Gopi Nath Daptary, Ph. D

Affiliation: Assistant Professor
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Work experience:

- April 2023 – present: Assistant Professor at National Institute of Technology Rourkela, Odisha, India.
- Aug, 2022 – April, 2023: Postdoctoral Scholar, Okinawa Institute of Science and Technology Graduate University, Japan
  Postdoctoral mentor: Prof. Yoshinori Okada
- Dec, 2021 – Feb, 2022: Visiting Postdoctoral Fellow, Tata Institute of Fundamental Research, Mumbai
  Postdoctoral mentor: Dr. Shouvik Chatterjee
- Sep, 2019 – Oct, 2021: Postdoctoral Fellow, Department of Physics, Bar Ilan University, Israel
  Postdoctoral mentor: Prof. Aviad Frydman
- Sep, 2018 – Sep, 2019: Kolman Soref Postdoctoral Fellow, Department of Physics, Bar Ilan University, Israel
  Postdoctoral mentor: Prof. Aviad Frydman

Education:

- Aug, 2013 – Sep, 2018: Ph. D in the Department of Physics, Indian Institute of Science (IISc), Bangalore, India. (Defended Feb, 2019)
  PhD thesis: Electronic transport in low dimensional $LaAlO_3/SrTiO_3$ heterointerface.
  PhD Mentor: Prof. Aveek Bid
  Referees: Dr. Anjana Dogra, NPL, New Delhi and Dr. A.D. Caviglia, TU Delft, The Netherlands
- Aug, 2011 – Aug, 2013: M.S. in Physics, Indian Institute of Science, Bangalore, India. First class.
  MS project: Resistance and resistance fluctuations of metallic $SrRuO_3$ thin films.
  MS project supervisor: Prof. Aveek Bid
- 2008 – 2011: B.Sc. with honours in Physics, Ramakrishna Mission Residential College, Narendrapur (Under the University of Calcutta). First class.
- 2008: Higher Secondary (class XII), Mazilpur J M Training High School, West Bengal Council of Higher Secondary Education. First Division.
- 2006: Secondary (class X), Bazar Beria Ramkrishna Siksha Sadan High School, West Bengal Board of Secondary Education. First Division.

Academic Awards/Scholarships:

- *Postdoctoral Scholar* offered by the Okinawa Institute of Science and Technology, Japan (Aug, 2022).
- *Visiting Fellow* offered by the Tata Institute of Fundamental Research Mumbai (Dec, 2021).
- *Kolman Soref* Postdoctoral fellowship by the Bar Ilan University, Israel (Sept, 2018).
- *Young scientist award* – Materials Research Society of India (MRSI), SNBOSE, Kolkata (2016).
- *Best poster prize* at the year 2015 for presenting the work on 'Observation of transient superconductivity at the $LaAlO_3$/$SrTiO_3$ interface' in the international conference Frontiers in advanced Materials (2015), IISc, Bangalore.
- *Integrated PhD* scholarship from Ministry of Human Resource Development (MHRD), India (2011).
- Qualified IIT-JAM, 2011.

Research Skills and Experiences:

1. Electrical transport in oxide thin films, oxide heterostructures (e.g., $LaAlO_3$/$SrTiO_3$ heterostructures), spinel oxide (e.g., $LiTi_2O_4$), graphene, topological insulators, disordered superconductor (amorphous indium oxide), superconductor to insulator transition in disordered superconductor in ultra-low temperature (down to 10 mK) and high magnetic field (upto 16 T).
2. Low frequency 1/f noise measurement using Lock-in AC technique: Set up an apparatus for the measurement of low frequency resistance fluctuations in oxides. Expertise in gating experiment.
3. Electron beam lithography, Mask aligner, experienced in clean room to fabricate the mesoscopic devices.
4. Measurement of Seebeck experiment down to 2 K and 9T field.
5. Scanning electron microscope (SEM), Atomic Force Microscopy (AFM).
6. Sample contact: wedge bonding, ball bonding.
7. Thermal evaporation for metallization, electron beam evaporation for growing disordered superconducting film.
8. Programming: LabVIEW for data collection, Data analysis using MATLAB, Drawing schematic using Inscape.

Facilities Established:

Optimized low frequency *1/f* noise measurement in sub-kelvin temperature and high magnetic field for complex oxide systems, Written LabVIEW programming to collect the data, had a major role in setting up our research lab - have played a key role in installing the cryostats used, i.e., He-3 refrigerator, cryo-free dilution refrigerator, and in setting up the measurement protocol.

Developing measurement of Seebeck experiment at low temperature.
Establishing the exfoliation technique to make single layer of graphene or thin flake of topological insulator, Optimized lithography contact on graphene and topological insulator.

Publications:

Papers Under preparation:

1. Observation of dragging effect of hidden entropy
   Gopi Nath Daptary, Yuita Fujisawa, Anjana Krishnadas, Atwa Mohamed, and Yoshinori Okada (under preparation)

2. Andreev reflection at the interface between 3D topological insulator and disordered superconductor.
   Gopi Nath Daptary, Aviad Frydman (under preparation)

3. Observation of Chiral Andreev edge states in proximitized graphene.
   Gopi Nath Daptary, Udit Khanna, Efrat Shimshoni, and Aviad Frydman (under preparation)

Papers published/under review in refereed journals:

1. Superconducting Dirac point in proximitized graphene.
   Gopi Nath Daptary, Eyal Walach, Efrat Shimshoni, and Aviad Frydman ***arXiv: 2009.14603 (Under Review).***

2. Enhancement of superconductivity upon reduction of carrier density in proximitized graphene.
   Gopi Nath Daptary, Udit Khanna, Eyal Walach, Arnab Roy, Efrat Shimshoni, and Aviad Frydman. ***Physical Review B (Letter) 105, L100507 (2022); DOI:10.1103/PhysRevB.105.L100507***

3. Unveiling the Mechanisms Ruling the Efficient Hydrogen Evolution Reaction with Mitrofanovite Pt_3Te_4.
   Danil Boukhvalov, Jia Cheng, Gianluca D'Olimpio, François Bocquet, Chia-Nung Kuo, Anan Bari Sarkar, Barun Ghosh, Ivana Vobornik, Jun Fujii, Kuan Hsu, Li-Min Wang, Ori Azulay, **Gopi Nath Daptary**, Doron Naveh, Chinshan Lue, Mykhailo Vorokhta, Amit Agarwal, Lixue Zhang, Antonio Politano ***The Journal of Physical Chemistry Letters 12, 8627−8636 (2021); DOI: 10.1021/acs.jpclett.1c01261***

4. Effect of spin-orbit interaction on the vortex-dynamics in $LaAlO_3/SrTiO_3$ interfaces near the superconducting transition.
   Gopi Nath Daptary, Hemanta Kumar Kundu, Pramod Kumar, Anjana Dogra, Narayan Mohanta, A. Taraphder and Aveek Bid ***Physical Review B 100, 125117 (2019); DOI: 10.1103/PhysRevB.100.125117***

5. Conductivity noise across temperature driven transitions of rare-earth nickelate heterostructures.
   Gopi Nath Daptary, Siddharth Kumar, M. Kareev, J. Chakhalian, Aveek Bid, Srimanta Middey ***Physical Review B, 100, 125105 (2019); DOI: 10.1103/PhysRevB.100.125105***

6. Continuous transition from weakly localized regime to strong localization regime in $Nd_{0.7}La_{0.3}NiO_3$ films.
   Ravindra Singh Bisht, **Gopi Nath Daptary,** Aveek Bid, and A. K. Raychaudhuri ***Journal of Physics: Condensed Matter 31.14, 145603 (2019); https://doi.org/10.1088/1361-648X/aafdba.***

7. Effect of multi-band transport on charge carrier density fluctuations at the $LaAlO_3/SrTiO_3$ interface.
   Gopi Nath Daptary, Pramod Kumar, Anjana Dogra, and Aveek Bid ***Physical Review B 98, 035433 (2018); DOI: 10.1103/PhysRevB.98.035433.***

8. Observation of transient superconductivity at the $LaAlO_3/SrTiO_3$ interface.
   Gopi Nath Daptary, Shelender Kumar, Pramod Kumar, Anjana Dogra, Dushyant Kumar, R. C. Budhani, N. Mohanta, A. Taraphder, and Aveek Bid ***Physical Review B 95, 174502 (2017); DOI: 10.1103/PhysRevB.95.174502***
   (Media reports: (1) Indian Scientists Pioneer Safe Power Supply Without Transmission Loss, updated: Dec 23, 2014 in *Bangalore Mirror.* (2) IISc Triggers LAO/STO Transient SC with Magnetic Field, January 31, 2015 Vol. 29, No. 1 *Superconductor Week Magazine.*)

9. Effect of microstructure on the electronic transport properties of epitaxial $CaRuO_3$ thin films.
   Gopi Nath Daptary, Chanchal Sow, Suman Sarkar, Santosh Chiniwar, P.S. Anil Kumar, Anomitra Sil and Aveek Bid ***Physica B 511, 74–79 (2017); http://dx.doi.org/10.1016/j.physb.2017.02.005***

10. Correlated non-Gaussian phase fluctuations in $LaAlO_3/SrTiO_3$ heterointerfaces.
    Gopi Nath Daptary, Shelender Kumar, Pramod Kumar, Anjana Dogra, N. Mohanta, A. Taraphder, and Aveek Bid ***Physical Review B 94, 085104 (2016); DOI: 10.1103/PhysRevB.94.085104.***

11. Probing a spin-glass state in $SrRuO_3$ thin films through higher-order statistics of resistance fluctuations.

Gopi Nath Daptary, Chanchal Sow, P. S. Anil Kumar, and Aveek Bid ***Physical Review B 90, 115153 (2014); DOI: 10.1103/PhysRevB.90.115153***

Papers published in conference journals:

1. Resistance fluctuations near the Berezinskii-Kosterlitz-Thouless transition temperature in low dimensional superconductors.
   Gopi Nath Daptary, Hemanta Kumar Kundu, John Jesudasan, Pramod Kumar, Anjana Dogra, Pratap Raychaudhuri, R. C. Budhani, and Aveek Bid ***International Conference on Noise and Fluctuations (ICNF) Xi'an, China, 2015 (2-6 June), pp. 1-4, doi: 10.1109/ICNF.2015.7288555.***

Presented in international conferences:

- Novel quantum state at the interface between graphene and disordered superconductor. The 4th Asia-Pacific Symposium on Solid Surfaces (APSSS-4)/The 92nd IUVSTA workshop on Advanced Spectroscopy and Transport for 2D Materials at Surfaces, Okinawa, Japan (Sep 18-21, 2022) (Poster presentation)
- Novel quantum state at the interface between graphene and disordered superconductor. German Physical Society (DPG), virtual international conference, Germany (Sep 27 – Oct 1, 2021) (Oral presentation)
- Superconducting Dirac point in proximitized graphene. SurfCoat Korea 2021/ Graphene Korea 2021 Virtual International Joint conferences, Incheon, Rep. of Korea (May 26 - 28, 2021) (Oral presentation)
- Superconducting Dirac point in proximetized graphene. Young Investigator's online workshop - *Nanoengineered Superconductors - NES21*, University of Vienna, Austria (May 10 - 12, 2021) (Poster presentation)
- Superconducting Dirac point in proximetized graphene. The 66th (1st virtual) annual meeting of the *Israeli Physical Society*, Israel (February 22, 2021) (Oral presentation)
- The 64th annual meeting of the Israeli Physical Society (Dec, 2018)
- Observation of transient superconductivity at the $LaAlO_3$/$SrTiO_3$ interface. *APS March meeting*, New Orleans, USA (March 13-17, 2017) (Oral presentation)
- Observation of transient superconductivity at the $LaAlO_3$/$SrTiO_3$ interface. *Frontiers in advanced Materials*, Indian Institute of Science, Bangalore (June 15 – 18, 2015) (Poster presentation)

Presented in national conferences:

- Superconducting Dirac point in proximetized graphene. Centre for Quantum science and technology, Ben-Gurion University of the Negav, Third conference for young researchers on Quantum science and Technology, Israel (June 15, 2021) (Oral presentation)
- Bar-Ilan Institute of Nanotechnology and Advanced Materials, Annual Internal Conference (February 11, 2020)

- Correlated non-Gaussian phase fluctuations in $LaAlO_3/SrTiO_3$ heterointerfaces. "*In-house symposium*" organized by Department of Physics, Indian Institute of Science, Bangalore (2017) (Oral presentation)
- Observation of transient superconductivity at the $LaAlO_3/SrTiO_3$ interface. *"Young Scientists Colloquium 2016" organized by Materials Research Society of India (MRSI),* S.N. Bose National Centre for Basic Sciences, Kolkata (September 16, 2016) (Poster presentation)
- Magneto transport and *1/f* noise in 2DEG at the $LaAlO_3/SrTiO_3$ interface. *"In-house symposium*" organized by Department of Physics, Indian Institute of Science, Bangalore (2013) (Poster presentation)

Seminars:

- Department seminar organized by IIT Kanpur titled "Resistance fluctuations in low dimensional $LaAlO_3/SrTiO_3$ heterointerface" (28^{th} Jan, 2022)
- Department seminar organized by IIT Palakkad titled "Novel quantum state at the interface between graphene and low-density superconductor" (14^{th} Dec, 2021)
- Department seminar organized by IIT Bombay titled "Novel quantum state at the interface between graphene and low-density superconductor" (20^{th} Nov, 2021)
- Department seminar organized by IIT Jodhpur titled "Novel quantum state at the interface between graphene and low-density superconductor" (25^{th} Sep, 2021)
- Department seminar organized by IIT Madras titled "Novel quantum state at the interface between graphene and disordered superconductor" (June, 2021)
- Condensed Matter Resnick seminar organized by Bar Ilan University titled "Electronic transport in low dimensional $LaAlO_3/SrTiO_3$ heterointerface" (2018)

Research interest: Experimental condensed Matter:

My research interests in generally are Transport properties of mesoscopic systems: Electronic transport in low dimensional oxide films, oxide interfaces, Andreev reflection between Quantum Materials and disordered superconductor interface, low frequency 1/f noise, Seebeck measurement, low temperature and high magnetic field.

Teaching:

- Teaching Assistant on PH212 Experiments in Condensed Matter Physics, [January - April, 2014], Indian Institute of Science, Bangalore.

References:

1. **Prof. Aveek Bid** (Ph. D Supervisor)
   Department of Physics, Indian Institute of Science, Bangalore - 560012, India
   Email: aveek@iisc.ac.in
   aveekbid@gmail.com

2. **Prof. Aviad Frydman** (Postdoctoral Supervisor)
Department of Physics, Bar Ilan University, Ramat Gan - 5290002, Israel
Email: aviad.frydman@gmail.com
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3. **Prof. Arghya Taraphder**
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5. **Prof. Yoshinori Okada**
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6. **Dr. Anjana Dogra**
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