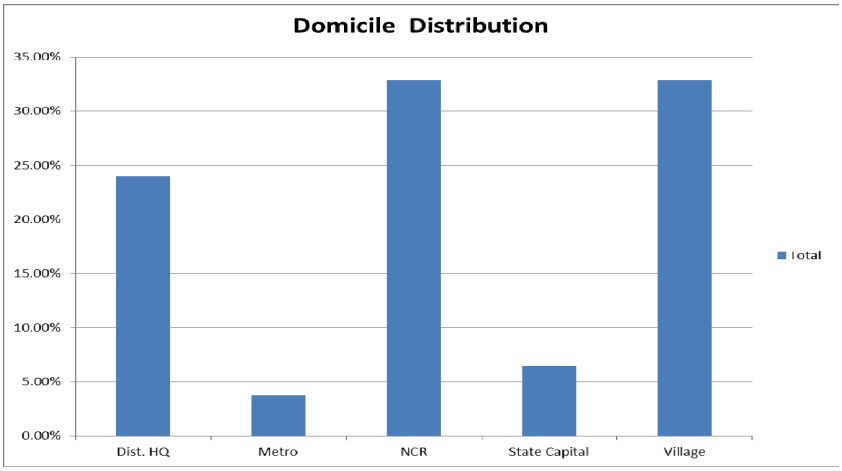




Socio-economic profile of the students*

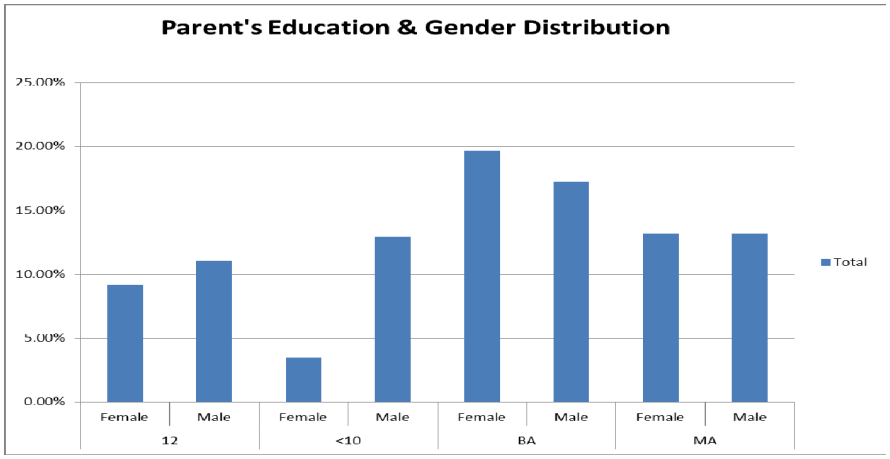
Domicile: Our Department attracts a sizable number of students from outside Delhi. Nearly 67% of the students are from outside Delhi NCR. Out of these, more than 85% have their parents living in villages/outskirts. Thus more than 55% of the total are from non-metropolitan cities.

*** All the data are from a sample of 372 students in 2014-16**



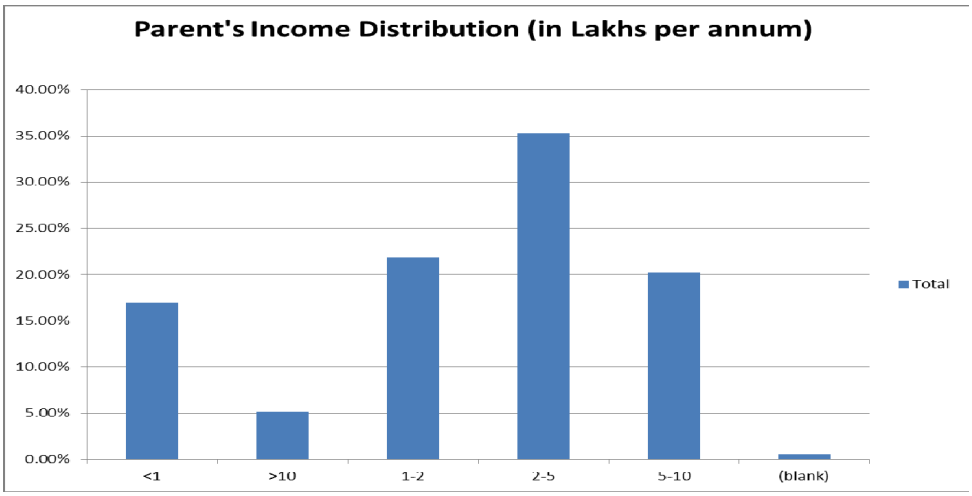
Parent education and gender ratio:

More than 37% students have parents who are educated till Class 12 or less. This essentially means that these students are the first generation college goers in their family. Here too, the male students are over represented in this category compared to girls as are the reserved category students.The gender ratio of the students is 46% female and 54% male students. This is interesting since it indicates that the gender ratio, even in traditionally male dominated streams such as Physics, is now tending towards equality.



Economic background

Almost three out of four students come from what can be categorized as economically disadvantaged families. Thus, 17% of them are from families with annual incomes below Rs. 1 lakh, 22% with incomes between 1 and 2 lakhs and 35 % with incomes between 2 and 5 lakhs. The girls are more from the higher income families while the reserved category students are over represented in the lower income categories.



In summary, our Department caters to the needs of various sections of the society in the true spirit of a Central University

PLACEMENT OF STUDENTS

Ph.D. alumni hold positions in premier institutions worldwide, such as Princeton, Stanford, CERN, Max Planck Inst., Johns Hopkins, ... and National Institutes as follows :

- **Under DRDO**
    - **Solid State Physics Lab (SSPL)**
    - **Laser Science & Technology Centre (LASTEC)**
    - **Defence Institute of Physiology and Allied Sciences (DIPAS)**

- **CSIR and DST Institutions**
    - **National Physical Laboratory**
    - **Indian Institute of Geomagnetism**

- **Department of Atomic Energy (DAE)**
    - **Institute of Mathematical Sciences (IMSc)**
    - **Bhabha Atomic Research Centre (BARC)**
    - **Saha Institute of Nuclear Physics (SINP)**

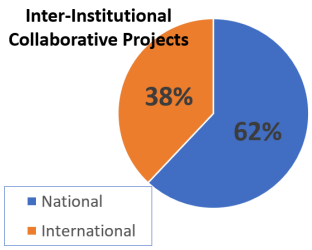
- **Post Doctoral Fellowships/Research Associateships in various National and International institutions/universities.**

- **Teaching in various colleges, Central and State Universities and IITs**

RESEARCH, INNOVATIONS AND EXTENSION

The Department has a rich history of carrying out research in various fields, and is currently active in many areas of fundamental and applied physics, viz. High Energy, Nuclear, Atomic and Molecular, Plasma, Condensed Matter Physics, Astrophysics, Cosmology, Nonlinear Dynamics and interdisciplinary areas like Complex Systems, Biological Physics and Econophysics.

The Department has received funding from various sources and faculty have generated funds from individual projects as well as from both National and International agencies.



Some of the prominent collaborative/ funding agencies are:

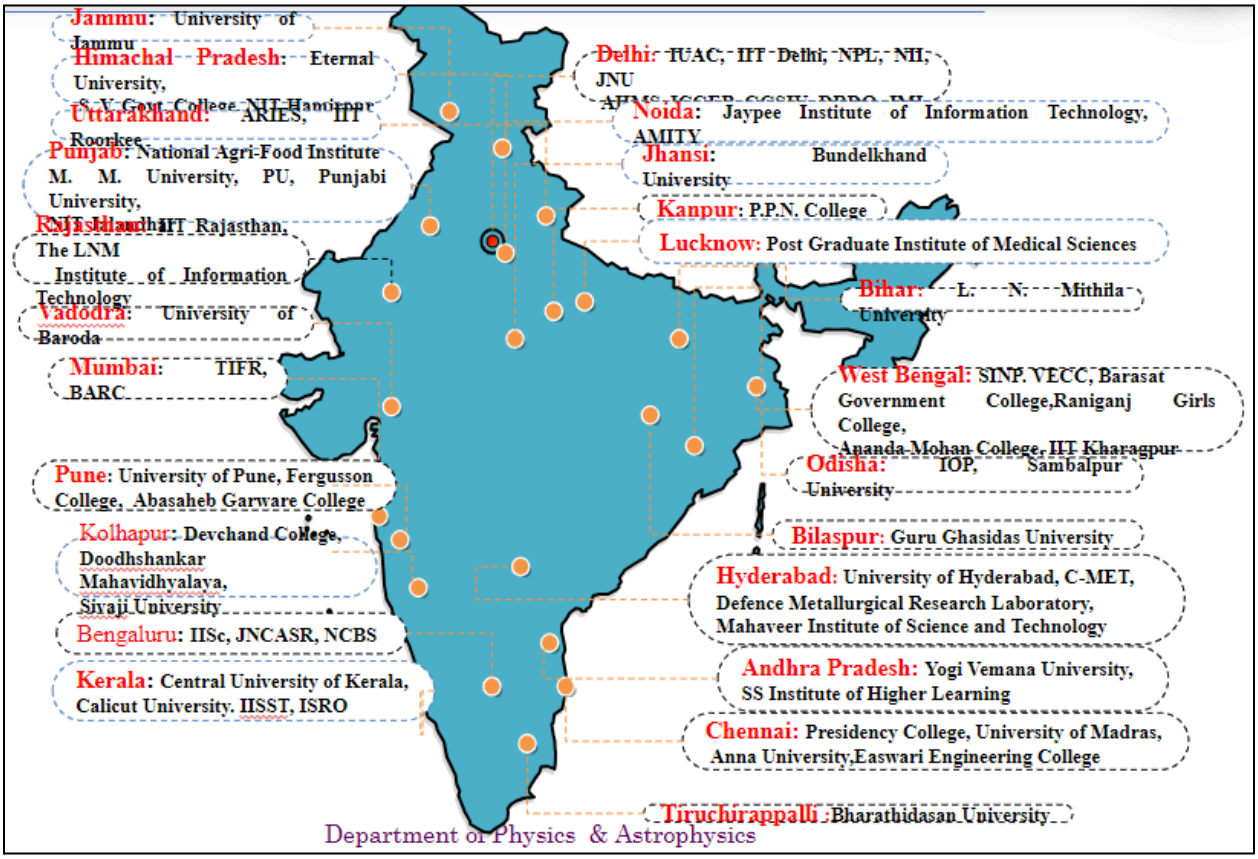
International:

- CERN (Geneva)
- Fermilab (Chicago)
- Facility for Antiproton and Ion Research (FAIR), Darmstadt, Germany
- NASA (USA)
- International Atomic Energy Agency (Vienna)
- Alexander von Humboldt Foundation (Germany)
- Russian Foundation for Basic Research (Russia)
- Japan Society for Promotion of Science (Japan)

National:

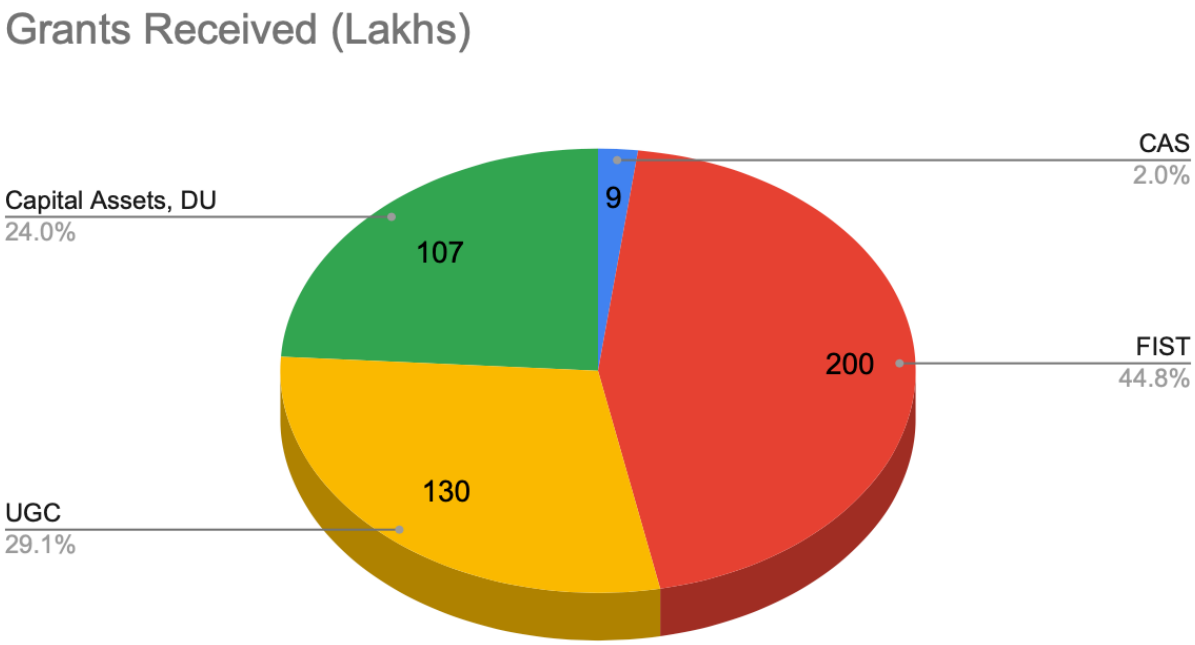
- National Physical Laboratory (NPL)
- Inter University Centre for Astronomy and Astrophysics (IUCAA)
- Defense Research and Development Organization (DRDO)
- Tata Institute of Fundamental Research (TIFR)
- Saha Institute of Nuclear Physics (SINP)
- Bhabha Atomic Research Centre (BARC)
- Institute of Mathematical Sciences (IMSc)
- Harish Chandra Research Institute (HRI)

- **National collaborations**



- **International collaborations**

Extramural funding (in lakhs) received from various agencies



Research projects sponsored by government, international bodies, endowments, industry and inter-institutional collaborative projects between 2018-23:

- Total Number of projects: ~ 100
- Total funds as individual faculty projects = 75 Cr.
- Project per faculty member: ~ 2

Publications details (2018-23) [Scopus indexed only]

Total papers published in journals: 1282

Total citations: 20764

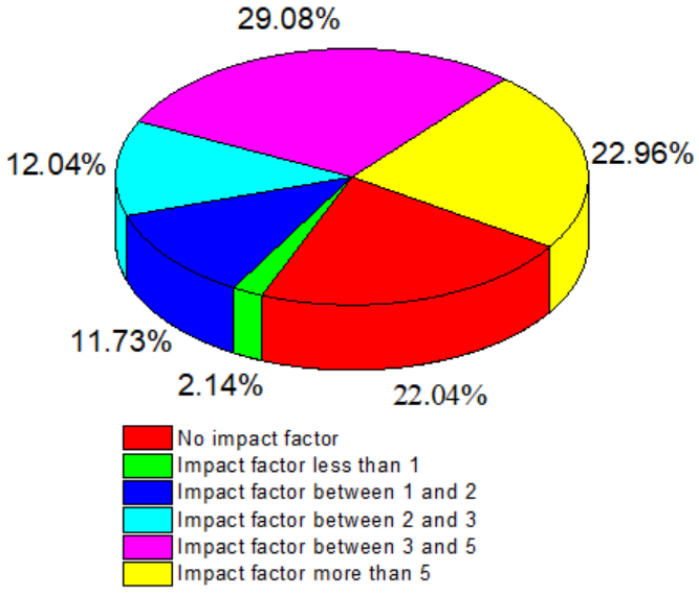
Self citations: 13193

h-index: 57 to over 110

Books and chapters in edited volumes: 42

Conference proceedings: 114

JCR Impact factor distribution of the published research papers (2018-23)

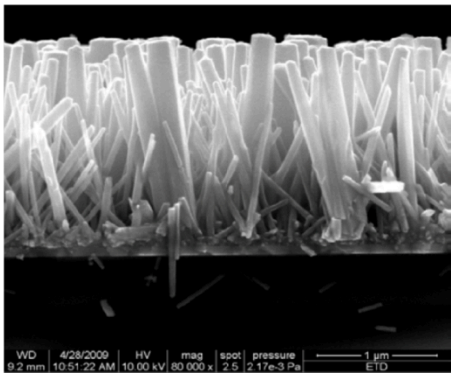


Average impact factor of the papers published is above 2.

RESEARCH IN EXPERIMENTAL PHYSICS

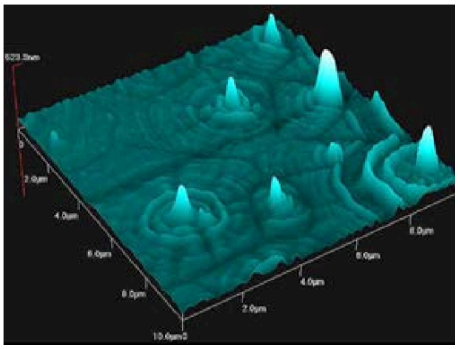
- **Experimental Condensed Matter Physics**

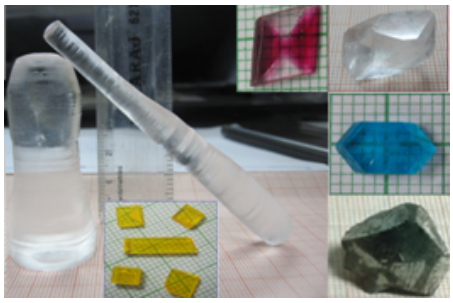
This is one of the largest groups of the Department. With almost half the faculty being involved in Condensed Matter Physics, its sub areas have proliferated, with research activity in both basic and applied areas.



There are active groups working on various topics which include Dielectric, Ferroelectric, Piezoelectric and Pyro-electric properties of multi component oxides, ceramics, single crystals and thin films. The faculty and students have also developed an expertise in Sputtering, Laser Ablation and sol gel deposition techniques.

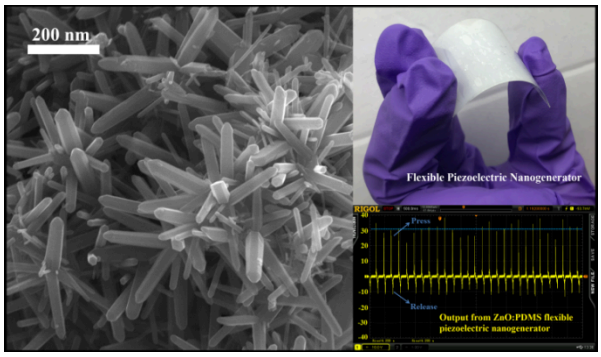
Some faculty members are exploring acousto-electric and magneto electric effects in composites and thin film structures. Development of surface acoustic wave based UV sensors, Ferroelectric memories, Gas sensing devices, characterizing high temperature piezoelectric sensors and characterizing ZnO film based UV light detectors is also area of interest.





Synthesis and study of various technologically important materials like high performance lead based and lead free piezoelectric, Organic Vs Semi-organic NLO materials, multiferroic BFO, multifaceted ZnO, etc. in the form of single crystals, ceramic and nanostructure and their quality improvement for various applications is being carried out.

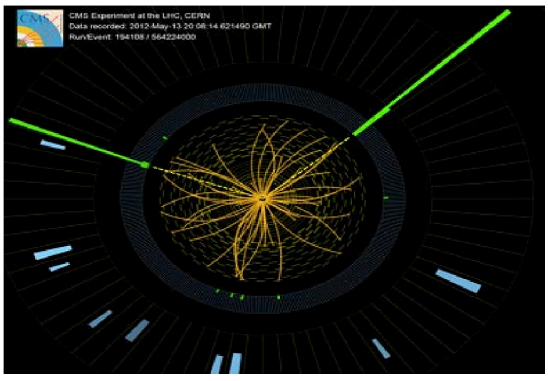
There is a group working on the development of functional materials for various electronic devices including acoustic sensors, biosensors, gas sensors, and UV-photodetectors. The emphasis is on fabrication of multiferroics and piezoelectric materials for energy harvesting besides development of surface acoustic wave devices and MEMS based micro-heaters. A table top Surface Plasmon Resonance set up to study the optical properties of various materials and detection of biomolecules, chemical species and gases, besides the realization of temperature and magnetic field sensors have been developed.



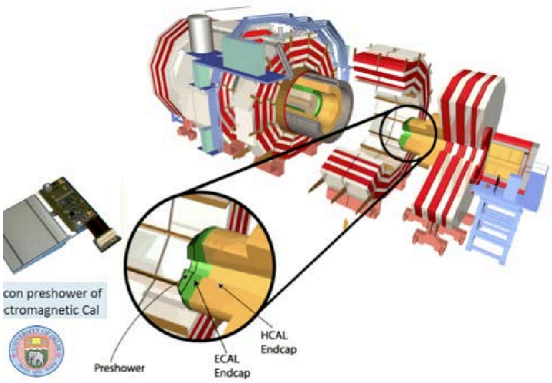
Many of the condensed matter physicists are working in the field of Nanotechnology. Various metal and oxide systems are synthesized at nanoscale by different techniques like wet chemical route, sol gel, ball milling, combustion, electro exploding etc. and used the synthesized NP for green energy harvesting, sensor and data storage applications.

- **Experimental High Energy Physics**

The Department has been on the forefront of both theoretical and experimental particle physics since its inception. It was one of the major centers for theoretical particle physics during the decades of the 1950s and 60s and has trained a whole generation of researchers in the area.



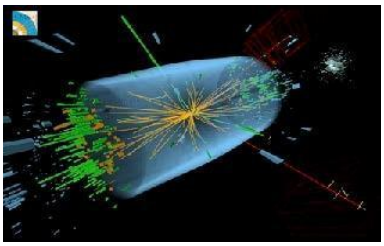
In experimental particle physics, the Department was involved in collaborative research programs with CERN and Fermilab on emulsion studies and fixed target experiment to probe the structure of nucleons through production of direct photons.



In experimental particle physics, the Department was involved in collaborative research programs with CERN and Fermilab on emulsion studies and fixed target experiments to probe the structure of nucleons through production of direct photons.

In early 1990s the group joined the proton antiproton collider experiment D0 at the Tevatron in Fermilab and participated in the discovery of the top quark in 1995, Bs oscillation and search for several new baryons.

The group also joined the CMS experiment at CERN in late 1990s and built part of the silicon pre-shower detector and participated in across the board physics measurements, new limits, and finally the discovery of the Higgs Boson in 2012.

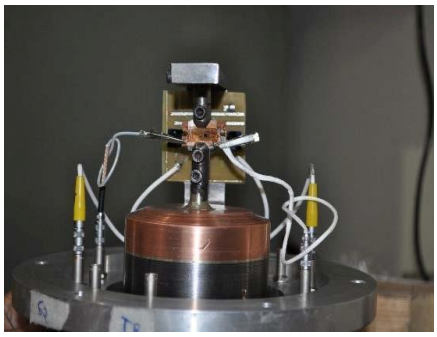


Members are also involved in the R&D and simulation effort for the ICAL experiment at India-based Neutrino Observatory (INO) near Madurai. Some members have also joined a multi-institutional Indian effort on Long-baseline neutrino experiments NOVA and LBNE at Fermilab under India-Fermilab Neutrino Collaboration.

The facilities at the Department include a high performance computing cluster, detector assembly and characterization facilities for gaseous ionization detectors like GEM and RPC and semiconductor detectors like Si strip sensors.

- **Nuclear Physics**

Nuclear physics research began in the department during the 1950s. Despite the fact that most of the nuclear physicists in the department during that time were theoreticians, experimental nuclear physics research was greatly encouraged. During the 1950s and 1960s, some detectors and several home-made electronic modules were used with these detectors to produce interesting scientific results.



The faculty members in the department interested in Nuclear Physics are active in various subfields of experimental nuclear physics research. Their research interests include g-factor, nuclear lifetime and neutron multiplicity measurements in collaboration with the Inter University Accelerator Centre (IUAC) and high spin gamma-ray spectroscopy in the Indian National Gamma Array (INGA) collaboration.

Members are also involved in the study of nuclear reactions, gamma-ray pulse shape analysis, gamma ray tracking and imaging (in collaboration with NUSTAR at GSI, Darmstadt, Germany), tests of the Standard Model using precision spectroscopy and theoretical nuclear structure calculations in the framework of the Interacting Boson Model (IBM)& the tilted axis cranking approximation.

- **Atomic & Molecular Physics**

The Atomic & Molecular Physics Group has been actively involved in many sub-areas. Faculty members are involved in setting up a molecular physics research lab, primarily based on the technique of recoil ion time-off light mass spectrometry. Once operational, this setup will be used to study the kinematics & dynamics of molecular dissociation.

- **Astronomy and Astrophysics**

The Department has a strong Astronomy, Astrophysics and Cosmology group. This has an impact in teaching as well as research. To strengthen students' training in observational Astronomy, the observing facility at the Department has been upgraded with the purchase of 11 inch Celestron telescope and a 9.25 inch Celestron telescope together with back-end instruments like an SBIG ST7 CCD Camera and an OPTEC SSP3A stellar Photometer. A 3.5 meter Observatory has been imported from Sirius Observatories. An IUCAA Resource Centre is located in the Department as well.

RESEARCH IN THEORETICAL PHYSICS

The Department has a strong and active theoretical group working on a wide variety of topics. These range from field theory to particle physics to complexity theory and cosmology. Gravitational waves from highly magnetized spinning white dwarfs, Chern-Simons gravity, torsion and dark energy from a dynamical four-form & black hole evaporation theory, studies of dark matter is an area of interest.

- **Theoretical High Energy Physics & Quantum Field Theory**

  There are several faculty members working on the phase structure of QCD (Quantum chromodynamics), Quark-Hadron phase Transition and signature of Heavy-Ion Collision of Quark Gluon Plasma, which is believed to exist in the early universe formation just after the big Bang at very high temperature and high nuclear density. Nonlinear dynamics, modeling and analysis of nonlinear time series and applications of chaos theory to physical and biomedical signals & systems is another area of interest.

There is a very active group working on Top & Higgs Physics, Supersymmetry, Theories in extra dimensions, Effective Lagrangians, Perturbative QCD, CP violation and rare decay, Dark matter. Superstring theories & D'Branes. de Sitter vacua, higher form gauge theories, Non-perturbative quantum gravity, Non-commutative geometries, Anti de Sitter (AdS) gravity/conformal field theory (CFT) duality, and AdS/CFT applications to condensed matter physics are also of interest to some members.

- **Cosmology**

  Other areas include early universe cosmology and alternative cosmology as well as the study of areas such as cosmological nucleosynthesis, cosmic microwave background anisotropy and inflation, late time acceleration, magneto genesis and black hole thermodynamics.

- **Plasma Physics**

  Plasma physics research is active in the areas of magnetic fusion, laser fusion, dusty plasma, laser-plasma interaction, particle acceleration using laser plasma and dense plasma focus devices. The theoretical work is analytical and computation using PIC and MD simulation codes using the 20 node cluster in the department. While in the dense plasma focus device, the plasma route to synthesizing nanoparticles is studied.

- **Complex Systems**

  Interdisciplinary research on complex systems, including the structure, dynamics and evolution of complex networks in biology and the social sciences, as well as biological physics and theoretical systems biology is being conducted in the department.

INFRASTRUCTURE AND LEARNING SOURCES

LIBRARY

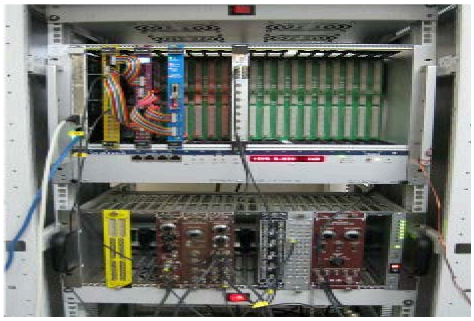
The Department has a well-stocked Library, named CARPA, with a separate textbook section. It has two sections: reference and textbook section. All the students of the department are members of the library. In addition they can avail the library facility of their respective colleges as well. The Central Science Library as well as the Main Reference Library are at walking distance. The DU library system subscribes to the electronic version of all major science journals, as well as database services. These can be accessed from any point on the University network. It has nearly 4500 number of reference books while the text books are nearly 1200. It also has a rare collection of old journals numbering nearly 2400.

COMPUTATIONAL FACILITIES/ DOCUMENTATION CENTER

The Department has a Computational Facility which includes about 50 computers providing network access for students, faculties and visitors and a 32 node blade based High Performance Computing Cluster and workstations for research for Ph.D. students and faculty. M.Sc. students can also use this facility.

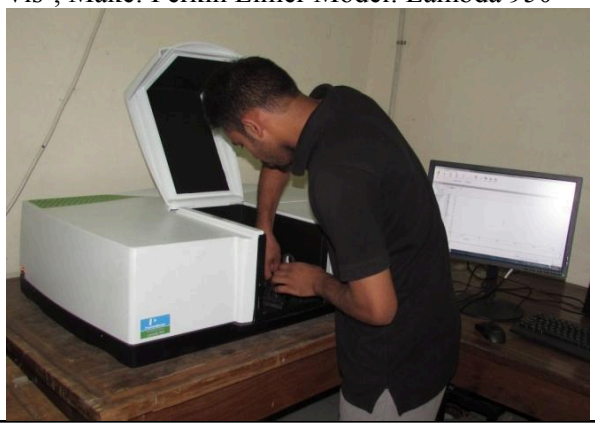
WIFI AND INTERNET CONNECTIVITY

The Department has high speed internet / WiFi connectivity for which all the faculty members and students have individual Id. A dedicated computer room is available for M.Sc. students.



COMMON EXPERIMENTAL FACILITIES

A high tech Common Experimental Facility has been working which includes XRD, AFM, FESEM, UV-Vis, DSC, etc. for the research students of our department. It also caters the research requirements of students of other departments as well as of various colleges.

FESEM; Make: TESCAN; Model: MIRA3LMH 	XRD; Make: RIKAGU; Model: Ultima IV 
UVVis-; Make: Perkin Elmer Model: Lambda 950 	AFM; Make: Park System; Model: NX10 

In addition, the Central Instrumentation Facility of the University has been housed in the Old Block of the Department. Some of the facilities available are HRTEM, HRXRD, SCXRD, NMR, RAMAN, DSC, FE-SEM,VSM, Ellipsometry, etc.

STUDENT SUPPORT & BEST PRACTICES

Title: Need for high quality publications from Ph.D. students and prospective supervisors

Description: In order to ensure high quality of research work during Ph.D., the Department had adopted the following practice back in 2009 and has been consistently following it since then:

Ph.D. Student: Publication in Journal with Impact Factor $\geq$ 1. It is mandatory for every Ph.D. student of the Department to publish at least one paper as the first author or as the sole author in a journal with impact factor (IF) at least 1.00 (IF given by Journal Citation Reports, JCR). The impact factor requirement encourages the student to take the research seriously and produce quality work. The first or sole authorship requirement ensures that the student has contributed significantly to the publication on which her/his Ph.D. thesis is based. In certain areas of physics where it is customary for the author list to be alphabetical, other evidence of substantial contribution by students is taken into account.

Prospective Ph.D. Supervisors: Evidence of independent and continued research. For the recognition of a faculty member in the Department or in Colleges as a Ph.D. supervisor, we have adopted guidelines to ensure that the prospective supervisors are capable of carrying out independent research of certain minimum quality. The prospective supervisors are required to be (a) author of at least two papers as the *corresponding author* in a journal with Mean Impact Factor (MIF) at least 1.00, or (b) author of at least four papers in which the list of authors does not include the person's own Ph.D. Supervisor or Joint Supervisor and which have an MIF at least 1.00, or (c) having a running project funded by a recognized agency with a JRF position in which the person is the Principal Investigator.Even a recognized supervisor is required to satisfy certain publication criteria as evidence of continued research to register a fresh Ph.D. student.

Uniqueness of the Practice: The Department formulated and started this practice more than 8 years back. To our knowledge our Physics Department is the first and possibly the only Department to formalize such a practice. Now, UGC also requires a Ph.D. student to have a publication for the Ph.D. thesis, but it does not insist on a minimum journal impact factor. It also does not insist on the first authorship for students and corresponding author requirement for prospective supervisors. Our criteria are much more stringent than the UGC requirements and thus ensure better quality research output.

Redressal of the concerns of our students: We do consider the problems raised by both M.Sc. and Ph.D. students very seriously and try to resolve them within our limits.

(i) For the M.Sc. students, the allotment of optional papers, preparation of the date sheet for examinations, etc. we do consider various requests by students and try to accommodate them with possible limits. Every request is considered by a committee on a case by case basis.

(ii) For Ph.D. students, we do have regular meetings with them and consider their problems. The cases of individual problems are considered by a duly appointed committee and the students are given a fair chance to represent her/his case.

Mentorship programme:

- Each M.Sc student assigned a faculty mentor.
- Counseling: discuss academic, social, personal issues including career counseling.

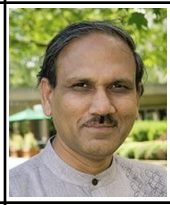
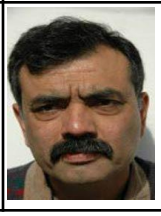
Physics Society:

- Office bearers, representing different batches of M.Sc. and Ph.D. students, are elected through secret voting. Elected student representatives conduct cultural and academic events.
- Interface with faculty about student problems.

Placements : A large number of Ph.D. students choose academic and research careers and are placed in reputed National and International Universities/Institutes.

FACULTY MEMBERS (2018 – Present)

(including those who have superannuated/expired/resigned during 2018-24, all marked by *)

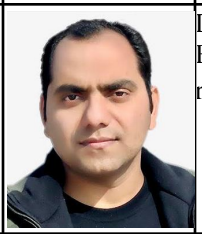
S. No.	Photograph	Details	Research interests	Courses taught
1.		Prof. Sanjay Jain Email: jain@physics.du.ac.in, jain_physics@yahoo.co.in	Theoretical systems biology, Complex networks, Models of non-equilibrium statistical mechanics, Nonlinear dynamics, random matrix models and quantum chaos, Quantum field theory, superstring theory and quantum gravity.	Complex Systems and Networks Statistical Mechanics, Classical Mechanics, Quantum Mechanics, Radiation Theory.
2.		Prof. B C Choudhary(HOD) Email: brajesh@fnal.gov, brajesh.choudhary@cern.ch	Experimental High Energy Particle Physics and Astrophysics. Detector and Accelerator Development.	Statistical Mechanics, Nuclear Physics & Particle Physics, Atomic & Molecular Physics.
3.		Prof. Debajyoti Choudhury Email:Debajyoti.Choudhry@gmail.com, debchou@physics.du.ac.in	High Energy Physics and Cosmology.	Classical Mechanics, Quantum Mechanics, Statistical Mechanics, Electromagnetic Theory, Quantum Field Theory and Particle Physics.
4.		Prof. Patrick Das Gupta* Email: patrickdasgupta1@gmail.com	General Relativity, High energy astrophysics, black holes, quantum theory.	Classical mechanics, Quantum mechanics, Electromagnetic theory, Radiation theory, General relativity and Cosmology, Astronomy & Astrophysics.
5.		Prof. Avinash Khare * Email: ak0005@uah.edu, ojavinash@yahoo.co.in	Fusion Plasmas, Non Neutral Plasmas, Rocket/space propulsion. Laser plasma interaction, Astrophysics, Gravitational Collapse, Formations of Stars, Planets.	Statistical Mechanics, Electromagnetic Theory and Plasma Physics.
6.		Prof. S Annapoorni Email: annapoornis@yahoo.co.in, annapoornis.phys@gmail.com	Magnetic Phase transition in metal alloys, Nanomagnetic materials, Magnetic nanocomposites, Conducting Polymers, Biosensors, Plasmonic materials, Organic/inorganic interfaces.	Solid State Physics, Nanoscience and nanotechnology.
7.		Prof. Shobhit Mahajan Email: Shobhit.mahajan@gmail.com	Particle Physics & Cosmology, Biological networks.	Mathematical Physics, Radiation Theory, Computational Physics and Electrodynamics, Astrophysics.

8.		Prof. Vinay Gupta* vgupta@physics.du.ac.in, drguptavinay@gmail.com	Semiconductor oxides and SAW sensors for gas/chemical /radiations/bio-molecules, Amperiometric biosensors, Surface Plasmon Resonance (SPR) technique for various applications.	Electromagnetic Theory, Solid State Physics, Advanced Electronics, Physics at Nanoscale, Plasma Physics laboratory.
9.		Prof. K. Sreenivas* Email: kondepudysreenivas@gmail.com	Gas sensing mechanisms, Dielectrics, Ferroelectrics, and Piezoelectric properties in ceramics, composites and sputtered films	Electronics and Semiconducting devices.
10.		Prof. H P Singh* Email: hpsingh@physics.du.ac.in	Structure and Evolution of Stars, solar physics, observational aspects of spectra of stars and techniques of automated data analysis in Astronomy.	Astronomy & Astrophysics
11.		Prof. A G Vedeshwar* Email: agni@physics.du.ac.in	Transport & Optical Properties, High Tc Superconductors in both bulk & thin film forms, Thin Film fabrication	Quantum Mechanics, Electronics, Laser & Spectroscopy, Classical Mechanics, Electromagnetic Theory, Statistical Mechanics, Atomic & Molecular Physics.
12.		Prof. P D Sahare* Email: Pdsahare1959@gmail.com, pdsahare@physics.du.ac.in	Spectroscopy, Luminescence, Radiation dosimetry, Laser materials, Detectors and optical sensors.	Experimental Methods in Physics, Electronics, Atoms and Molecules, Optics, Lasers, Nuclear Physics.
13.		Prof. T R Seshadri Email: seshadri.tr@gmail.com	Astrophysics and Cosmology, Cosmic Microwave Background Radiation, Large-scale Structures in the Universe, Cosmic Reionization, Late time Acceleration of the Universe	Classical Mechanics, Quantum Mechanics, Statistical Mechanics, Astronomy and Astrophysics, General theory of relativity and Cosmology.
14.		Prof. Binay Kumar Email: bkumar@physics.du.ac.in, b3kumar69@gmail.com	Crystal Growth, Nanostructure &Ceramics of Ferro-Pyro-Piezoelectric, Dielectric, NLO materials. Crystal engineering.Pressure sensor, Energy harvesting and Communication devices.	Atomic & Molecular Physics, Electronics, Solid State Physics.
15.		Prof. Nivedita Deo Email: ndeo@physics.du.ac.in, ndeo1@yahoo.co.in	Statistical Mechanics of Superstrings, Quantum Chaos, Random Matrix Models and Networks, Physics of NanoStructures, Topological quantum matter, RNA and Proteins.	Electromagnetic Theory and Quantum Mechanics.

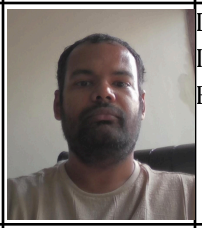
16.		Prof. Amarjeet Kaur Email: amarkaur@physics.du.ac.in	Fabrication and characterization of optoelectronics devices based on conducting polymers.	Electronics, Solid state Physics, Experimental Solid State Physics, Molecular Electronics.
17.		Prof. Amita Chandra Email: achandra@physics.du.ac.in, amitach1@yahoo.com	Mixed ion+electron conductors, Ion track based electronic devices, chaos in electrochemical systems, Organic-inorganic hybrid electrolytes	Electronics, Solid State Physics, Physics of Materials, Atomic and Molecular Physics
18.		Prof. Poonam Silotia Email: psilotia21@gmail.com	Theoretical Condensed Matter Physics. Atomic auto-correlation functions, Bose-Einstein Condensation, Fullerenes, Collective dynamics of fluids.	Advanced solid state physics
19.		Prof. Samit K. Mandal Email: smandal@physics.du.ac.in, smandal@physics.du.ac.in	Design and fabrication of gas detectors, Study of nuclear reaction dynamics using nuclear scattering, transfer,break-up and fusion reaction at low energy.	Advance Nuclear Physics, Quantum Mechanics.
20.		Prof. S A Hashmi Email: sahashmi@physics.du.ac.in, hashmisa2002@yahoo.co.in	Electroactive polymers for Batteries and Supercapacitors	Electronics, Atomic & Molecular Physics
21.		Prof. Shyama Rath Email: srath@physics.du.ac.in	Fabrication and optical characterization of semiconductor thin films/heterostructures/nanostructures, Metal oxide semiconductors synthesis, Ion beam modification.	Atomic and Molecular Physics, Quantum Mechanics, Nuclear and Particle Physics, Laser and Spectroscopy, Solid State Physics.
22.		Prof. Anjan Datta Email: adutta@physics.du.ac.in, dutta.anjan33@gmail.com, adutta@iucaa.ernet.in	Cosmic Rays, Space Physics, X-Ray Astronomy.	Atomic & Molecular Physics, Electronics, Statistical Mechanics Nuclear Physics, E.M. Theory, Astronomy & Astrophysics.
23.		Prof. Kirti Ranjan Email: Kirti.Ranjan@cern.ch, kranjan@physics.du.ac.in	Experimental high energy physics/Accelerator Physics.	Nuclear and Particle Physics, Quantum Mechanics, Statistical Mechanics.

24.		Prof. S Murugavel Email: murug@physics.du.ac.in	Electrical transport investigates glasses, ion-conducting glasses, glass-ceramics and electrode materials for lithium ion batteries.	Physics at Nanoscale, Advanced Experimental Solid State Physics.
25.		Prof. Supriya K. Kar* Email: skkar@physics.du.ac.in, supriya.k.kar@gmail.com	Quantum Gravity & Cosmology, Superstrings, D-branes & Non-commutative geometry.	Classical Mechanics, Quantum Mechanics, Radiation Theory, Electromagnetic Theory, General Theory of Relativity & Cosmology, Quantum Field Theory, Particle Physics.
26.		Prof. Ashutosh Bhardwaj Email: abhardwaj@physics.du.ac.in, go2ashu@gmail.com	Experimental High Energy Physics (HEP) & Detector physics. Major International collaborations: Compact Muon Solenoid (CMS) experiment at the Large Hadron Collider (LHC), and RD50 collaboration at CERN, Switzerland.	Nuclear Radiation Detection and Experimental Techniques Nuclear and particle physics Quantum Mechanics
27.		Prof.. S S Singh Email: sssingh@physics.du.ac.in	High Energy Physics and Quark-Gluon Plasma, QCD Phase Structure, Dilepton/Photon production from QGP, Compact star.	Classical Mechanics, Quantum Mechanics, Statistical Mechanics, Electromagnetic theory, Radiation Theory.
28.		Prof. Awadhesh Prasad Email: Awadhesh@physics.du.ac.in	Instantaneous or delayed interacting nonlinear oscillators, strange chaotic & nonchaotic attractors, bifurcation theory, nonlinear time-series analysis.	Statistics and Computer Applications, Mathematical Physics, Classical Mechanics, Nuclear and Particle physics, Computational lab and NLD
29.		Prof.. Devaki Nandan Gupta Email: dngupta@physics.du.ac.in, dngupta2001@gmail.com	Laser-Plasma Interactions (Theory and Simulation)	Plasma Physics and Nuclear Fusion Reactors, Applied Thermodynamics.
30.		Prof. M Naimuddin Email: nayeem@fnal.gov, nayeemsworld@gmail.com, nayeem@physics.du.ac.in	High Energy Particle Physics, Nuclear Physics, Medical physics, Higgs Searches, Searches for New Physics beyond Standard Model.	Classical Mechanics, Nuclear and Particle Physics Theory, Computational physics.
31.		Prof. Ajit Mahapatro Email: ajit.km001@gmail.com	Micro/nano-fabrication, Nanotechnology, Nanoelectronics, Biotechnology, Molecular electronics, Electronic transport through micro/nano-structured organic/bio-functionalized systems.	Physics at Nanoscale, Solid State Physics, Molecular Electronics.

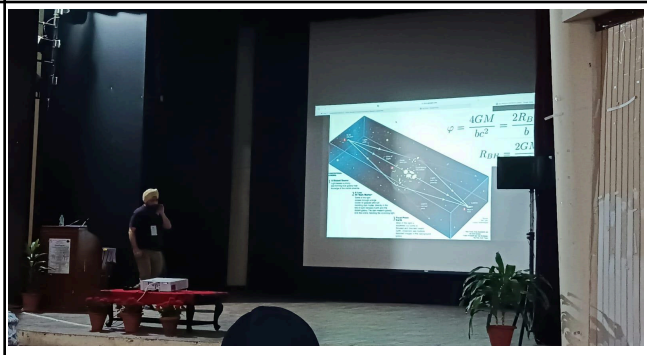
32.		Prof. Sanjay K. Chamoli Email: skchamoli@physics.du.ac.in, cylab123@gmail.com	Nuclear Physics, Nuclear g-factor measurement of excited nuclear states using the TDPAD technique, Transient Field technique and IPAC technique	Nuclear physics
33.		Prof. Shashi Verma Email: sverma@physics.du.ac.in, vermasvin2006@gmail.com	Nuclear reactions: Nuclear reactions involving Radioactive Ion Beam, Nuclear Spectroscopy.	Nuclear and Particle Physics, Quantum Physics.
34.		Prof. Jyoti Rajput Email: jrajput@physics.du.ac.in, jrajput.du@gmail.com	Atomic and Molecular Physics design and implementation of an electrostatic deceleration lens for highly charged ions	Atomic and Molecular Physics Quantum Mechanics
35.		Prof. Suresh Kumar Email: skumar@physics.du.ac.in, sursvmk123@gmail.com	Experimental Nuclear Physics, Phenomenological Theoretical Calculation and Nuclear Data Compilation.	Nuclear Physics, Quantum Mechanics and Applied Thermodynamics.
36.		Prof. P. Senthil Kumar Email: pskumar@physics.du.ac.in pskumardu@gmail.com	Microscopic and spectroscopic aspects of advanced functional materials.	Quantum mechanics, Laser & spectroscopy and advanced solid state physics.
37.		Dr. Swarnendu Sarkar* Email: ssarkar@physics.du.ac.in	Quantum Field Theory, String Theory	Classical Mechanics, Field Theory and Quantum Electrodynamics, Quantum Mechanics, Radiation Theory, Statistical Mechanics.
38.		Dr. Sourav Sur Email: sourav.sur@gmail.com, sourav@physics.du.ac.in	General Relativity and Cosmology, Physics of Black Holes, String and Extra-dimensional Theories.	Electromagnetic Theory & Electrodynamics, Quantum Mechanics, Radiation Theory, General Theory of Relativity & Cosmology, Solid State Physics Lab.
39.		Dr. Ashok Kumar (On EOL, since 2022) Email: ashok.hep@gmail.com	High Energy Physics, Higgs Physics, Detectors and Instrumentation CMS experiment at Large Hadron Collider	Nuclear Physics, Particle Physics, Classical Mechanics, Quantum Mechanics, Radiation Technology & its applications

40.		Dr. Sanjeev K Verma Email: sanjeevkumarverma@outlook.in	High energy physics, Cosmology, Astrophysics.	Classical Mechanics, Electromagnetic Theory, Radiation Theory, Advanced Numerical Techniques.
41.		Dr. Debabrata Mishra Email: debabrata.iit@gmail.com	Spin based Molecular Electronics, Organic and Inorganic interface.	Electromagnetic theory
42.		Dr. Sumalay Roy Email: sumalay.roy@gmail.com	Surface physics and Nanoscience	Computer Laboratory, Statistical Mechanics, Advanced Solid State Physics Laboratory
43.		Dr. Ayushi Paliwal Email: 87.ayushi@gmail.com	Experimental Condensed Matter Physics	
44.		Dr. Krishnakanta Mondal Email: kmondal@physics.du.ac.in	Computational Condensed Matter Physics	
45.		Dr. Yana Bagbi Email: yanabagbi@gmail.com; ybagbi@physics.du.ac.in	Experimental condensed Matter Physics	
46.		Dr. Rakesh Kumar Mishra Email: rkumarmishra@physics.du.ac.in	Soft Condensed Matter, Biological Physics,	
47.		Dr. Amol Singh Email: asingh1@physics.du.ac.in	Experimental Condensed Matter Physics	

48.		Dr. Mangilal Choudhary Email: mchoudhary@physics.du.ac.in	Experimental Plasma Physics	
49.		Dr. Archana Mishra Email: amishra@physics.du.ac.in	Theoretical Condensed Matter Physics	
50.		Dr. Suman Chowdhury Email: sumanchowdhury88@gmail.com	Computational Condensed Matter Physics	
51.		Dr. Sachin Pandey Email: spandey@physics.du.ac.in	Quantum Cosmology, Gravity	
52.		Dr. Govind Dayal Email: gdayal@physics.du.ac.in	Light-Matter Interaction, Plasmonics & Metamaterials,	
53.		Dr. Arun Kumar Email: akumar7@physics.du.ac.in	Experimental High Energy Physics	
54.		Dr. Utkarsh Mishra Email: umishra@physics.du.ac.in	Quantum Information and Computation	

55.		Dr. Om Prakash Email: om.prakash@physics.du.ac.in	Superconducting Materials and Devices	
56.		Dr. Vikram Rathee Email: vr21@physics.du.ac.in	Soft Computational Condensed Matter Physics	
57.		Dr. Subhajit Paul Email : spaul@physics.du.ac.in, subhajit18itp@gmail.com	Statistical and Soft matter Physics	
58.		Dr.Debottam Nandi INSPIRE Faculty Email: debottam.nandi@gmail.com	Gravitation and Cosmology (mainly, the early universe, gravitational waves, black holes, and magnetic fields)	
59.		Dr. Abhass Kumar INSPIRE Faculty Email:abhasskumar@gmail.com	High energy physics (theory & phenomenology), Cosmology	
60.		Dr. Madhusudhan Raman INSPIRE Faculty Email:mraman@physics.du.ac.in	Quantum Field Theory and String Theory	

EVENTS AND ACTIVITIES

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