



[Home](#) / [Department](#) / [University of Delhi\(Department Annual Report\)](#)

Department's 100<sup>th</sup> Annual Report (1<sup>st</sup> April 2022 to 31<sup>st</sup> March 2023): Physics and Astrophysics



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**Name of the Department**

Physics and Astrophysics

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**Name of the Faculty**

Science

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**Brief History**

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The Physics Department of the University of Delhi (later renamed Department of Physics and Astrophysics) was set up in 1922. In its early years the Department was influenced by M.N. Saha and when the University moved to its present campus, the Physics Department was allocated in the former Viceroy's complex, alongwith the Chemistry Department, in a building which continues to function as the shared Old Block. Faculty members in the early days of the Department included Profs. D.S. Kothari, R.C. Majumdar, F.C. Auluck, N.K. Saha and P.K. Kichlu. The Masters programme started in 1942.

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Subsequently some experimental groups were set up in Optics, Nuclear Physics and High Energy Physics, while a Helium Plant and a telescope tower for a solar observatory were set up. The faculty members of the Department have won numerous honours and awards over the years.

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## Major Activities and Achievements

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The Department of Physics and Astrophysics has maintained its position as the topmost QS ranked university physics department in India. It is also one of the largest physics departments in the country, with nearly 730 MSc students and over 180 PhD students, in addition to the presently available 37 regular faculty members. It has sustained its high quality in research, which is evident from nearly 300 research publications (including books/chapters and conference proceedings) by only its regular faculty members, apart from those by its students, in international refereed journals during the year. Its faculty received several national and international grants and participated in several collaborative projects across the globe. It had also hosted various eminent researchers who gave inspiring lectures to motivate young students. The department's Master's curriculum provides a wide choice of electives, including inter-disciplinary subjects, to its students. Moreover, the various sorts of methodology applied over time to time to enhance learning experiences have been much more strategized when the department went from the offline to the online/blended mode of teaching in recent times. Such strategies include: 1. Online resources, e.g. lecture notes, links to video lectures or experimental demonstrations, and other study materials being provided to the students in online classes, either in the Google classrooms platform or in the Microsoft Teams platform. 2. Interactive classroom sessions, with instant quizzes, group discussions, as well as time-bound assignments, with the provision of students' self assessment being emphasized. The department, under a vibrant Ph.D. program, has offered a plethora of cutting-edge research topics as well, in recent times, making the above strategies much relevant for the Ph.D. course-work. Furthermore, an exclusive departmental portal <http://physics.du.ac.in>, displaying regular updates on its academic and other activities, has successfully run online during the year.

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## Honours/Distinctions

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[1] PROF. BRAJESH CHANDRA CHOUDHARY: (a) Spokesperson, Indian Institutions: Fermilab Collaboration in Neutrino Physics -- continuing in 2022-23, till 2026, (b) Co-Chair, CMS Diversity Office -- continued till 2022. . [2] PROF. DEBAJYOTI CHOUDHURY: (a) Member, PAC of Department of Science and Technology (DST), Govt. of India, for High Energy Physics, Nuclear Physics, Astrophysics, Plasma Physics and Nonlinear Dynamics -- continuing in 2022-23, (b) Member, Expert Committee of Department of Science and Technology (DST), Govt. of India, for SERC School in THEP -- continuing in 2022-23, (c) Member, Selection Committee for INSPIRE Faculty Awards -- continuing in 2022-23. . [3] PROF. PATRICK DAS GUPTA: (a) President, Indian association of General Relativity and Gravitation (IAGRG) -- continuing from 2020, (b) Member, Departmental Research Committee, of the Department of Physics, Indira Gandhi National Tribal University, Amarkantak, Chhattishgarh -- continuing from 2020. . [4] PROF. ANNAPOORNI SUBRAMANIAM: Member, Academic council, Jawaharlal Nehru University, Pondicherry University and Amity Institute of Nanotechnology -- continuing in 2022-23. . [5] PROF. AMITA CHANDRA: (a) Member, Board of Studies, School of Vocational Studies and Applied Sciences, Gautam Buddha University -- continuing in 2022-23, (b) Research Ambassador, DAAD -- continuing in 2022-23. . [6] PROF. NIVEDITA DEO: Member, Complex Systems Society (CCS), Inc -- continuing in 2022-23. . [7] PROF. AWADHESH PRASAD: Member, PAC of Department of Science and Technology (DST), Govt. of India, for High Energy Physics, Nuclear Physics, Astrophysics, Plasma Physics and Nonlinear Dynamics -- continuing in 2022-23. . [8] PROF. SHYAMA RATH: (a) Coordinator, Internal Quality Assurance Cell (IQAC), University of Delhi -- continuing in 2022-23 , (b) Member, PAC of Department of Science and Technology (DST), Govt. of India, for High Energy Physics, Nuclear Physics, Astrophysics, Plasma Physics and Nonlinear Dynamics -- continuing in 2022-23. . [9] PROF. SAMIT KR MANDAL: (a) Member, Special committee, Special Centre for Nanoscience (SCNS), Jawaharlal Nehru University -- continuing in 2022-23, (b) Member, Selection committees for JRF/Research Associate/Scientist, Inter-University Accelerator Center -- continuing in 2022-23, (c) Member, Evaluation Committee for JRF to SRF, Inter-University Accelerator Center --

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continuing in 2022-23. . [10] DR. SOURAV SUR: (a) Visiting Associate, Inter-University Centre for Astronomy and Astrophysics (IUCAA) -- continuing in 2022-23, till 2025, (b) Member, Indian association of General Relativity and Gravitation (IAGRG) -- continuing in 2022-23.

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## Publications

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### (a.) Research Articles

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1. Ahmed A.; Kumar A.; Naimuddin Md.; Babij M.; Bielowka P. , (2022) , The qualification of GEM detector and its application to imaging , *Journal of Instrumentation* , 4 , 17 , P04002 , 2
  2. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Precision measurement of the W boson decay branching fractions in proton-proton collisions at  $\sqrt{s} = 13$  TeV , *Physical Review D* , 7 , 105 , 72008 , 5
  3. Hor A.A.; Yadav N.; Hashmi S.A. , (2022) , High-Energy-Density 3.5 v Carbon Supercapacitor Fabricated with Ionic-Liquid-Incorporated Redox-Active Gel Polymer Electrolyte , *ACS Applied Energy Materials* , 6 , 5 , 7627 , 4
  4. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Search for single production of a vector-like T quark decaying to a top quark and a Z boson in the final state with jets and missing transverse momentum at  $\sqrt{s} = 13$  TeV , *Journal of High Energy Physics* , NA , 5 , 93 , 5
  5. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Measurement of the production cross section for Z+b jets in proton-proton collisions at  $\sqrt{s} = 13$  TeV , *Physical Review D* , 9 , 105 , 92014 , 3
  6. Kumar A.; Jamdegni M.; Kaur A. , (2022) , Study of electrochromic behavior of the supporting electrolyte free electrochromic devices based on the graphene quantum dots functionalized viologens for energy-saving smart window application , *Synthetic Metals* , NA , 287 , 117084 , 1
  7. Ashanujjaman S.; Choudhury D.; Ghosh K. , (2022) , Search for exotic leptons in final states with two or three leptons and fat-jets at 13 TeV LHC , *Journal of High*
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8. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Search for heavy resonances decaying to  $Z(\nu\nu)\gamma(qq')$  in proton-proton collisions at  $\sqrt{s}=13$  TeV , *Physical Review D* , 1 , 106 , 12004 , 1
  9. Joshi A.; Pandey J.C.; Rawat N.; Raj A.; Wang W.; Singh H.P. , (2022) , Optical Characterization of Two Cataclysmic Variables: RBS 0490 and SDSS J075939.79+191417.3 , *Astronomical Journal* , 5 , 163 , 221 , 0
  10. Yadav G.; Paliwal A.; Gupta V.; Tomar M. , (2022) , Optical Confinement Study of Laser MBE Grown InGaN/GaN Quantum Well Structure using Surface Plasmon Resonance Technique , *Plasmonics* , 2 , 17 , 869 , 3
  11. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Search for heavy resonances decaying to ZZ or ZW and axion-like particles mediating nonresonant ZZ or ZH production at  $\sqrt{s}=13$  TeV , *Journal of High Energy Physics* , NA , 4 , 87 , 9
  12. Sirunyan, A.M.; Tumasyan, A.; ...; Bhardwaj, A.; Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...; Ranjan K.; ... , (2022) , Erratum to: Measurement of exclusive  $\Upsilon$  photoproduction from protons in pPb collisions at  $\sqrt{s_{NN}}=5.02$  TeV (The European Physical Journal C, (2019), 79, 3, (277), 10.1140/epjc/s10052-019-6774-8) , *European Physical Journal C* , 4 , 82 , 343 , 0
  13. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Search for low-mass dilepton resonances in Higgs boson decays to four-lepton final states in proton–proton collisions at  $\sqrt{s}=13$ TeV , *European Physical Journal C* , 4 , 82 , 290 , 13
  14. Yadav G.; Dewan S.; Tomar M. , (2022) , Electroluminescence study of InGaN/GaN QW based p-i-n and inverted p-i-n junction based short-wavelength LED device using laser MBE technique , *Optical Materials* , NA , 126 , 112149 , 7
  15. Gambhir M.; Varsha; Prasad V. , (2022) , Pressure- and temperature-dependent EIT studies in a parabolic quantum dot coupled with excitonic effects in a static magnetic field , *Pramana - Journal of Physics* , 2 , 96 , 81 , 0
  16. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Search for Resonances Decaying to Three
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W Bosons in Proton-Proton Collisions at  $\sqrt{s} = 13$  TeV , *Physical Review Letters* , 2 , 129 , 21802 , 5

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20. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Search for supersymmetry in final states with two or three soft leptons and missing transverse momentum in proton-proton collisions at  $\sqrt{s} = 13$  TeV , *Journal of High Energy Physics* , NA , 4 , 91 , 5

21. Kumar P.; Singh N.; Kumar P.; Verma V. , (2022) , Nanocomposite based hydroelectric cells: Working principle and production of green electrical energy , *Inorganic Chemistry Communications* , NA , 141 , 109515 , 6

22. Lakaal K.; Kria M.; El Hamdaoui J.; Varsha; Prasad V.; Nautiyal V.V.; El-Yadri M.; Pérez L.M.; Laroze D.; Feddi E. , (2022) , Polaronic corrections on magnetization and thermodynamic properties of electron–electron in 2D systems with Rashba spin–orbit coupling , *Journal of Magnetism and Magnetic Materials* , NA , 551 , 169042 , 2

23. Yadav J.; Safvan C.P.; Bhatt P.; Kumari P.; Kumar A.; Rajput J. , (2022) , Hydrogen migration in triply charged acetylene , *Journal of Chemical Physics* , 14 , 156 , 141101 , 2

24. Kumarasamy S.; Srinivasan S.; Gogoi P.B.; Prasad A. , (2022) , Emergence of extreme events in coupled systems with time-dependent interactions , *Communications in Nonlinear Science and Numerical Simulation* , NA , 107 , 106170 , 7

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29. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Identification of hadronic tau lepton decays using a deep neural network , *Journal of Instrumentation* , 7 , 17 , P07023 , 7
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33. Sankaran S.S.; Dhanasekaran R.; Kumar B.; Durairajan A.; Valente M.A.; Devaraj Stephen L. , (2022) , Study on growth, optical and dielectric properties of 'Nd' DOPED NBT-BT (0.94(Na<sub>0.5</sub>Bi<sub>0.5</sub>TiO<sub>3</sub>)-0.06BaTiO<sub>3</sub>) relaxor ferroelectric single crystals , *Journal of Electroceramics* , 3 , 48 , 143 , 0
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36. Arti; Gupta R.; Singh S.P.; Walia R.; Kumar V.; Verma V. , (2022) , Modification in photovoltaic and photocatalytic properties of bismuth ferrites by tailoring band-gap and ferroelectric properties , *Journal of Alloys and Compounds* , NA , 908 , 164602 , 11
37. Dey P.; Negi D.; ...; Kumar S.; ...; Neelam; ... , (2022) , Experimental investigation of high-spin states in Zr 90 , *Physical Review C* , 4 , 105 , 44307 , 2
38. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Observation of  $B^0 \rightarrow \psi(2S)K^0S\pi^+\pi^-$  and  $B^0S \rightarrow \psi(2S)K^0S$  decays , *European Physical Journal C* , 5 , 82 , 499 , 1
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40. Kumar N.; Nomura T.; Okada H. , (2022) , A multi-charged particle model with local U(1)<sub>μ-τ</sub> to explain muon g-2, flavor physics, and possible collider signature \* \* This research was supported by an appointment to the JRG Program at the APCTP through the Science and Technology Promotion Fund and Lottery Fund of the Korean Government , *Chinese Physics C* , 4 , 46 , 43106 , 2
41. Alnajjar M.H.; Kumar B. , (2022) , Comparative investigation on the Di-/ferroelectric and optical properties of Ce/Nd dual doped ZnO nanostructures prepared in different reaction mechanisms , *Physica E: Low-Dimensional Systems and Nanostructures* , NA , 139 , 115110 , 8
42. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Search for heavy resonances decaying to a pair of Lorentz-boosted Higgs bosons in final states with leptons and a bottom quark pair at  $\sqrt{s} = 13$  TeV , *Journal of High Energy Physics* , NA , 5 , 5 , 3
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46. Chakraborty I.; Roy H.; Srivastava T. , (2022) , Resonant leptogenesis in (2,2) inverse see-saw realisation , *Nuclear Physics B* , NA , 979 , 115780 , 3
47. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Search for new physics in the lepton plus missing transverse momentum final state in proton-proton collisions at  $\sqrt{s} = 13$  TeV , *Journal of High Energy Physics* , NA , 7 , 67 , 13
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49. Goswami K.; Luthra M.; Arora A.K.; Bharadvaja A.; Baluja K.L. , (2022) , Electron impact partial ionization cross sections of 1-butanol , *European Physical Journal D* , 5 , 76 , 97 , 4
50. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Observation of the  $B_c^+$  Meson in Pb-Pb and pp Collisions at  $\sqrt{s_{NN}} = 5.02$  TeV and Measurement of its Nuclear Modification Factor , *Physical Review Letters* , 25 , 128 , 252301 , 2
51. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Search for resonances decaying to three W bosons in the hadronic final state in proton-proton collisions at  $\sqrt{s} = 13$  TeV , *Physical Review D* , 1 , 106 , 12002 , 2
52. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Measurement of the inclusive  $t\bar{t}$
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production cross section in proton-proton collisions at  $\sqrt{s} = 5.02$  TeV , *Journal of High Energy Physics* , NA , 4 , 144 , 5

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54. Sirunyan, A.M.; Tumasyan, A.; ...; Bhardwaj, A.; Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...; Ranjan K.; ... , (2022) , Erratum to: Search for new physics in dijet angular distributions using proton-proton collisions at  $s = 13$  TeV and constraints on dark matter and other models (The European Physical Journal C, (2018), 78, 9, (789), 10.1140/epjc/s10052-018-6242-x) , *European Physical Journal* , 4 , 82 , 379 , 0

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58. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Analysis of the CP structure of the Yukawa coupling between the Higgs boson and  $\tau$  leptons in proton-proton collisions at  $\sqrt{s} = 13$  TeV , *Journal of High Energy Physics* , NA , 6 , 12 , 9

59. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Search for resonant production of strongly coupled dark matter in proton-proton collisions at 13 TeV , *Journal of High Energy Physics* , NA , 6 , 156 , 10

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61. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Inclusive nonresonant multilepton probes of new phenomena at  $s = 13$  TeV , *Physical Review D* , 11 , 105 , 112007 , 18
62. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Search for higgsinos decaying to two Higgs bosons and missing transverse momentum in proton-proton collisions at  $\sqrt{s} = 13$  TeV , *Journal of High Energy Physics* , NA , 5 , 14 , 3
63. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Search for a heavy resonance decaying into a top quark and a W boson in the lepton+jets final state at  $\sqrt{s} = 13$  TeV , *Journal of High Energy Physics* , NA , 4 , 48 , 2
64. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , First Search for Exclusive Diphoton Production at High Mass with Tagged Protons in Proton-Proton Collisions at  $s = 13$  TeV , *Physical Review Letters* , 1 , 129 , 11801 , 7
65. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Search for long-lived heavy neutral leptons with displaced vertices in proton-proton collisions at  $\sqrt{s} = 13$  TeV , *Journal of High Energy Physics* , NA , 7 , 81 , 10
66. Borkar H.; Gaikwad V.M.; Choudhary R.J.; Tomar M.; Gupta V.; Kumar A. , (2022) , Flexomagnetic effects on inhomogeneously strained multiferroics composites , *Journal of Magnetism and Magnetic Materials* , NA , 553 , 169274 , 1
67. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Search for electroweak production of charginos and neutralinos in proton-proton collisions at  $\sqrt{s} = 13$  TeV , *Journal of High Energy Physics* , NA , 4 , 147 , 15
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72. Dutta S.; Saini L.K. , (2022) , Limiting heavy-quark and gluonphilic real dark matter , *Physical Review D* , 1 , 106 , 15026 , 0

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100. Rani A.; Mandal S.; Chakraborty K.; Gupta R.; Ahmad C.V.; Parihari A.; Vishwakarma D.; Khandelwal P.; Rawat P.S.; Sherpa P.; Kumar S.; ... , (2022) , Examining the correlation between multi-neutron transfer and inelastic excitations in sub-barrier fusion enhancement , *Physical Review C* , 6 , 106 , 64606 , 2
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103. Kumar R.; Sinha N.; Yadav H.; Kumar B. , (2022) , Hirshfeld surface, etching, mechanical and electrical enhancement analyses of pyramid pattern of Xylenol Orange dye in Triglycine Sulphate single crystals , *Journal of Solid State Chemistry* , NA , 315 , 123498 , 1
104. Tumasyan, A.; Adam, W.; ...; Bhardwaj, A., Choudhary, B.C.; ...Kumar, A.; Naimuddin M.; ...Ranjan K.; ... , (2022) , Search for new particles in an extended Higgs sector with four b quarks in the final state at s=13TeV , *Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics* , NA , 835 , 137566 , 2
105. Khurana S.; Chandra A. , (2022) , Role of modified silica nanoparticles in enhancing the properties of flexible solid electrolytes , *Electrochimica Acta* , NA , 432 , 141197 , 1

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## **(b.) Books/Chapter in Books**

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1. Mishra D. , (2023) , Biomedical applications of perovskite-based materials , *Perovskite Metal Oxides: Synthesis, Properties, and Applications* , Elsevier , 978-032399529-0; 978-032399530-6 , 367-393
  2. Chauhan V.; Vashisht G.; Gupta D.; Kumar S.; Kumar R. , (2023) , Atomic layer deposition of ferrite thin films , *Ferrite Nanostructured Magnetic Materials*:
-

*Technologies and Applications* , Elsevier , 978-012823717-5; 978-012823718-2 , 267-292

3. Nathawat R.; Rathore S.S.; Kharangarh P.R.; Devi R.; Kumari A. , (2023) , Synthesis and application of carbon-based nanocomposite , *Carbon Nanomaterials and their Nanocomposite-Based Chemiresistive Gas Sensors: Applications, Fabrication and Commercialization* , Elsevier , 978-012822837-1 , 169-203

4. Chauhan V.; Saran M.; Yadav J.; Kumar R. , (2023) , Methods for the Development of High-Performance Metallic Nanocomposites , *Nanoparticles Reinforced Metal Nanocomposites: Mechanical Performance and Durability* , Springer Nature , 978-981199729-7, 978-981199728-0 , 89–126

5. Kumar R.; Gautam G.; Yadav N.; Sharma S.; Kumar M. , (2022) , Graphene: A prominent nanomaterial for energy application , *Advances in Nanotechnology, Vol. 27* , Nova Science Publishers , 979-888697183-5; 979-888697171-2 , 83-101

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### **(c.) Journal(s) Published by the Department**

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1. NA,(NA) ,NA , NA , NA , NA , NA

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### **Research Projects**

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1. SERB – DST [Prof. B. C. Choudhary], 2022 (to 2027) , Collaborative Research Project entitled “Indian Participation in the CMS Experiment at CERN: Maintenance, Operation and Upgradation” , 346.00 Lakh

2. SERB – DST [Prof. Kirti Ranjan, Prof. M. Naimuddin] , 2022 (to 2027) , Collaborative Research Project entitled “Indian Participation in the CMS Experiment at CERN: Maintenance, Operation and Upgradation” , 1505.00 Lakh

3. DST [Prof. B.C. Choudhary, Prof. Debajyoti Choudhury, and Prof. Samit K. Mandal] , 2019 (to 2024) , Research Project grant on "Indian Institutions – Fermilab Collaboration in neutrino physics" , 280.00 Lakh

4. DST & Russian Foundation of Basic Research [Prof. D. N. Gupta], 2019 (to 2022) , Research Project entitled "Compact 'Table-top' powerful terahertz source by laser-matter interactions and some applications" , 26.00 Lakh

5. DST [Prof. D. N. Gupta], 2022 (to 2025) , WOSA Project Mentorship entitled

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“Fabrication of anti-microbial textile clothing with cold plasma PVD technology” ,  
36.00 Lakh

6. SERB-DST (CRG) [Prof. D. N. Gupta], 2023 (to 2026), Research Project entitled  
"Exploring quantum electrodynamics plasma at the new laser intensity frontier" ,  
30.00 Lakh

7. IoE, University of Delhi [Prof. D. N. Gupta], 2022 (to 2023), Faculty Research  
Project entitled "Compact electromagnetic radiation source from laser-plasma  
interactions" , 5.00 Lakh

8. IoE, University of Delhi [Prof. Amita Chandra], 2022 (to 2023), Faculty Research  
Project entitled "Polymer composites for EMI shielding and energy devices" , 5.00  
Lakh

9. SERB – DST [Prof. S. Annapoorni], 2023 (to 2028) , Research Project entitled  
"The role of spacer layer in exchange-coupled bi-phased magnetic multilayers and  
nano-composites" , 20.81 Lakh

10. Indo-Japan DST-JSPS [Prof. Shyama Rath], 2021 (to 2023) , Research Project  
entitled “Fingerprinting of point defects in silicon carbide created by energetic  
particles for their relevance in quantum technologies” , 6.86 Lakh

11. SERB – DST [Prof. Shyama Rath], 2021 (to 2024) , Research Project entitled  
"Generation and Assessment of Optically Addressable Point Defects in Silicon  
Carbide for new quantum technologies" , 42.46 Lakh

12. IoE, University of Delhi [Prof. Shyama Rath] , 2022 (to 2023) , Research Project  
entitled “Surface-enhanced Raman scattering for trace-level biological and chemical  
sensing” , 5.00 Lakh

13. SERB – DST [Prof. Samit K Mandal], 2019 (to 2022) , Research Project entitled  
"Multi-nucleon transfer reaction dynamics and its effect on fusion near the Coulomb  
barrier for medium mass nuclei" , 41.75 Lakh

14. SERB – DST [Prof. Debajyoti Choudhury], 2019 (to 2022), Research Project  
entitled "Probing New Physics Interactions", 75.00 Lakh

15. UGC-DAE CSR [Prof. Sevi Murugavel], 2022 (to 2025) , Research Project  
entitled "Singular Structural and Charge Transport Properties of Highly Defective  
Polyanionic Solids” , 1.35 Lakhs

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16. IoE, University of Delhi [Dr. Sourav Sur] , 2022 (to 2023), Faculty Research Project entitled "Unified Cosmic Dark sector from the perspective of Scalar coupled Metric-Torsion Gravity" , 3.20 Lakh
17. SERB – DST (CRG) [Dr. Debabrata Mishra], 2019 (to 2022) , Research Project entitled "To Design and Develop a novel spin controlled chiral quantum dot DNA bio-sensor" , 17.71 Lakh
18. MHRD-DST (IMPRINT 2) [Dr. Debabrata Mishra], 2019 (to 2022), Research Project entitled "Development of spin dependent smart electrode for DNA bio-sensor" , 32.45 Lakh
19. IoE, University of Delhi [Dr. Debabrata Mishra], 2022 (to 2023), Faculty Research Project entitled "Designing and development of spin-based DNA hybridization biosensor by fluorescent spectroscopy and optical technique" , 5.00 Lakh
20. SERB – DST [Dr Sumalay Roy], 2019 (to 2022) , Research Project entitled "Growth of periodic multi-bi-layer structures of high Z metals on the surface of three dimensional topological insulators" , 29.15 Lakh
21. UGC-DAE CSR and RRCAT, Indore, India [Dr Sumalay Roy] , 2022 (to 2025) , Research Project entitled "Magneto-topological insulator interface: Synthesis and structure-property correlation studies" , 1.35 Lakh
22. IoE, University of Delhi [Prof. S. A. Hashmi], 2022 (to 2025), Research Project entitled "Development of eco-friendly sodium-ion storage devices with sustainable carbon electrodes and bio-degradable polymer-based electrolytes" , 27.00 Lakh

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### **Patents Filed/Granted**

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1. NA and NA
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### **Seminars/Conferences organized by the Department**

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1. Ajit K. Mahpatro, Professor, Department of Physics and Astrophysics, DST, International Conference on Electron Microscopy & XLI Annual Meeting of the Electron Microscope Society of India (EMSI - 2023), 10-02-2023
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## **Seminar/Conference Presentations (National/International) by Faculty Members**

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- . "Boundary Quantum Gravity", on June 10, 2023, invited talk at Saha Institute of Nuclear Physics, Kolkata, by Supriya Kar.
  - . "Cosmological Pair(s) in Higher Form Theories", on December 29, 2022, invited talk at National Institute of Science, Education and Research (NISER), Bhubaneswar, by Supriya Kar.
  - . "Boundary Quantum Gravity", on January 5, 2023, invited talk at the Institute of Physics, Bhubaneswar, by Supriya Kar.
  - . "Perspectives of Quantum Gravity", on January 6, 2023, invited talk at Siksha O Anusandhan University, Bhubaneswar, by Supriya Kar.
  - . "Nobel Prize 2020 in Physics: Large and Small Black Holes", on February 28, 2023, (online), invited talk at SBR Govt. Autonomous Women's College, Berhampur, by Supriya Kar.
  - . "Recent Advances in Biosensing Approaches for Screening and Diagnostic Applications" in Continuous Education Programme (CEP), on December 7, 2022, at DIPAS, DRDO, Delhi, by Debabrata Mishra.
  - . "Development of spin-based biosensor using CISS effect", on January 12, 2023, at the seminar on "Sensors for Society, Electrochemical society, India chapter, JNU, Delhi, by Debabrata Mishra.
  - . "Recent Advances in spin-based bio sensing", on February 8, 2023, invited talk at University of Delhi, Delhi, by Debabrata Mishra.
  - . "Prebiotic autocatalytic sets: Possible structure and mechanism of evolution", on July 7, 2022, at Santa Fe Institute; Working Group on Feasible but Undiscovered Metabolisms, Santa Fe Institute, Santa Fe, New Mexico, USA, by Sanjay Jain.
  - . "Microstructural investigations and light-emitting behavior of two-dimensional MoSe<sub>2</sub> and MoS<sub>2</sub> (Invited)", on February 8, 2023, at International Conference on Electron Microscopy, by Shyama Rath.
  - . "Optical spectroscopic characterization of two-dimensional transitional metal dichalcogenides", on December 12, 2022, invited talk at Chungnam National
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University, South Korea, by Shyama Rath.

. "Exploring Shape Coexistence in Mass  $A < 190$  Nuclei with Lifetime Measurements", at the International Nuclear Physics Conference (INPC 2022), Cape Town, South Africa, on September 11, 2022, by Sanjay Kumar Chamoli.

. "RDM Lifetime Measurements @ IUAC, Delhi, India" invited talk at the Heavy Ion Laboratory (HIL), University of Warsaw, Poland, on July 15, 2022, by Sanjay Kumar Chamoli.

. "Random Matrix and Network Analysis of Protein Families", on February 2, 2023, invited talk at Ramanujan Lecture Hall, ICTS Bengaluru, by Nivedita Deo.

. "Tailoring magnetisation switching in magnetic alloy films: Microscopic Investigations", on February 08, 2023, at INTERNATIONAL CONFERENCE ON ELECTRON MICROSCOPY & XLI ANNUAL MEETING OF ELECTRON MICROSCOPE SOCIETY OF INDIA (EMSI-2023), by S. Annapoorni

. "Modelling magnetic switching behaviour induced by thermal annealing and transient electronic excitations of ion beams in magnetic multilayers", on March 2, 2023, at "Radiation Awareness and Detection in Natural Environment" (RADNET-IV), Dolphin, (PG) Institute of Biomedical and Natural Sciences, Dehradun, India, by S. Annapoorni

. "Modern Astronomy - Opportunities in the Era of Big Data", on March 16, 2023, invited talk at DIT University, Dehradun, by H. P. Singh

. "Free energy evolution under loop corrections", on January 16, 2023, at DAE-BRNS workshop on Hadron Physics 2023, NIT, Jalandhar, Punjab, India, by S. Somorendro Singh

. "Unified Cosmic Dark sector from a Mimetic-Metric-Torsion perspective", on December 22, 2022, at the conference on "Beyond Standard Models in Particle Physics and Gravity", IACS, Kolkata, India, by Sourav Sur

. "Mimetic-Metric-Torsion Gravity: Plausible Extensions and Cosmological Implication", on December 27, 2022, invited talk at IACS, Kolkata, India, by Sourav Sur

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**National/International MoUs Signed**

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## Other Inter-Institutional Collaborations

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Collaborating Faculty Members:

- 1) Prof. B. C. Choudhary -- (a) India-CMS Collaboration at CERN, Geneva, Switzerland, (b) NOvA Collaboration, Fermilab, USA.
  - 2) Prof. Kirti Ranjan -- (a) Indo-Italy Collaboration on Detectors, (b) India-CMS Collaboration at CERN, Geneva, Switzerland.
  - 3) Prof. Nivedita Deo -- Institute of Fundamental Studies, Naresuan University, Thailand.
  - 4) Prof. Shyama Rath -- (a) Indian Council for Cultural Relations (ICCR), India, (b) Departamento de Física Atómica, Molecular, Nuclear, Facultad de Física, University of Sevilla, Spain, (c) Physics Department, University of Torino and INFN, Torino, Italy, (d) Department of Physics, University of Surrey, Guildford, Surrey, United Kingdom, (e) Center for Accelerator Science, ANSTO, Australia, (f) Sandia National Laboratories, Radiation-Solid Interactions, Albuquerque, NM, USA, (g) Intl. Atomic Energy Agency, Vienna, Austria, (h) Solid State Physics Lab, DRDO, New Delhi, India, (i) NPL, New Delhi, India, (j) Inter-University Accelerator Centre (IUAC), New Delhi, India, (k) National Chemical Laboratory, Pune, India, (l) Institute of Physics, Bhubaneswar, India.
  - 5) Prof. H. P. Singh -- Indo-US Collaboration with Nodal Institute: Delhi Univ., India.
  - 6) Prof. Samit Kumar Mandal -- (a) FAIR Collaboration, GSI, Germany, (b) Nuclear Physics Research AGATA Collaboration, (c) PRESPEC Collaboration, GSI, Germany, (d) INO Collaboration, India, (e) INGA Collaboration, India.
  - 7) Prof. D. N. Gupta -- Strathclyde University, Glasgow.
  - 8) Prof. Jyoti Rajput -- (a) Inter-University Accelerator Centre (IUAC), New Delhi, India.
  - 9) Prof. Ajit Kumar Mahapatro -- (a) Prof. Y-R Ma and Prof. Y-K Cuo, Department of Physics, National Dong Hwa University, Hualien, Taiwan, (b) Dr. S. P. Singh, NPL, New Delhi, India, (c) Prof. S. Ghosh, JNU, New Delhi, India, (d) Prof. T. Basu, AMITY, Noida, India, (e) Dr. P. Poddar, NCL, Pune, India.
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- 10) Prof. Ashutosh Bhardwaj -- CMS Experiment RD50 Collaboration.
- 11) Dr. Ashok Kumar -- CMS Collaboration.
- 12) Prof. M. Naimuddin -- CMS Collaboration.
- 13) Dr. Sourav Sur -- Prof. Saurya Das, Department of Physics and Astronomy, University of Lethbridge, Alberta, Canada.
- 14) Dr. Sumalay Roy -- UGC-DAE CSR, Indore, India.
- 15) Dr. Sanjeev Kumar Verma -- INO Collaboration, India

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**No. of Students under Exchange Programme**

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Information Not available

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**Placement Details (Number and percentage of students placed)**

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Information Not available (NOT within the purview of the Department)

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**Extension and Outreach Activities**

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VISITOR'S PROGRAM on 13th March 2023 - 9AM to 6PM. For other extension activities, such as the INDIAN SCIENCE CONGRESS ASSOCIATION on the National Science Day, please visit <https://physics.du.ac.in/outreach-extension.php> .

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**Faculty Strength**

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37 + 2 (UGC-FRP) + 2 (INSPIRE FACULTY) [in 2022-23]

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**Number of Ph.D. Degrees Awarded**

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27

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**Number of M.Phil. Degrees Awarded**

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NA

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