Shinjan Mandal

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Summary

I am a doctoral candidate at the Indian Institute of Science, Bangalore, studying the transport properties of quantum materials using a combination of atomistic modelling and first-principles calculations.

Education

2018 - present **PhD** at Indian Institute of Science (IISc), Bangalore
Advisor: Manish Jain
Thesis title: Interplay of Electrons and Phonons in 2D Materials

2017 - 18 **MSc in Physics** at IISc, Bangalore

2013 - 17 **BSc(Research) with major in Physics** at IISc, Bangalore

Research Works

Publications

[1] P. S. Mahapatra, B. Ghawri, M. Garg, **Shinjan Mandal**, K. Watanabe, T. Taniguchi, M. Jain, S. Mukerjee, and A. Ghosh. "**Misorientation-controlled cross-plane thermoelectricity in twisted bilayer graphene**". In: *Physical Review Letters* 125.22 (2020), p. 226802. DOI: 10.1103/PhysRevLett.125.226802.

[2] B. Ghawri, P. S. Mahapatra, M. Garg, **Shinjan Mandal**, S. Bhowmik, A. Jayaraman, R. Soni, K. Watanabe, T. Taniguchi, H. R. Krishnamurthy, M. Jain, S. Banerjee, U. Chandni, and A. Ghosh. "**Breakdown of semi-classical description of thermoelectricity in near-magic angle twisted bilayer graphene**". In: *Nature communications* 13.1 (2022), pp. 1–7. DOI: 10.1038/s41467-022-29198-4.

[3] B. Ghawri, P. S. Mahapatra, M. Garg, **Shinjan Mandal**, A. Jayaraman, K. Watanabe, T. Taniguchi, M. Jain, U. Chandni, and A. Ghosh. "**Non-Boltzmann thermoelectric transport in minimally twisted bilayer graphene**". In: *Physical Review B* 109.4 (2024), p. 045436. DOI: 10.1103/PhysRevB.109.045436.

[4] M. K. Jat, P. Tiwari, R. Bajaj, I. Shitut, **Shinjan Mandal**, K. Watanabe, T. Taniguchi, H. R. Krishnamurthy, M. Jain, and A. Bid. "**Higher-order Bragg gaps in the electronic band structure of bilayer graphene renormalized by recursive supermoiré potential**". In: *Nature communications* 15.1 (2024), p. 2335. DOI: 10.1038/s41467-024-46672-3.

Submitted

[5] K. P. Bera†, D. Solanki†, **Shinjan Mandal**†, R. Biswas, T. Taniguchi, K. Watanabe, V. Raghunathan, M. Jain, A. Sood, and A. Das. "**Twist Angle Dependent Phonon Hybridization in WSe2/WSe2 Homobilayer**". In: *(Under Review)* (2023). (†equal contribution).

[6] S. Sett, R. Debnath, A. Singha, **Shinjan Mandal**, Jyotsna KM, V. Raghunathan, M. Bhakar, G. Sheet, M. Jain, and A. Ghosh. "**Emergent inhomogeneity and non-locality in a graphene field-effect transistor on a near-parallel moiré superlattice of transition metal dichalcogenides**". In: *arXiv:2405.18024* (2023).

[7] R. Dutta, A. Ghosh, **Shinjan Mandal**, K. Watanabe, T. Taniguchi, S. Banerjee, H. R. Krishnamurthy, M. Jain, and A. Das. "**Electric field tunable superconductivity in near magic angle twisted bilayer graphene**". In: *arXiv:2402.11649* (2024).

[8] **Shinjan Mandal**, I. Maity, H. R. Krishnamurthy, and M. Jain. "**Phonon Linewidths in twisted bilayer graphene near Magic Angle**". In: *arXiv:2403.09692* (2024).

[9] S. Kumbhakar, T. K. Maji, B. Tongbram, **Shinjan Mandal**, S. H. Soundaraj, B. Debnath, T. P. Sai, M. Jain, H. R. Krishnamurthy, A. Pandey, and A. Ghosh. "**Engineering ultra-strong electron-phonon coupling and non-classical electron transport in crystalline gold with nanoscale interfaces**". In: *arXiv:2405.14684* (2024).

Under Preparation

[10] D. Solanki, K. P. Bera, **Shinjan Mandal**, M. Jain, A. Sood, and A. Das. "**Evolution of G and 2D Raman Modes in Twisted Bilayer Graphene**". In: *Under Preparation* (2024).

[11] **Shinjan Mandal**, I. Maity, H. R. Krishnamurthy, and M. Jain. "**PARPHOM: PARallel PHOnon calculator for Moiré systems**". In: *Under Preparation* (2024).

[12] **Shinjan Mandal**, S. H. Soundararaj, M. Jain, and H. R. Krishnamurthy. "**Possibilities for enhanced electron-phonon interactions and high-T_c superconductivity in engineered Au-Ag nano-structures** ". In: *Under Preparation* (2024).

Softwares Developed

PARPHOM: PARallel PHOnon calculator for Moiré systems

A massively parallel Python/FORTRAN hybrid package interfaced with LAMMPS, that computes the force constants in moiré systems, and uses that information to compute the phonon spectra

ELPHONSO: ELectron PHONon SOlver

FORTRAN package with hybrid parallelization (MPI+OpenMP) to compute the electron phonon coupling coefficients in systems with large number of atoms. A tight binding code written exclusively to handle large systems is an accessory to this project.

Teaching Experience

TA for PH203: Quantum Mechanics I — Nov 2020 - Feb 2021, Aug 2021 - Dec 2021

TA for PH320: Condensed Matter Physics II — Aug 2022 - Dec 2022

TA-ship duties included conducting regular tutorial sessions and grading assignments for a mixed class of undergraduate and graduate students in PH203 and a class of advanced graduate students in PH320.

Skills

General Computational Proficiency	FORTRAN, Python, Matlab, Mathematica Extensive experience in MPI and OpenMP parallelization
Specialized Softwares	LAMMPS, Quantum Espresso, Wannier90, EPW

Academic Highlights

DCOMP Travel Award APS March Meeting, 2024	2024
Senior Research Fellowship, Department of Science and Technology, India	2020
Junior Research Fellowship, Department of Science and Technology, India	2018
MP Birla Award (for securing a rank of 9 among $\sim$ 600,000 students in WBCHSE)	2013
KVPY Scholarship, Department of Science and Technology (Awarded to $\sim$ top 250 students across India)	2012

Conferences and Talks

APS March Meeting, 2024, Minneapolis, USA [Talk]	March, 2024
Workshop on moiré materials: Bridging the Gap between Theory and Experiments, ICTP, Italy [Talk]	Jan, 2024
Recent Progress in Graphene Research, Bangalore, India [Talk]	Nov, 2023
NAMMA Psi-K, JNCASR & IISc, Bangalore, India [Poster]	July, 2023
Indo-Israel Meeting, Weizmann Institute of Science, Rehovot, Israel [Poster]	July, 2023
APS March Meeting, 2022 (online) [Talk]	March, 2022
Novel Phases of Quantum Matter, ICTS, Bangalore, India [Poster]	Dec, 2019

References

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