Curriculum Vitae

Name*:* Sanjib Banik
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D.O.B: 26 April, 1987

Work Experience:

Post-doctoral Research Associate — Nov-*2021 –Till date*
Prof. Ji Ung Lee
State University of New York Research Foundation, NY 12203, USA

Post-doctoral Research Associate — *Jan-2019 – Jan 2021*
Chair holder: Prof. Laurens W. Molenkamp
University of Wuerzburg, Wuerzburg-97070, Germany

Academic Qualifications:

- Ph.D. (Doctor of Philosopy, Advisor: Prof. Indranil Das) — *Aug-2012-Dec. 2018*
  CMP Division, SINP, Kolkata, India.
- M.Sc. (Master of Science) in Physics (CGPA: 8.656) — *Aug. 2008- July 2010*
  Indian Institute of Technology Delhi, New Delhi, India
- B.Sc. (Bachelor of Science) with Honours in Physics — *Aug. 2005- June 2008*
  Barasat Government College, affiliated to University of Calcutta, Kolkata, India.

Awards and fellowships:

- **Joint Admission Test to M.Sc in Physics (JAM 2008):** Obtained all India rank 122, conducted jointly by the Indian Institutes of Technology (IIT's) for entry into postgraduate programs.
- **Graduate Aptitude Test in Engineering in Physics (GATE 2010):** Obtained all India rank 24, conducted jointly by the Indian Institutes of Technology (IIT's) for entry into postgraduate programs (M.Tech) and to Ph.D. program in basic sciences.

- Merit cum means scholarship from IIT Delhi for excellent result in M.Sc, Physics from 2008 to 2010 at IIT Delhi.

- **National Eligibility Test in Physics (NET):** Selected in 2011 and got all India rank CSIR-57. This is conducted by the Council of Scientific and Industrial Research (CSIR), Government of India, for obtaining Junior Research Fellowship.

- **Joint Entrance Screening Test in Physics (JEST 2012):** Obtained all India rank 113 in the Joint entrance screening test (JEST) conducted jointly by the different research institutes of India for entry to Ph.D. program in basic sciences.

Ph.D Thesis Title:

Study of magnetic, magneto-transport and magnetocaloric properties in bulk and nanocrystalline manganites

Pre Ph.D Completed Projects:

- A project on '**Synthesis and characterization of Cu_2O thin films and nanorods of Cu_2O and In_2O_3**' under the supervision of Prof. B. R. Mehta, Indian Institute of Technology, Delhi.
- A project on **'Magnetoelectricity in bi-layer thin films and in core-shell nanoparticles'** under the supervision of Prof. Indranil Das, Saha Institute of Nuclear Physics, Kolkata.

Research Experience:

- My Ph.D thesis work (2012-2018) is based on finite size effect in manganite nanoparticles, and involves a study of the complex interplay of different magnetic interactions, surface effects and size-induced lattice deformation. I have summarized my research fields below.

  1. Colossal magnetoresistive manganites

  2. Structural, magnetic and magneto-transport properties of the nanostructures

  3. Magnetocaloric effect and magnetic refrigeration

  4. Synthesis of magnetic materials

  5. Manganite nanowire synthesis by hydrothermal method

- My Post-doctoral work (2019 to 2021) is on the antiferromagnetic Heusler compound. Here we have investigated the influence of strain on the band diagram and its corresponding change in the physical properties by making micro hall bars.

Technical Skills:

Sample Fabrication:

- Fabrication of micro and Nano structure using Photolithography and e-beam lithography

Growth of materials

- Chemical synthesis of nanomaterial by sol gel technique
- Familiar with single crystal growth in optical floating zone furnaces
- Thin film deposition using Pulsed laser deposition
- DC/RF magnetron sputtering of nanostructured materials
- Thermal Evaporation
- Electrodeposition for growth of nanords

Characterization techniques

- Crystallography
  - Powder X-Ray diffraction for crystallographic phase and particle size analysis. Operation of x-ray diffractometers Rigaku-TTRAX III (with low temperature facility).
- Microstructural characterization
  - Field emission scanning electron microscope
- Elemental analysis using EDX

Vacuum System

- Assembling and handling multiple types of vacuum systems incorporating rotary pump, Scroll pump and turbo-molecular pump etc.

Low temperature measurements

- Resistivity measurement under magnetic field using Cryogenic's Variable Temperature Cryostat and magnet system.
- Heat capacity measurements using Physical Properties Measurement System (Quantum Design Inc. USA).
- High resistivity (~ GΩ) measurements using electrometer (6517A).
- Magnetization measurements using SQUID based magnetometer (Quantum Design Inc. USA).
- Ac-susceptibility measurement using Cryobind, Croatia.

Instrumentation:

- Interfacing standard resistivity system having multiple current sources, voltmeter and samples using GPIB protocol and LABVIEW.

Experience in mentoring project students:

I have experience in guiding four project students in our lab during 2-6 month long projects on (a) Preparation of manganite thin film by pulsed laser deposition (b) preparation of core-shell manganite nanoparticles (ferromagnetic core, antiferromagnetic shell) and (c) magnetotransport measurements towards extreme limits.

Research Interests:

- Low energy excitations with fractional statistics in Quantum Spin Liquid (QSL) systems
- Unconventional superconductivity
- Quantum transport in 2D-material systems
- Investigation the spin-orbit torque in antiferromagnet
- Investigation the interfacial multiferroicity using different oxide interfaces
- Controlling the electroresistance using the interfaces of ferroelectric and charge-ordered materials
- Study the effect of light on the electroresistance
- Investigate the strain effect on metamagnetic transition for room temperature memory devices
- Fabrication and characterization of nanostructures

Personal Information:

- Nationality: Indian
- Languages spoken and written: English, Bengali, Hindi

Conferences/Workshop attended:

- International workshop on Electron Microscopy and XXXIV Annual Meeting of the Electron Microscope Society of India (EMSI 2013), Kolkata, India.
- 59th DAE Solid State Physics Symposium (DAE-SSPS 2014), VIT University, Vellore, Tamilnadu, India.
- International conference on Emerging Materials: Characterization & Application (EMCA 2015), CSIR-CGCRI, Kolkata, India.
- 60th DAE Solid State Physics Symposium (DAE-SSPS 2015), Amity University, Noida, Uttar Pradesh, India.
- 61st DAE Solid State Physics Symposium (DAE-SSPS 2016), KIIT University, Bhubaneswar, Odisha, India.
- National conference on Recent Trends in Condensed Matter Physics (RTCMP 2017), Bose Institute, Kolkata, India.
- SPICE-Workshop on Antiferromagnetic Spintronics: from topology to neuromorphic computing (2019), Johannes Gutenberg-Universitat Mainz

List of Publications:

1. Designing multi-level resistance states for multi-bit storage using half doped manganites (**Sanjib Banik**, Kalipada Das, kalpataru Pradhan and I. das *arXiv:1902.04377v1, EPL* **133**, 17006 (2021)).
   My contribution: Sample preparation, characterization, measurement (partially) and data analysis (partially)

2. Real-space imaging of magnetic phase transformation in single-crystalline Sm-Ca-Sr based manganite compound (Dipak Mazumdar, Rajeev Rawat, **Sanjib Banik**, Kalipada Das, and I. Das **Accepted in JPCM**)
   My contribution: Transport measurements (partially) and data analysis (partially)

3. Study of magnetic and magnetotransport properties in polycrystalline Pr0.6A′0.2Sr0.2MnO3 (A′≡Y, La) compounds: Observation of enhanced electron–electron interaction (Apurba Dutta, **Sanjib Banik**, and I. das *Journal of Magnetism and Magnetic Materials* **533**, 167996 (2021))
   My contribution: Transport measurements (partially) and data analysis (partially)

4. Molecular beam epitaxy of the half-Heusler antiferromagnet CuMnSb (Lukas Scheffler, Katarzyna Gas, **Sanjib Banik**, Martin Kamp, Jonas Knobel, Haicheng Lin, Claus Schumacher, Charles Gould, Maciej Sawicki, Johannes Kleinlein, Laurens W. Molenkamp PRM **4**, 114402 (2020))
   My contribution: Resistivity measurement

5. Effect of A-site ionic radius on metamagnetic transition in charge ordered $Sm_{0.5}(Ca_{0.5-y}Sr_y)$ MnO_3 compounds (**Sanjib Banik**, kalpataru Pradhan and I. das *arXiv:1903.11348, Journal of Alloys and Compoun*ds **862**, 158515 (2020)).
   My contribution: Sample preparation, characterization, measurement (partially) and data analysis (partially)

6. Inhomogeneous superconductivity in high-density nonmagnetic cobalt in a polycrystalline Co film (Nasrin Banu, M. Aslam, Arpita Paul, **Sanjib Banik**, S. Das, S. Datta, A. Roy, I. Das, G. Sheet, U. V. Waghmare, B. N. Dev *EPL* **131**, 47001 (2020)).
   My contribution: Resistivity measurement

7. Enhancement of magnetoresistance and magnetocaloric effect at room temperature in polycrystalline $Pr_{0.8-x}La_xSr_{0.2}MnO_3$ (x = 0.2) compound (**Sanjib Banik**, Kalipada Das and I. das *Journal of Magnetism and Magnetic Materials* **490**, 165443 (2019)).
   My contribution: Sample preparation, characterization, measurement and data analysis

8. Evolution from Griffiths like phase to non-Griffiths like phase with Y doping in $(La_{1-x}Y_x)_{0.7}Ca_{0.3}MnO_3$. (**Sanjib Banik** and I. das *Journal of Magnetism and Magnetic Materials* **469**, 40-45 (2019)).

My contribution: Sample preparation, characterization, measurement and data analysis

9. Instability of insulator state towards nanocrystallinity in $(La_{0.5}Y_{0.5})_{0.7}Ca_{0.3}MnO_3$ compound: Enhancement of low field magnetoresistance (**Sanjib Banik**, Pintu Sen and I. das *Journal of Magnetism and Magnetic Materials* **469**, 211-216 (2019)).
   My contribution: Sample preparation, characterization, measurement and data analysis

10. Huge magnetoresistance and ultrasharp metamagnetic transition in polycrystalline $Sm_{0.5}Ca_{0.25}Sr_{0.25}MnO_3$ (**Sanjib Banik**, Kalipada Das, Tapas Paramanik, N. P. Lalla, I. Das *NPG Asia Materials* **10**, 923-930 (2018)).
    My contribution: Sample preparation, characterization, measurement and data analysis

11. Effect of A-site ionic disorder on magnetocaloric properties in large bandwidth manganite systems (**Sanjib Banik** and I. das *Journal of Alloys and Compoun*ds **742**, 248 (2018)).
    My contribution: Sample preparation, characterization, measurement and data analysis
12. Evolution from non-Griffiths phase to Griffiths phase: Giant enhancement of magnetoresistance in nanocrystalline $(La_{0.4}Y_{0.6})_{0.7}Ca_{0.3}MnO_3$ compound (**Sanjib Banik**, Nasrin Banu and I. das *Journal of Alloys and Compounds* **745**, 753 (2018)).
    My contribution: Sample preparation, characterization, measurement and data analysis

13. Large magnetoresistance and relative cooling power in polycrystalline $Pr_{0.775}Sr_{0.225}MnO_3$ compound (**Sanjib Banik** and I. das *Journal of Magnetism and Magnetic Materials* **460**, 234 (2018)).
    My contribution: Sample preparation, characterization, measurement and data analysis

14. Large magnetocaloric effect in geometrically frustrated polycrystalline $ErMnO_3$ compound at cryogenic temperature (Kalipada Das, **Sanjib Banik** and I. Das *Physica B: Condensed Matter* **533**, 46 (2018)).
    My contribution: Sample preparation, characterization and measurement

15. Enhancement of the magnetoresistive property by introducing disorder in the $(La_{1-x}Y_x)_{0.7}Ca_{0.3}MnO_3$ compound (**Sanjib Banik**, Kalipada Das and I. das *RSC Advances* **7**, 16575 (2017)).
    My contribution: Sample preparation, characterization, measurement and data analysis

16. Size-induced modification of magneto-transport properties in nanocrystalline $Sm_{0.5}Ca_{0.5}MnO_3$ compound (**Sanjib Banik**, Kalipada Das and I. das *Journal of Magnetism and Magnetic Materials* **403**, 36 (2016)).
    My contribution: Sample preparation, characterization, measurement and data analysis

17. Large magnetocaloric effect near room temperature in polycrystalline $(La_{0.7}Y_{0.3})_{0.7}Sr_{0.3}MnO_3$ compound (Kalipada Das, **Sanjib Banik** and I. Das *Materials Research Bulletin* **73**, 256 (2016)).
    My contribution: Characterization and measurement

18. Interfacial magnetoelectricity in complex oxide heterostructure and multiple memory state (Sanjib Banik, Apurba Dutta and I. Das (*Manuscript under preparation*))
    My contribution: Sample preparation, measurement (partially) and data analysis (partially)

19. Anisotropic magnetotransport study in half-Heusler antiferromagnet CuMnSb (**Sanjib Banik**, Lukas Scheffler, Julian Werther, Claus Schumacher, Charles Gould, Maciej Sawicki, Johannes Kleinlein, Laurens W. Molenkamp (*Manuscript under preparation*))
    My contribution: Transport measurements

References:

1. Prof. Indranil Das
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