

Curriculum Vitae

Prof. Bhupendra Nath Dev

My research involves mostly experiment, and some theory as required for understanding my experimental results. During my doctoral work, in addition to my experiments in surface physics, I developed a theoretical cluster approach to surface physics using quantum chemical techniques to investigate surface structure and properties. Later, with my doctoral students, I developed (i) the theory of X-ray interactions with multilayers and generation of X-ray standing waves, (ii) simulations of physical processes leading to growth of fractal structures and (iii) simulation of electronic structure for low dimensional structures in the dimensional crossover regimes.

I initiated research in surface science involving clean surfaces, which can be achieved only under ultrahigh vacuum (UHV) condition, at Institute of Physics (IOP), Bhubaneswar. I also designed the world's smallest molecular beam epitaxy (MBE) facility, which allows contamination-free growth of epitaxial layers and self-organized epitaxial nanostructures and quantum structures on clean surfaces of single crystals. This smallest MBE facility has now become a commercial product of Omicron Nanotechnology, Germany. We started this research programme in 2001, the year the vision document "Physics in a New Era: An overview" was released by the National Research Council, USA, identifying "developing quantum technologies" as a thrust area. MBE happens to be the main tool for materials growth in this area.

At IOP I developed several state of the art experimental facilities since 1990, which are either one of its kind or the first of its kind in India. One of these facilities, a general purpose ion scattering experimental facility, has been used by over 40 user groups from all over India. With one Ph.D. student I developed the first ion microbeam facility in India (in collaboration with my alma mater State University of New York at Albany, New York) as well as the only UHV surface physics experimental facility, including ion scattering techniques, in India. With two doctoral students I set up the only X-ray standing wave experimental facility in India.

In semiconductor industry, copper was usually used as an electrical contact material on silicon. However, interdiffusion across the Cu/Si interface degrades semiconductor devices. To avoid this problem micrometer thick TiN films were used at the Cu/Si interface as a conducting diffusion barrier. By Rutherford backscattering spectrometry (RBS) experiments we demonstrated how as thin as a 6 nm TiN layer at the interface [Cu/TiN/Si] can effectively prevent interdiffusion. By RBS/channeling we extensively investigated defects in buried epitaxial layers, for example, epitaxial CoSi_2 buried in Si [Si/CoSi₂/Si]. Such structures are used in modern electronics, e.g. permeable base transistors.

For self-organized epitaxial structures, shape transition was proposed as a means to obtain self-organized quantum wires. This theoretical work came from IBM in 1993. In 1995 we published the first experimental results on shape transition for self-organized epitaxial structures. More recently, for self-organized endotaxial structures, we have demonstrated for the first time a nanodot to nanowire shape transition.

We developed a theory of interaction of X-rays with multilayers and the generation of standing waves of X-rays (XSW). We then verified the predictions of this theory by carrying out experiments with the XSW experimental facility that we set up in our laboratory. Using this combined theory and experiment, we then showed that atomic movement or displacement in multilayers could be determined with an extremely high precision of about 0.2 nanometer (or equivalent to an interatomic distance). We then showed how this technique helped in understanding an ion-irradiation-induced nonmagnetic to ferromagnetic transformation phenomenon in a multilayer system.

When I moved to Indian Association for the Cultivation of Science (IACS), Kolkata, we set up an all UHV interconnected MBE-STM-PEEM system (STM: scanning tunneling microscopy, PEEM: photoemission electron microscopy). This is also the only facility of its kind in India. Using PEEM we developed a new method for the determination of lateral diffusion coefficient in nanoscale structures. This was chosen as 'result of the month' by Omicron Nanotechnology. A figure from this work of ours also appeared in Omicron Nanotechnology 2013 calendar along with their ten other choices from USA, Japan and European laboratories. With the MBE-STM facility we fabricated and investigated low dimensional quantum structures including structures in the dimensional crossover regimes. We explained their electronic structure and transport with our own theoretical work.

Cobalt metal is known to be ferromagnetic. We have discovered a superdense (density about 1.4 times the normal density) nonmagnetic phase of cobalt. There was a theoretical prediction of this superdense nonmagnetic phase of cobalt. We have given the first experimental evidence of this phase. Moreover, over a century after the discovery of the phenomenon of superconductivity, we discovered superconductivity in cobalt.

I carried out several bilateral research collaborations as principal investigator, such as, Indo-US (Office of Naval Research Grant, USA), Indo-German (through the Department of Atomic Energy, Government of India) and Indo-Japan (through the Department of Science and Technology, Government of India). I have just completed a Rs. 10.40 crore (about \$ 1.7 M) project on "quantum structures".

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DESIGNATION: VISITING PROFESSOR

ADDRESS FOR CORRESPONDENCE :

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Residence:

GD-83, Sector III, Salt Lake City, Kolkata 700106. &

A-67, IIT Kharagpur Campus, Kharagpur 721302

PERSONAL DATA:

Nationality: Indian

Date of birth: 15.11.1953

Sex: Male

Marital status: Married

ACADEMIC BACKGROUND :

[1] Sept 1980 - May 1985 : Doctor of Philosophy, Physics,
State University of New York at Albany, N.Y., U.S.A.

[Doctoral research with Prof. Walter M Gibson (deceased) (experiment) & Prof. Tara P
Das (theory)]

[2] Sept 1977 - June 1978 : Post M.Sc., Solid State Stream,
S.I.N.P, Calcutta, India, Associate of Saha Institute of Nuclear Physics.

[3] March 1977: Master of Science, Physics (First Class)
Rajshahi University, Bangladesh

[4] May 1975 : Bachelor of Science (Honours)(1st class)
Rajshahi University, Bangladesh

AWARDS and HONOURS:

1985 Presidential Distinguished Doctoral Dissertation Award,
State University of New York at Albany. N.Y., U.S.A.

2003 MRSI Medal of Materials Research Society of India

2005 Marie Curie International Fellow of European Union

2005 Elected Fellow of the Indian Academy of Sciences
2007 Elected Fellow of the West Bengal Academy of Science and Technology
2009 DAE-Raja Ramanna Prize in Physics of Jawaharlal Nehru Centre for Advanced Scientific Research
2010 International Alumni Award for Exceptional Achievement
State University of New York at Albany. N.Y. U.S.A.
2011 Elected Fellow of the National Academy of Sciences, India
2012 S. P. Sengupta Memorial Lecture of Materials Research Society of India, Kolkata Chapter.
2015- 2016 MRSI Distinguished Lectureship Award, Materials Research Society of India
2015 Anil Kumar Memorial Lecture, Indian Institute of Science, Bangalore, India

FIELD OF RESEARCH: Surface Science and Nanoscale science

Service on International Journals:

- [i] Member of the Advisory Editorial Board of *Applied Surface Science* (a North-Holland, Elsevier Science Journal, The Netherlands). (1999 -)
- [ii] Member of the Board of Editors of *Indian Journal of Physics* (2008 -)
- [iii] Member of the Advisory Editorial Board of *Nuclear Instruments and Methods in Physics Research B* (an Elsevier Science journal) (2009 – 2014)
- [iv] Member of the Editorial Board of *Pramana – journal of physics* (2015-)

National and International Refereeing, Reviewing and Assessment:

- [i] Project Reviewer of Research Grants Council, Hong Kong. (1999 - present)
- [ii] Member of the Program Advisory Committee on Condensed Matter Physics and Materials Science, Department of Science and Technology (DST), Government of India. (1997 - 2000)
- [iii] Chairman and Member of DST Project Monitoring Committees. (1997 - 2000).
- [iv] Reviewer of research proposals submitted to DST, CSIR, BRNS, Govt. of India.
- [v] Referee for several international and national journals.
- [vi] Member of the Accelerator Users' Committee of Nuclear Science Centre, New Delhi (An Inter University Centre of UGC), (2002 - 2004).
- [vii] Reviewed a book series proposal from Elsevier Science, The Netherlands, entitled "Recent Advances in Electronic Structures and Properties of Atomic, Molecular, Condensed Matter and Biological Systems".
- [viii] Member of the National Committee for Utilization of Indus Rings (NCUIR), (9/2004 - present).
- [ix] Member of the Expert Committee on Nano Science and Technology Initiative (NSTI) of Department of Science and Technology (DST), Govt. of India (2004- 2007).

- [x] Member of the International Programme Committee of the "31st International Conference on Micro- and Nano-Engineering", 19-22 September, 2005, Vienna, Austria.
- [xi] Member of the International Programme Committee of the "32nd International Conference on Micro- and Nano-Engineering", 17-20 September, 2006, Barcelona, Spain.
- [xii] Member of the Expert Committee on Review of Accelerators, Department of Science and Technology, Government of India (2009 -)
- [xiii] Member of the International Committee of the International Conference on Atomic Collisions in Solids (ICACS) (Elected for a term of 10 years, 2010 - 2020)
- [xiv] Member of University Grants Commission SAP Advisory Committee, Tezpur University (2012- 2015)
- [xv] Member of the Board of Professional Studies in Nanotechnology, North-Eastern Hill University (2013 –)
- [xvi] Member of the Scientific Advisory Committee, UGC-DAE Consortium for Scientific Research, Indore (2015 –)
- [xvii] Member of the Programme Advisory Committee on Physics and Astrophysics, Department of Science and Technology, Govt. of India (2016 –)

Expertise in Experimental Techniques:

X-ray diffraction (XRD), X-ray standing wave (XSW) and reflectometry (XRR) with extensive use of synchrotron radiation, Neutron scattering, Ion scattering (RBS and channeling), Ion implantation and irradiation, Molecular beam epitaxy (MBE), UHV low temperature scanning tunneling microscopy (STM) and spectroscopy (STS), X-ray photoelectron spectroscopy (XPS), Photoemission electron microscopy (PEEM), Spin-polarized low energy electron microscopy (SPLEEM), Low energy electron diffraction (LEED), Reflection high energy electron diffraction (RHEED), Auger electron spectroscopy (AES).

EMPLOYMENT HISTORY:

- Tata Institute of Fundamental Research, Bombay, India
Senior Scientific Assistant 7/78-8/80
- State University of New York at Albany, Albany, N. Y., U. S. A.
Teaching Assistant 9/80-12/81
- State University of New York at Albany, Albany, N. Y., U. S. A.
Research Assistant 1/82-5/85
- Deutsches Elektronen synchrotron DESY, Hamburg, Germany,
Guest Scientist 6/85 -9/88
- Institute of Physics, Bhubaneswar, India.,
Senior Lecturer 10/88-1/92
Asst. Professor 2/92-1/98

Assoc. Professor 2/98-7/2004
Professor 8/2004- 6/2006
Indian Association for the Cultivation of Science, Kolkata, India
Adjunct Professor 2/2005 – 6/2006
Indian Association for the Cultivation of Science, Kolkata, India
Senior Professor 06/2006 – 11/2017
Indian Institute of Technology Kharagpur, Kharagpur, India
Visiting Professor 12/2017 -

Research Guidance:

No. of Ph.D. thesis supervised : 21

Teaching:

- [i] State University of New York at Albany, U.S.A.
Teaching Assistant (Teaching at the Bachelor level, Laboratory)
- [ii] Institute of Physics, Bhubaneswar (1989 - 2006)
Post-M.Sc./Predoctoral Teaching (Core courses: Condensed Matter Physics, Experimental Physics; Special Courses: X-ray Scattering, Surface Physics).
- [iii] Indian Association for the Cultivation of Science, Kolkata (2006-)
Course on Materials Science, Nanoscale Science to Research Scholars.
- [v] Refresher courses at
Calcutta University, Jadavpur University, Manipur University
NERIST, Itanagar
- [vi] Microcredit course offered in IIT Kharagpur (2016 – 2017)
- [vii] Indian Institute of Technology Kharagpur (2017 -)

International Collaborations (as principal investigator):

- (i) Indo-German bilateral collaboration with Hamburg Synchrotron Radiation Laboratory (HASYLAB) at DESY, Hamburg, Germany (Physics-25). (1990-2002) .
- (ii) Indo-US collaboration with State University of New York at Albany, New York, U.S.A. Grantee: Office of Naval Research, U.S.A. Grant No.N00014-95-1-0130. (1995-2006)
- (iii) Indo-Japan (DST-JST) collaborative research programme with Osaka Electro-Communication University (2009- 2012)

Visits Abroad, Lectures, Seminars:

Long visits:

- [1] Hamburg Synchrotron Radiation Laboratory (HASYLAB) at DESY, Hamburg, Germany. (November 1995 - November 1996), Guest Scientist
- [2] Helmholtz Center Dresden-Rossendorf, Dresden, Germany
EU Guest Scientist (Marie Curie International Fellow of European Union)
(April 2005 - March 2006)

Short visits and seminars:

- 1990 : State University of New York at Albany (SUNYA), New York, U.S.A.
HASYLAB at DESY, Hamburg, Germany
- 1992: HASYLAB at DESY, Hamburg, Germany
- 1994: Naval Research Laboratory, Washington DC, U.S.A.
SUNY at Albany, New York, USA
- 1996: University of Osnabrueck, Osnabrueck, Germany
Max-Planck Institute for Polymer Research, Mainz, Germany
- 1997: University of Maryland, College Park, U.S.A.
National Institute of Standards and Technology (NIST), U.S.A.
Argonne National Laboratory, Argonne, U.S.A.
SUNY at Albany, New York, U.S.A.
- 1999: Ecole Polytechnique, Paris, France
Research Centre Dresden-Rossendorf, Dresden, Germany
- 2000: HASYLAB at DESY, Hamburg, Germany
- 2002: National University of Singapore, Singapore
Brookhaven National Laboratory, U.S.A.
State University of New York at Albany, U.S.A.
Paul-Drude Institute, Berlin, Germany
University of Bremen, Germany
HASYLAB at DESY, Hamburg, Germany
- 2003: Argonne National Laboratory, Argonne, U.S.A.
- 2005: Institute of Solid State and Materials Science, Dresden, Germany
Technical University Chemnitz, Chemnitz, Germany
European Synchrotron Radiation Facility (ESRF), Grenoble, France
State University of New York at Albany, Albany, USA
- 2006: Max-Planck Institute for Metal Research, Stuttgart, Germany
University of Leipzig, Leipzig, Germany
University of Bremen, Bremen, Germany
CRMCN - CNRS, University of Marseille, Marseille, France
Humboldt University, Berlin, Germany
Hahn-Meitner Institute, Berlin, Germany

- University of Uppsala, Uppsala, Sweden
- 2007: Research Centre Dresden-Rossendorf, Dresden, Germany
- 2008: Max-Planck Institute for Microstructure Physics, Halle, Germany
Research Centre Dresden-Rossendorf, Dresden, Germany
National University of Singapore
National University of Singapore, Singapore
- 2009 Kurchatov Institute, Moscow, Russia
Osaka Electro-Communication University, Osaka, Japan
- 2010 State University of New York at Albany, Albany, USA
Brookhaven National Laboratory, USA
Northwestern University, Evanston, USA
Argonne National Laboratory, USA
Michigan State University, East Lansing, USA
- 2012 Osaka Electro-Communication University, Osaka, Japan
Leibniz Institute of Surface Modification, Leipzig, Germany
Max-Planck Institute for Microstructure Physics, Halle, Germany
Osaka Electro-Communication University, Osaka, Japan
Tokyo University, Japan
- 2013 Kurchatov Institute, Moscow, Russia
University of Texas at Austin, USA
- 2014 Helmholtz Centre Dresden-Rossendorf, Dresden, Germany
Brookhaven National Laboratory, Upton, N.Y., USA
University of North Texas, Denton, Texas, USA
- 2015 Rajshahi University, Rajshahi, Bangladesh
Fudan University, Shanghai, China
Hong Kong University of Science and Technology, Hong Kong, China
Institute of Atomic and Molecular Sciences, Taipei, Taiwan
- 2016 University of Electronic Science and Technology of China, Chengdu, China
Tsinghua University, Beijing, China
- 2017 Fudan University, Shanghai, China
- 2018 Tokyo Institute of Technology, Tokyo, Japan

Invited Talks in International Conferences, Workshops and Schools:

- [1] X-ray standing waves in noncentrosymmetric crystals and the phase problem in crystallography, International Conference on Anomalous Scattering, August 17 - 21, 1992, Malente/Hamburg, Germany.
- [2] X-ray standing waves as a tool to study periodic structures, Third International School and Symposium on Synchrotron Radiation in Natural Science, May 31 - June 8, 1996, Jaszowiec, Poland.
- [3] Structural and phase transition studies of layered materials by X-ray standing waves, 17th International Conference on X-ray and Inner-Shell Processes, September 9 -13, 1996, Hamburg, Germany.

- [4] Coherent beam and the resonant enhancement of x-rays in thin films, International Workshop on X-ray Free Electron Laser Applications, September 16-17, 1996, Hamburg, Germany.
- [5] X-ray standing wave studies on crystalline materials using synchrotron radiation, International School on Powder Diffraction, October 7-10, 1998, Calcutta, India.
- [6] Surface modification in ion-solid interactions, The 5th IUMRS International Conference in Asia, October 13-16, 1998, Bangalore, India,.
- [7] High resolution X-ray diffraction and X-ray standing waves, India-Italy Workshop on Utilization of ELETTRA Synchrotron, November 10-13, 1998, Calcutta, India.
- [8] Materials modifications in heavy ion interactions with single crystals and their ion beam characterization, International Conference on Swift Heavy Ions in Materials Engineering and Characterization, October 19-22, 1998, New Delhi, India.
- [9] High resolution X-ray diffraction and X-ray standing waves in condensed matter physics, International Workshop on Recent Advances in Scattering Studies in Condensed Matter Physics, Nov. 28-Dec. 4, 1999, Coorg, India.
- [10] Characterization of microstructures formed on MeV ion irradiated Ag films on Si(111) surfaces, 7th International Conference on Nuclear Microprobe Technology and Applications, 10-15 September, 2000, Bordeaux, France.
- [11] Interface modification and characterization by ion beams and synchrotron radiation, The Third International Conference on Synchrotron Radiation in Materials Science, January 21-24, 2002, Singapore.
- [12] Layered synthetic microstructures: Importance of a combined X-ray standing wave and X-ray reflectometric analysis, International Conference on Physics at Surfaces and Interfaces, March 4-8, 2002, Puri, India.
- [13] Ion beam analysis of surfaces, interfaces and epilayers, 20th International Conference on Atomic Collisions in Solids, January 19-24, 2003, Puri, India.
- [14] Synchrotron X-radiation in studies of layered and self-assembled structures, Indo-US Workshop on Radiation Physics with Synchrotron and Other New Sources, May 14-16, 2003, Argonne National Lab., USA.
- [15] Novel growth of Ag islands on Si(111) by molecular beam epitaxy: Plateaus with atomic-scale preferred heights, Indo-US Workshop on Nanoscale Materials: From Science to Technology, April 5-8, 2004, Puri, India.
- [16] Nanoscale self-affine surface smoothing by ion bombardment and the morphology of nanostructures grown on ion-bombarded surfaces, 21st International Conference on Atomic Collisions in Solids (ICACS21), July 4-9, 2004, Genoa, Italy.
- [17] Epitaxial self-assembled nanostructures on silicon, International Conference on Nanomaterials: Synthesis, Characterization and Application, November 4-6, 2004, Kolkata, India.
- [18] Epitaxial quantum dot structures on silicon and single-electron tunneling effects, Indo-US Workshop on Collaborations and Networking, December 19-21, 2004, NCL Pune, India.
- [19] Nonmagnetic to magnetic nanostructures via ion irradiation, 31st International Conference on Micro- and Nano-Engineering, Vienna, Austria, 19-22 September, 2005.
- [20] Nanoscience: Experiences of a Marie Curie Researcher in India, US and Europe, (Plenary Talk) in "European Marie Curie Conference 2005", Tuscany (Pisa/Livorno), Italy, 28-30 September, 2005.

- [21] Marie Curie Incoming International Fellowship: Experiences and views of a Fellow, (Invited Panelist) in "The international dimension of the 'Europe of knowledge': A common interest of Europe and to the world", Brussels, Belgium, 5-7 October, 2005.
- [22] Detecting atomic migration with sub-nanometer precision and understanding magnetism in a multilayer, 10th International Conference on Advanced Materials (IUMRS-ICAM 2007), Bangalore, India, October 8 – 13, 2007
- [23] Transforming a nonmagnetic system into a ferromagnetic system and vice versa by ion irradiation, 3rd Indo-Japan Conference on Ferroics and Multiferroics, Kolkata, India, February 4–6, 2008.
- [24] Magnetic transformations due to ion beam induced defects and atomic migration, Plenary talk at the 23rd International Conference on Atomic Collisions in Solids (ICACS23), Hans Merensky Estate, Phalaborwa, South Africa, August 17-22, 2008.
- [25] Ion-beam induced surface topography, Tutorial talk at the 23rd International Conference on Atomic Collisions in Solids (ICACS23), Hans Merensky Estate, Phalaborwa, South Africa, August 17-22, 2008.
- [26] Cross-over behaviour in electrical response in swift heavy ion irradiated copper-oxide/copper thin film systems, 16th International Conference on Ion Beam Modification of Materials, Dresden, Germany, August 31 – September 05, 2008.
- [27] Modification and patterning of nanostructures by ion beam, In AsiaNANO 2008 (The 2008 Asian Conference on Nanoscience and Nanotechnology), Biopolis, Singapore, November 3-7, 2008
- [29] Magnetic exchange bias and its ion beam induced enhancement in a Nanoscale Si/Co/Si system. Plenary Talk in the 19th International Conference on Ion-Surface Interactions, Zvenigorod, Russia, August 21-25, 2009
- [30] Magnetic exchange bias modification by ion irradiation, 6th International Conference on Magnetism, Superconductivity and Phase Transitions in Novel and Complex Materials, Kolkata, India, November 11-14, 2009.
- [31] Application of X-ray standing waves and photoemission electron microscopy in condensed matter systems, Indo-Italian Workshop on Applications of Synchrotron Radiation to Condensed Matter Problems: Basic and Applied Research, Bangalore, India, 23-25 November, 2009.
- [32] Ion irradiation induced evolution of magnetic behaviour in nanoscale layered systems, International Conference on Advanced Nanomaterials and Nanotechnology, Guwahati, India, December 9-11, 2009.
- [33] Diffusion in nanoscale doped semiconductors, Fifteenth International Workshop on Physics of Semiconductor Devices, New Delhi, India, December 15-19, 2009.
- [34] Lateral straggling and its influence on lateral diffusion in implantation with a focused ion beam, 24th International Conference on Atomic Collisions in Solids, Krakow, Poland, July 18-23, 2010.
- [35] Lateral diffusion in nanostructures fabricated by focused ion beams, 21st International Conference on the Application of Accelerators in Research and Industry, Fort Worth, USA, August 8-13, 2010.
- [35] Epitaxial nanostructures on surfaces: Electronic and magnetic behaviour, International Conference on Fundamental and Applications of Nanoscience & Technology, Kolkata, India, December 9-11, 2010.

- [36] Nanoscale doping of semiconductors and the role of lateral dopant diffusion, International Symposium on Advances in Nanomaterials, Kolkata, India, December 6-7, 2010.
- [37] Quantum size effects in electronic and magnetic behaviour in epitaxial nanostructures, 8th International Symposium on Atomic Level Characterizations for New Materials and Devices, Seoul, Republic of Korea, May 22-27, 2011.
- [38] Electronic density of states at Fermi level in the extreme two dimensional limit, International Symposium on Clusters, Cluster Assemblies and Nano-scale Materials, Harish-Chandra Research Institute, Allahabad, Nov. 28- Dec. 01, 2011
- [39] Physical phenomena in atomic scale thin films, International Conference on Theoretical and Applied Physics (ICTAP), IIT Kharagpur, 1-3 December, 2011
- [40] Magnetic domains in thin Co films on Si with a buffer layer: A spin polarized low energy electron microscopy investigation, International Workshop on “Novel Development of Magnetic Microscopy and Smart Spintronics Materials”, Osaka, Japan, 17-18 January, 2012
- [41] Electronic structure and transport in ultrathin films near the two-dimensional limit, International Conference on Thin Films and Applications, SASTRA University, Thanjavur, 15-17 March, 2012
- [42] X-ray standing wave analysis of ion irradiated multilayers: correlation between nanostructure and properties, 12th International Conference on Surface X-ray and Neutron Scattering, Kolkata, India, 25-28 July, 2012
- [43] Electronic structure and transport in ultrathin films near the two dimensional limit, Kolkata-Moscow Symposium, Kolkata (22-23 January, 2013)
- [44] Spontaneous formation of quantum wires via shape transition in epitaxial and endotaxial growth, 6th India Singapore Joint Physics Symposium on Physics of Advanced Materials 2013, 25-27 February, 2013, IIT Kharagpur
- [45] Photoemission electron microscopy and other low energy electron microscopies for surface and near- surface investigations. International Conference on Electron Microscopy, EMSI 2013, Kolkata, India 03 – 05 July, 2013
- [46] Ion irradiation and implantation effects in multilayer and multistripe systems. 21st International Conference on Ion-Surface Interactions (ISI-2013), Yaroslavl, Russia. 22 – 26 August, 2013
- [47] Evolution of electronic structure and transport properties of ultrathin films near the 2-D limit. ACCMS-VO8, Tohoku University, Sendai and Matsushima, Japan, 7-9 November, 2013
- [48] Electronic structure and transport in atomic layer thin films in the 2D to 3D crossover regime 9th International Symposium on Atomic Level Characterization for New Materials and Devices '13 (ALC'13), The Big Island, Hawaii, USA, 02-06 December, 2013
- [49] Self-organized epitaxial nanostructures on silicon surfaces International Conference in Asia (IUMRS-ICA2013), Bangalore, 16-20 December, 2013

- [50] Surface science: An introduction (Tutorial)
The 3rd International Conference on Physics at Surfaces and Interfaces (PSI 2014), Puri, India, 24-28 February, 2014
- [51] Towards tunable properties via structures in the lower dimensional crossover regimes.
The 3rd International Conference on Physics at Surfaces and Interfaces (PSI 2014), Puri, India, 24-28 February, 2014
- [52] A spin-polarized low energy electron microscopic investigation of magnetic domains in thin Co films on Si with a buffer layer
International Conference on Spin Physics and Nanomagnetism, Max-Planck Institute of Microstructure Physics, Halle, Germany, 10-13 July, 2014
- [53] Engineering quantum structures at surfaces
International Conference on Emerging Materials: Characterization and Application, Kolkata, India, 4 – 6 December, 2014 (Plenary lecture)
- [54] Electronic structure and transport in low dimensional structures in the dimensional crossover regimes,
8th India-Singapore Symposium in Condensed Matter Physics, IIT Kanpur, 25-27 February, 2015
- [55] Quantum phenomena in nanostructures
International Conference on Advances in Physics, Rajshahi, Bangladesh, 18-19 April, 2015 (Plenary lecture)
- [56] Surfactant role of Ag in an effort to grow germanene on a Si(111)/Ge($\sqrt{3}\times\sqrt{3}$)-Ag substrate,
International Conference on Applied Surface Science, Shanghai, China
27-30 July, 2015
- [57] Phenomena in self-organized epitaxial nanostructure growth and structures in the dimensional crossover regimes,
EMN (Energy Materials Nanotechnology) Meeting, Hong Kong, 09-12 December, 2015
- [58] Growth of epitaxial nanowires using substrate symmetry as well as by symmetry breaking,
EMN Meeting on Nanowires (Energy, Materials, Nanotechnology), Amsterdam, Netherlands, 16 – 19 May, 2016
- [59] Self-organized epitaxial quantum dots on Si, single electron tunneling and quantum capacitance,
International Frontier Forum on Quantum Information 2016, Chengdu, China, 17 – 19 June, 2016
- [60] Ion fluence dependent oscillatory amorphization and recrystallization,
27th International Conference on Atomic Collisions in Solids, Lanzhou, China, 24 – 29 July, 2016
- [61] Epitaxial, endotaxial and polycrystalline transition metal silicide nanostructures on silicon,
Third International Conference on Emerging Electronics (ICEE 2016), IIT Bombay, 27 – 30 December, 2016
- [62] Self-organized epitaxial metal silicide nanostructures on silicon surfaces,
The 3rd International Conference on Surface and Interface of Materials (SIM2017), Bangkok, Thailand, 3 – 5 January, 2017

- [63] Nanoscale transition metal silicides in nanoelectronics, International Conference on Advances in Functional Materials (ICAFM2017), Chennai, India, 6-8 January, 2017
- [64] Emerging materials and novel phenomena in thin films, The 2nd International Conference on Emerging Materials: Characterization and Application (EMCA 2017), NIT Durgapur, India, 15-17 March, 2017
- [65] Materials and issues in miniaturization in silicon technology towards quantum computers, 1st International Conference on Electronics, Materials Engineering and Nanotechnology (IEMENTech 2017), Kolkata, India, 28 -29 April, 2017
- [66] Superdense nonmagnetic cobalt, The 9th International Conference on Materials for Advanced Technologies (ICMAT 2017), Singapore, 18 – 23 June, 2017
- [67] Electronic structure of atomic- and nanoscale structures in the dimensional crossover regimes, BIT's 1st Annual Conference of Quantum World 2017 (CQW 2017), Changsha, China, 16 – 18 October, 2017
- [68] Superconductivity in cobalt thin films, 17th International Conference on Thin Films 2017 (ICTF 2017), Delhi, India, 14 -17 November, 2017
- [69] Endotaxial silicide nanostructures on silicon and growth induced surface reconstruction, Indo-US Discussion Meeting on Surfaces and Interfaces, Kolkata, India, 02 – 04 January, 2018

Invited talks in national conferences/symposia/workshops:

- [1] Application of X-ray standing waves to the structural determination of the adsorbate covered crystal surfaces, Solid State Physics Symposium of DAE (India), Dec. 27-30, 1985, Nagpur, India.
- [2] Structure-property relation in surfaces and interfaces, XXI National Seminar on Crystallography, Dec. 27-29, 1989, Bombay, India .
- [3] Structural investigations of epitaxial interfaces, DAE Solid State Physics Symposium, Dec. 21-24, 1991, Varanasi, India.
- [4] Surface and interface studies with X-ray standing waves, National Conference on Science and Technology of Surfaces and Interfaces, Dec. 16-18, 1996, Kharagpur, India.
- [5] Strain relaxation, self-organization and defects in epitaxial growth, DAE Solid State Physics Symposium, Dec. 27 -31, 1997, Cochin, India.
- [6] Institute of Physics 3 MV 9SDH-2 Pelletron: Present status, Conference on Physics and Technology of Accelerators, February 10-13, 1998, Calcutta, India.
- [7] Multilayers characterization by X-ray standing waves, Workshop on Interface Engineering by Energetic Heavy Ions, April 3-4, 2000, IIT, Kanpur.
- [8] Multidisciplinary research at the 3 MV ion accelerator centre at IOP, DAE Solid State Physics Symposium, December 27 - 31, 2000, Bilashpur.

- [9] The ion microbeam facility in Bhubaneswar, Conference on Accelerator based research in basic and applied sciences, February 25-27, 2001, New Delhi.
- [10] Nanostructured multilayers - microstructures and ion beam induced effects, Symposium on New Developments in Materials: Nanomaterials and Manganites, March 2-3, 2001, New Delhi.
- [11] Ion beam characterization of thin films, Indian Vacuum Society Symposium, September 5-7, 2001, Bangalore.
- [12] Surface and interface phenomena and self-assembled nanostructures. (2003 MRSI Medal Lecture) 14th Annual General Meeting of Materials Research Society of India, 11-13 February, 2003, BARC, Mumbai.
- [13] Ion beam analysis and modifications of surfaces, interfaces and layered materials. Workshop on Utilization of Energetic Ion Beams for Materials Research, July 29-31, 2003, Kalpakkam.
- [14] Growth of self-assembled nanostructures by molecular beam epitaxy and their characterizations by scanning tunneling microscopy and spectroscopy. INAE conference on Nanotechnology (ICON-2003), December 22-23, 2003, Chandigarh. (with a large international participation)
- [15] MBE-grown self-assembled nanostructures and single-electron tunneling, MRSI Symposium on Nano and Biotechnology, August 7, 2004, Kharagpur.
- [16] Self-assembled nanostructures on silicon: Growth and quantum phenomena, National Conference on Current Trends in Condensed Matter Research, September 20-22, 2004. Kakatiya University, Warangal.
- [17] Epitaxial structures on single crystal surfaces, 54th DAE Solid State Physics Symposium, Vadodara, December 14-18, 2009.
- [18] Morphology and electronic structure of surface-based epitaxial nanostructures, Condensed Matter Days: Symposium on Condensed Matter Physics, Kalyani, August 25-27, 2010.
- [19] Quantum size effect in electronic and magnetic behaviour in epitaxial nanostructures, Current Trends in Condensed Matter Physics, Bhubaneswar, December 15-19, 2010.
- [20] Science at the atomic scale, National Conference on Recent Advances in Condensed Matter Physics, Aligarh, March 14-15, 2011.
- [21] Nanoscale structures towards future information and communication technologies. DST TIFAC Meeting – Vision 2035, Bose Institute, Kolkata, 6 June, 2011
- [22] Ion beams - a versatile tool for materials modification, Recent Advances in Mechanics and their Application in Nano Engineering and Technology, Itanagar, 1-12 August, 2011
- [23] Magnetism in ultrathin layers and ion beam induced effects National School cum Workshop on Magnetic Phase Transitions and Transformations, UGC-DAE CSR and Jadavpur University, Kolkata, 3-9 August, 2011
- [24] Ordered self-organization and fabrication of nanostructures by ion beams. DAE-BRNS Theme Meeting on Emerging Trends in Applications of Lasers and Accelerators in Nanomaterials, BARC, Mumbai, 20-21 October, 2011
- [25] Growth of epitaxially oriented nanoscale Ag islands on oxidized Si substrates: Influence of short range order on the oxide surface.

Indian Vacuum Society Symposium on Thin Films: Science and Technology, BARC, Mumbai, 9-12 November, 2011

[26] Scanning tunneling microscopy, photoemission electron microscopy and spin polarized low energy electron microscopy
Workshop on Electron Microscopy, Institute of Physics, Bhubaneswar, 22-25 November, 2011

[27] Pattern formation and electronic structure in atomic scale thin films
Conference on “Advanced Functional Materials”, S. N. Bose Centre, Kolkata, 1-2 March, 2012

[28] How does the electronic structure change as a material is thinned down to one atomic layer?
First National Seminar on Recent Trends in Condensed Matter Physics Including Laser Applications, Burdwan University, 6-7 March, 2012

[29] Standing waves of X-rays and their diverse applications in condensed matter physics and materials science
S. P. Sengupta Memorial Lecture of Material Society of India, Kolkata Chapter. 08 June, 2012

[30] Wonders in the ultrathin materials world,
In the C.V. Raman Session on Materials Science, 100th Indian Science Congress 03-07 January, 2013)

[31] Radiations in modification and analysis of materials,
National Workshop on Applications of Radiation in Physical, Chemical and Life Sciences, 04 – 06 September, 2013

[32] Probing Materials with ion beams,
National Short Term Course on Modern Methods in Materials Processing and Characterization, NIT Durgapur, 17 -19 September, 2013

[33] Quantum structures and phenomena – An emerging perspective,
Special invited lecture in Multiscale Modeling of Materials and Devices (MMMD-2014), BARC, Mumbai, 30 Oct. – 02 Nov., 2014

[34] Novel structures on surfaces in the dimensional crossover regimes,
National Conference on Current Trends in Advanced Materials (CTMat-2014), VECC, Kolkata, 19-21 November, 2014

[35] Induced substrate strain in heteroepitaxial growth
Advances in Nanomaterials using Synchrotron Techniques (ANST-2014)
Kolkata, 11-13 December, 2014

[36] Quantum structures and phenomena – an emerging perspective
26th Annual General Meeting, Materials Research Society of India, Jaipur, 9-11 February, 2015

[37] Quantum nanoelectronics
Keynote lecture in National Conference on Micro and Nano Electronic Systems and Devices (MINO-III), Jaipur, 20-21 March, 2015

[38] Slimming single crystals to fitness: Making them active, functional and beautiful,
SERC School on “Single Crystals of Functional Materials and their Applications”, SSN College of Engineering, Chennai, 02-22 September, 2015

[39] Playing with atoms for future technology,

West Bengal State Level Student Youth Science Fair, Kolkata, 05 October, 2015

[40] Multilayered structures in space research and the effect of their exposure to energetic ions in space,
Discussion Meeting on Materials Science Related to Nuclear and Space Research and Industry, SINP, Kolkata, 06-07 October, 2015

[41] Applications of energetic Ion beams in condensed matter physics and materials science,
Workshop on the Use of Low Energy Ion Beams, Institute of Physics, Bhubaneswar, 07-09 November, 2015

[42] Standing waves of X-rays and their diverse applications in condensed matter physics, Conference on “Synchrotron Radiation: Application to Condensed Matter Physics”, IISER, Kolkata, 09 January 2016

[43] Quantum structures and phenomena – An emerging perspective,
Solid State Physics Day, IACS, Kolkata, 12 January, 2016

[44] Self-organized quantum structures: Growth, electronic structure and transport,
Discussion Meeting on Nano-scale and Atomic-scale Quantum Structures and Devices, IACS, Kolkata, 16-17 February, 2016

[45] Demise of Moore’s law and the beginning of the quantum era (Keynote Lecture), National Conference on Advancement in Frontier Physics: From 20th Century to the Present, Bhairab Ganguly College, Kolkata, 26-27 February, 2016

[46] Growth of self-organized quantum structures by molecular beam epitaxy and reactive deposition epitaxy,
Conference on Emerging Materials (CEMAT 2016), Bengaluru, 18 – 19 July, 2016

[47] Seeing atoms and playing with atoms leading to future nanotechnologies, (Keynote lecture). National Workshop on Advances in Physics, Patna University, 8 - 9 July, 2016

[48] Advanced nanotechnology from atomic scale growth and atom manipulation, (Keynote lecture). National Conference on Recent Advances in Nanoscience and Nanotechnology (NCRANNT2016), Nehu, Shillong, 8 – 9 September, 2016

[49] Superdense nonmagnetic cobalt,
Silver Jubilee Research Conference on “Study of matter using intense radiation sources and under extreme conditions”, UGC-DAE CSR, Indore, 3 – 6 November, 2016

[50] Real time investigation of the effect of thermal expansion coefficient mismatch on film-substrate strain partitioning in epitaxial systems,
Discussion Meeting on Synchrotron Techniques in Materials Research, Dooars, 2-5 February, 2017

[51] Twist and turn in magnetism,
Seminar “Twist and Turn in Physics Research: Special Emphasis on Bio- and Condensed Matter Physics”, Jadavpur University, Kolkata, 21-22 February, 2017.

[52] Solid state quantum structures in quantum information processing and quantum technology,
Discussion Meeting on Quantum Optics and Quantum Technology (QOQT 2017), Kolkata, 5 – 8 June, 2017

[53] X-ray and neutron scattering in thin films: Reflectivity, standing waves and resonance enhancement,
Theme Meeting on Neutron Scattering, Mumbai, 19 August, 2017

Conference Organization:

- [1] Organized (Convener) several National Workshops over the years
- [2] Organized (Convener) "**The 1st International Conference on Physics at Surfaces and Interfaces**", March 2002, Puri, India
- [3] Organized (as Co-Chairman with Prof. A. P. Pathak) the "**20th International Conference on Atomic Collisions in Solids**", January 19-24, 2003, Puri, India (In the history of four decades of this conference this is the first time it was held in India. Previous two conferences were held in France and Denmark).
- [4] Organized (as Co-Chairman) the "**18th International Conference on Ion Beam Analysis**" in 2007. (held for the first time in India).
- [5] Organized (Convener) "**The 2nd International Conference on Physics at Surfaces and Interfaces**", February 23-27, 2009, Puri, India
- [6] Organized (Co-Chairman) "**The 3rd International Conference on Physics at Surfaces and Interfaces**", February 24-28, 2014, Puri, India

Current research interest :

- (i) Epitaxial layers, molecular beam epitaxy (MBE) and self-organized epitaxial growth and properties of nanostructures. Quantum dots and quantum wires.
- (ii) Ion-solid interaction, surface and interface modification by ion irradiation.
- (iii) Utilization of synchrotron radiation in surface and nanoscale science.
- (iv) Structure, morphology and properties of thin films, surfaces and interfaces.
- (v) Layered synthetic nanostructural multilayers and their ion-beam modification.
- (vi) Quantum structures

LIST OF PUBLICATIONS:

A. Books or Chapters in a Book:

1. **Physics at Surfaces and Interfaces**
Edited by B. N. Dev (World Scientific, Singapore, 2003)
2. **Nuclear Instruments and Methods in Physics Research, Section B**
Vol. 212, 2003 (North Holland, The Netherlands)
Edited by A. P. Pathak and B. N. Dev
Proceedings of the 20th International Conference on Atomic Collisions in Solids (ICACS20, January 19-24, 2003, Puri, India)

3. *RBS and Channeling Analysis of Self-Assembled Structures*,
B. N. Dev,
A chapter in the book *Ion Beam Analysis of Surfaces and Interfaces of Condensed Matter Systems*, (NOVA Science Publishers Inc., New York, 2003),
Ed P. Chakraborty, pp.103- 135.
4. Novel growth of Ag islands on Si(111) surfaces by molecular beam epitaxy: Plateaus with atomic scale preferred heights,
D. K. Goswami, K. Bhattacharjee and B. N. Dev, in
Nanoscale Materials: From Science and Technology,
Editors: S. N. Sahu, R. K. Choudhury and P. Jena

5. *Nuclear Instruments and Methods in Physics Research, Section B*
Vol.266, 2008 (Elsevier)
Edited by A. P. Pathak, D. K. Avasthi and B. N. Dev
Proceedings of the 18th International Conference on Ion Beam Analysis
(IBA2007, September 23-28, 2007, Hyderabad, India)

6. Writing an invited monograph on
Solid Surfaces and Nanostructures
as a part of a series on *Science and Technology of Atomic, Molecular, Condensed Matter and Biological Systems* to be published by Elsevier Science, The Netherlands. Series Editor: Professor T. P. Das (State University of New York at Albany, USA).
7. **Applied Surface Science, Vol. 256, No.2, 2009 (Elsevier)**
Edited by B. N. Dev and P. V. Satyam
Proceedings of the 2nd International Conference on Physics at Surfaces and Interfaces (Puri, India, 23-27 February, 2009)

B. Refereed Journals

- [1] First-principles investigation of location and electronic structure of adsorbed halogen atoms on semiconductor surfaces,
B.N.Dev, K.C.Mishra, W.M. Gibson and T.P.Das,
Phys. Rev. B29, 1101 (1984). (Rapid Commun.)

- [2] Investigation of electronic structure and associated nuclear quadrupole interaction of adsorbed fluorine atoms on silicon surface,
K.C.Mishra, B.N.Dev, S.M.Mahapatra, W.M.Gibson and T.P.Das,
Hyperfine Interactions 15/16, 997 (1983).

- [3] An X-ray standing wave interface spectrometric analysis of chemisorption of selenium on silicon (111) and (220) surfaces,

B.N.Dev, T.Thundat and W.M. Gibson,
J. Vac. Sci. Technol. A3, 946 (1985).

[4] An X-ray standing wave interference spectrometric analysis of bromine on cleaved silicon from solution ,

B.N.Dev, V.Aristov, N.Hertel, T.Thundat and W.M. Gibson,
J. Vac. Sci. Technol. A3, 975 (1985).

[5] Chemisorption of bromine on cleaved silicon (111) surfaces : An X-ray standing wave interference spectrometric analysis,

B.N.Dev, V.Aristov, N.Hertel, T.Thundat and W.M.Gibson,
Surf. Sci. 163, 457 (1985).

[6] First-principles investigation of geometric and electronic structure of aluminium adsorbed on silicon surface,

B.N.Dev, S.M.Mahapatra, K.C.Mishra, W.M.Gibson and T.P.Das,
Phys. Rev. B36, 2666 (1987).

[7] X-ray standing wave studies of germanium adsorbed on Si(111) surfaces ,

B. N.Dev, G.Materlik, R.L.Johnson, W.Kranz and P.Funke,
Surf. Sci. 178, 1 (1986).

[8] Geometrical structures of the Ge/Si(111) interface and the Si(111)(7x7) surfaces,

B.N.Dev, G.Materlik, F.Grey, R.L.Johnson and M.Clausnitzer,
Phys. Rev. Lett. 57, 3058 (1986); Phys. Rev. Lett. 59, 1790 (1987)

[9] Geometric structure of the NiSi₂-Si(111) interface: An X-ray standing wave analysis ,

E.Vlieg, A.E.M.J.Fischer, J.F van der Veen, B.N.Dev and G.Materlik,
Surf. Sci. 178, 36(1986).

[10] First principle investigation of moderately heavy atoms on semiconductor surfaces_ bromine on silicon,

S.M.Mahapatra, N.Sahoo, K.C.Mishra, B.N.Dev, W.M.Gibson and T.P.Das ,
J. Vac. Sci. Technol. A4, 2441 (1986).

[11] Nuclear quadrupole interaction associated with adsorbed halogen and chalcogen atoms at semiconductor surfaces,

S.M.Mahapatra, N.Sahoo , K.C.Mishra, B.N.Dev, W.M.Gibson and T.P.Das,
Hyperfine Interactions 34, 581 (1987)

[12] High temperature X-ray standing wave study : Application to melting of monolayers of Pb on Ge(111) surfaces,

B.N.Dev, F.Grey, R.L.Johnson and G.Materlik,
Europhys. Lett. 6, 311 (1988).

- [13] Coherent X-ray scattering by phonons: Determination of phonon eigenvectors, H.Spalt, A.Zounek, B.N.Dev and G.Materlik, **Phys. Rev. Lett. 60, 1868(1988); Phys. Rev. Lett. 61, 2819 (1988).**
- [14] Investigation of location, electronic structures and associated properties of chalcogen atoms adsorbed on silicon surfaces: Sulfur and selenium, S.M.Mahapatra, B.N.Dev, K.C.Mishra, W.M.Gibson and T.P.Das, **Phys. Rev. B38, 13335 (1988).**
- [15] Investigation of electronic structures and associated properties including hyperfine interactions for halogen adsorbed silicon surfaces: Fluorine through iodine, S.M.Mahapatra, B.N.Dev, K.C.Mishra, N.Sahoo, W.M.Gibson and T.P.Das, **Phys. Rev. B38, 12556 (1988).**
- [16] Experimental and theoretical investigations of chemisorbed Ga on Si(111), T.Thundat, S.M.Mahapatra, B.N.Dev, W.M.Gibson and T.P.Das, **J. Vac. Sci. Technol. A6, 681 (1988).**
- [17] Comment on "Quantitative structural determination of metallic film grown on semiconductor crystal: $(\sqrt{3}\times\sqrt{3})R30^\circ \rightarrow (1\times 1)$ Pb on Ge(111)", B.N.Dev, **Phys. Rev. Lett. 64, 1182 (1990).**
- [18] Electronic structure and associated properties of adsorbed atoms on silicon surfaces including hyperfine interactions, S.M.Mahapatra, B.N.Dev, L.Luo, T.Thundat, W.M.Gibson, K.C.Mishra, N.Sahoo and T.P.Das, **Revs. of Solid State Science, Vol.4, pp 873-900 (1990)** (World Scientific).
- [19] Compton Scattering study of the electronic structure of CuO, K.Sekar, B.K.Panda, B.N.Dev and D.P.Mahapatra, **J. Phys. Condens. Matt. 3, 6033 (1991).**
- [20] An RBS study on the annealing behaviour of Cu thin films on brominated Si(111) substrates, K. Sekar, P.V.Satyam, G.Kuri, D.P.Mahapatra and B.N.Dev, **Nucl. Instr. and Meth. B71, 308 (1992).**
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- [25] A high energy ion scattering facility for condensed matter physics and material science studies,
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- [27] Shape transition in the epitaxial growth of gold silicide in Au thin films on Si(111),
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P.V.Satyam, S.K.Ghose, D.Bahr, G.Kuri, B Sundaravel, B.Rout and B.N.Dev,
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B. Sundaravel , K. Sekar, P. V. Satyam, G. Kuri, B. Rout, S. K. Ghose, D. P. Mahapatra and B. N. Dev,

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P. V. Satyam, K. Sekar, G. Kuri, B. Sundaravel, D. P. Mahapatra, and B. N. Dev,

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B. Rout, S. K. Ghose, B. Sundaravel, G. Kuri, D. P. Mahapatra, B. N. Dev, P. Sen, H. Bakhru and A. W. Haberl,
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B. N. Dev, **(invited article)**

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