Department: Physics and Astronomical Sciences

NAME: Dr Ashish Kumar

DESIGNATION: Associate Professor

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ACADEMIC BACKGROUND:

- PhD (Physics, 2013), Indian Institute of Technology Delhi, New Delhi.
- MSc (Physics, 2007), Kurukshetra University, Kurukshetra.

CAREER GRAPH:

- **Associate Professor**, Central University of Jammu (CUJ), Jammu, India. July 2023– till date.
- **Associate Professor**, University of Petroleum and Energy Studies (UPES), Dehradun India. April 2023 – July 2023.
- **Assistant Professor**, University of Petroleum and Energy Studies (UPES), Dehradun India. April 2021 – March 2023.
- **SERB Research Scientist** (selected among the INSPIRE, Ramanujan & Ramalingam Faculty Fellows), Inter-University Accelerator Centre (IUAC), New Delhi, India. Oct. 2020 – March 2021.
- **DST INSPIRE Faculty**, Inter-University Accelerator Centre (IUAC), New Delhi, India. Aug. 2015– Sept. 2020.
- **Research Associate**, Inter-University Accelerator Centre (IUAC), New Delhi, India. May. 2013 – Aug 2015.

RESEARCH INTERESTS:

Research is focused on applied experimental condensed matter physics and materials science.

- Advance Energy Materials and Devices: Organic and Inorganic thermoelectric generators, perovskites solar cell, photodetectors.
- Flexible printed electronics; 2D materials like graphene, MoS_2, etc.
- Wide bandgap semiconductors (GaN, SiC, Ga_2O_3, ZnO, etc.) based devices like, Schottky devices, HEMT, Photodetectors, High power devices, semiconductor heterostructures.
- Defects characterisation in solids using deep level transient spectroscopy (DLTS), Low-temperature transport properties and 1/f noise measurements;
- Ion-matter interactions: effect and applications of various ions irradiation/implantation in materials; defect microstructures; nanostructures and surface patterning; structural, optical and electrical evolution of defects;
- Development of characterisation facilities: Seebeck & thermal conductivity measurement setup, DLTS, 1/f noise measurement, RT & dielectric, gas sensing,
- Theoretical treatment of thermoelectric properties.

HONOURS AND ACHIEVEMENTS:

- Represented India in 69th Lindau Nobel Laureate Meeting alumni, July 2019.
- ICTP grant to attend Conference on Modern Concepts and New Materials for Thermoelectricity at the ICTP, March 2019.
- DST -IST for visiting Valladolid, Spain, 2017.
- Qualified UGC/CSIR-JRF (two times), GATE 2008, JEST 2008, BARC (OCES/DGFS) 2008.
- Life member of Semiconductor Society of India (SSI), Indian Physics Association (IPA), Ion Beam Society of India (IBSI).

PROFESSIONAL SKILLS

- Professional Experiences:

- Worked at class 100 clean room facility for fabrication of devices.
- Expertise in transport measurement of in micro/nano devices, Low temperature measurements.
- Worked and developed programs in LabView and Test-point environment.

- In-House Facilities Developed:

- Thermal conductivity and ZT measurement setup for bulk samples (300 – 1000 K).
- Seebeck coefficient and Resistivity measurement system for wire, thin film, and bulk samples (LN2 – 650 K).
- In- situ deep level transient spectroscopy (DLTS).
- 1/f Noise measurement (LN2 – 500 K).
- Low temperature dipstick optical cryostat (LN2 – 500 K).

PROFESSIONAL CONTRIBUTIONS (PROJECTS & PUBLICATIONS)

- Sponsored Projects:

- DST INSPIRE Faculty- Defect Assisted Current Transport Mechanism in III-V Semiconductors for Thermoelectric/Energy Applications.
- SERB Research Scientist- All Printed Flexible Organic Thermoelectric Generators
- UPES SEED 2021- Development of Thermoelectric (Seebeck+ Resistivity+ Thermal Conductivity) Characterisation facilities
- UPES SEED 2022- Development of Electrical Characterisation (IV+ CV+ Resistivity +Dielectric) Facilities
- UGC DAE CSR 2022- Defect Evolution in wide band gap materials.

- Recent Publications:

Published more than **50** research papers, **20** conference papers, **4** patents; with ~1000 Citations, h-index 22 and i10-index 30. Developed 4 characterisation facilities, Running 5 funded projects. For complete publication details, visit: **ResearchGate, GoogleScholar, ORCiD , Web of Science, VIDWAN.**

News Articles:

- Defect engineering in wide bandgap materials for thermoelectric applications. Kumar A. Semiconductor Society of India Newsletter, 04/2019, http://www.ssindia.org.in/images/ NewsLetter March2019.pdf
- Passivating GaN with ruthenium (Research review). Compound Semiconductor, p60, Issue-II, Vol 29 (2023).

Referred Journals (selected few):

- Mishra M, Sharan J, Koul V, Kharbanda O P, Kumar A, Sharma A, Hackett T A, Sagar R, Kashyap M K, Gupta G,
  Surface functionalization of gallium nitride for biomedical implant applications
  Applied Surface Science, 612, 155858 (2023).
- Kumar N, Kumar A, Chand F,
  Surface states passivation in GaN single crystal by ruthenium solution
  Applied Physics Letters, 122, 13503 (2023).
- Kumar A, Mukherjee J, Rawal DS, Asokan K, Kanjilal D,
  Trap analysis on Pt-AlGaN/GaN Schottky barrier diode through deep level transient spectroscopy,
  Journal of Semiconductors, 44, 1-6 (2023)
- Pandey R K, Yadav R P, Kumar T, Kumar A, Pathak S, Awasthi S, Singh U B, Pandey AC,
  Fractal characterizations of MeV ion treated CaF_2 thin films,
  Chaos 33, 33110 (2023)
- Dixit H, Boro B, Ghosh S, Paul M, Kumar A, Singh T,
  Assessment of Lead-Free Tin Halide Perovskite Solar Cells Using J–V Hysteresis,
  Physica Status Solidi (a), 2100823 (2022).
- Bhogra A, Masarrat A, Hasina D, Kumar V, Meena R, Kumar A, Som T,
  Understanding the role of structural distortions on the transport properties of Ar ion irradiated SrTiO3 thin films: X-ray absorption investigation,
  Journal of Applied Physics 130 (17), 175102 (2021)
- Singh S., Srivastav SK, Patel A, Kumar A, Chatterjee R, Takeuchi T,
  Enhancement in thermoelectric properties of n-type (La0. 7Sr0. 3MnO3) 0.5.(NiO) 0.5: composite and nano-structure effect,
  Journal of Physics D: Applied Physics 55 (6), 0655032 (2021)
- Bhogra A., Masarrat A., Hasina D., Meena R., Kumar A., Som T., Dong C.L., Chen C.L., Asokan K.,
  Significant role of substrate temperature on the morphology, electronic structure and thermoelectric properties of SrTiO3 films deposited by pulsed laser deposition
  Surface and Coatings Technology 407, 126740 (2021).
- Kumar A., Singh S., Tak B.R., Patel A., Asokan K., Kanjilal D.,
  Wide range temperature-dependent (80-630 K) study of Hall effect and the Seebeck coefficient of B-Ga2O3 single crystals,
  Appl. Phys. Lett. 118, 062102 (2021).
- Kumar A., Singh S., Patel A., Asokan K., Kanjilal D.,
  Thermoelectric properties of GaN with carrier concentration modulation: an

experimental and theoretical investigation,
Phys. Chem. Chem. Phys. 23, 1601-1609 (2021).

- Bhogra A., Masarrat A., Hasina D., Meena R., Kumar A., Som T., Dong C.L., Chen C.L., Asokan K., Defects assisted structural and electrical properties of Ar ion irradiated TiO2/SrTiO3 bilayer
  Materials Letters, 282, 1288801 (2021).
- Singh J., Gupta H., Kumar A., Singh R.G., Singh F.,
  Radiation stability and reliability of Cu–ZnO/P3OT hybrid heterostructures under swift heavy ion irradiations.
  Materials Science in Semiconductor Processing, 108, 104885, (2020).
- Kumar S., Mariswamy V.K., Kumar A., Asokan K., and Krishnaveni S., Enhancement of Electrical Parameters of Ni/n-GaN SBDs under Remote and not In-flux Gamma Irradiation ECS Journal of Solid-State Science and Technology. 9, 093017, (2020).
- Kumar A., Patel A., Singh S., Asokan K. and Kanjilal K., Apparatus for Seebeck coefficient measurement of wire, thin film and bulk materials in the wide temperature range (80 – 650 K),
  Review of Scientific Instruments, 90, 104901, (2019).
- Bhogra A., Masarrat A., Meena R., Hasina D., Chen C.L., Som T., Kumar A., Asokan K.,Tuning the electrical and thermoelectric properties by N ion implantation in SrTiO3 thin films and their conduction mechanisms,
  Scientific Reports, 9 (1), 14486 (2019).
- Sharma C., Visvkarma A.K., Laishram R., Kumar A., Rawal D.S., Vinayak S., Singh R., Effect of γ-ray irradiation on Schottky and ohmic contacts on AlGaN/GaN hetero-structures,
  Microelectronics Reliability, 105, 113565, (2020).
- Kumar P., Sharma V., Singh J.P., Kumar A., Chahal S., Sachdev K., Chae K.H., Kumar A., Asokan K., Kanjilal D., Investigations on magnetic and electrical properties of Zn doped Fe2O3 nanoparticles and their correlation with local electronic structure, Journal of Magnetism and Magnetic Materials, 489, 165398, (2019).
- Neetika, Kumar S., Sanger A., Chourasiya H.K., Kumar A., Asokan K., Chandra R., Malik V.K., Influence of barrier inhomogeneities on transport properties of Pt/MoS2 Schottky barrier junction,
  Journal of Alloys and Compounds, 797, 582-588, (2019).
- Tak B.R., Garg M., Kumar A., Gupta V., Singh R.,
  Gamma irradiation effect on the performance of β-Ga2O3 metal-semiconductor-metal solar-blind photodetectors for space applications, ECS Journal of Solid-State Science and Technology, 8(7), Q3149-Q3153, (2019).
- Masarrat A., Bhogra A., Meena R., Bala M., Singh R., Barwal V., Dong C.L., Chen C.L., Som T., Kumar A., Niazi A., Asokan K.,
  Effect of Fe ion implantation on the thermoelectric properties and electronic structure of CoSb3 thin films, Journal of Alloys and Compounds, 9 (62), 36113, (2019).
- Kumar A., Dhillon J., Verma S., Kumar P., Asokan K., and Kanjilal D., Identification of swift heavy ion induced defects in Pt/n-GaN Schottky diodes by in-situ deep level transient spectroscopy,
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  Journal of Applied Physics, 123, 161539, (2018).
- Kumar S., Kumar A., Tripathi A., Tyagi A., and Avasthi D.K.,
  Engineering of electronic properties of single layer graphene by swift heavy ion irradiation, Journal of Applied Physics, 123, 161533, (2018).
- Kumar A., Dhillon J., Meena R.C., Kumar P., Asokan K., Singh R., and Kanjilal D.,
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  Nanoscale Research Letter, 8 (1), 336, (2013).

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- Kumar A., Hähnel A., Kanjilal D., Singh R., Electrical and microstructural analysis of 200 MeV Ag14+ ion irradiated Ni/GaN Schottky barrier diode, Applied Physics Letters, 101 (15), 153508, (2012).
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