Nikhil Tilak

Website: https://nikhiltilak.github.io/

Email nikhiltilak1991@gmail.com
Phone +1 (732)-500-6319
GitHub github.com/NikhilTilak
LinkedIn linkedin.com/in/nikhil-tilak

About Me

I am a PhD candidate at Rutgers University with 7 years of experience in Experimental Condensed Matter Physics. I have also developed a strong background in data analysis and Machine Learning primarily using Python. I am eager to use my analytical, problem-solving and communication skills in industry.

Education

PhD in Physics & Astronomy, Rutgers University, Piscataway, New Jersey, USA. *GPA: 3.9/4.0* 2015-Nov 2022 (expected)

B. Tech. in Engineering Physics, Indian Institute of Technology, Guwahati, Assam, India. *GPA: 9.04/10.00* 2010-2014

Certifications

Erdos Institute Data Science Bootcamp (May-July 2020).
Coursera: Applied Data Science with Python Specialization Michigan State University (Jan-Jun 2020).

Professional Experience

Graduate Research Assistant, Physics and Astronomy, Rutgers University, USA (2018-present)

Working with Prof. Eva Andrei on electronic properties of two-dimensional materials using STM.

Teaching Assistant, Physics and Astronomy, Rutgers University, USA (2015-2018)

TA for various introductory Physics classes and labs over five semesters.

Physics Faculty (Full-Time), Bakliwal Tutorials, Pune, India (2014-2015)

Taught Calculus-based Physics for the highly selective Indian Institutes of Technology Joint Entrance Exam (IIT-JEE). 1200+ hours of teaching experience to over 550 high school students (11^{th} and 12^{th} grade).

MITACS Globalink Research Intern, INRS, Montreal, Canada (Summer 2013)

Spent the summer working at INRS on lead-sulfide quantum dots.

Research Projects

1. Structure and Electronic Properties of Parallel Twisted MoS_2 Bilayers

Investigated lattice-relaxation, moiré potentials and interfacial ferroelectricity in twisted MoS_2 using Scanning Tunneling Microscopy and Piezoresponse Force Microscopy.

2. Flat band Carrier Confinement in Magic-Angle Twisted Bilayer Graphene

Investigated the effects of substrate potential disorder on Magic-Angle Twisted Bilayer Graphene using STM/STS.

3. Design and Construction of a Low Temperature Scanning Tunneling Microscopy System

Designed and constructed a dip-stick style STM and a scanner head capable of operating from 300 K to 4.2 K.

4. Chemical Vapor Deposition Growth of Graphene

Optimized the growth of monolayer Graphene on Copper foils. Transferred the Graphene to holey Silicon nitride substrates to make suspended Graphene devices for strain measurements.

Technical Skills

Device fabrication: e-beam Lithography, Thermal metal deposition, Reactive Ion Etching, Wet Etching
Characterization: Scanning Tunneling Microscopy, Scanning Probe Microscopy, Raman Spectroscopy
Mechanical and Electronics: Circuit design, Soldering, CAD, Machining
Data Analysis and Programming: Python, SQL, Excel, Mathematica, Origin

Selected Data Projects

Bookend — Final project for Erdos Institute Data Bootcamp (Winners) — GitHub, App

- Trained an ensemble classifier model on books scraped from project Gutenberg which can predict the authorship of a snippet of text with a 93% accuracy.
- Team placed first among 26 teams at the Erdos Institute Data Science Bootcamp (2020).

BreweryXplorer — Personal project — GitHub

- Browse and search 3000+ breweries and pubs in the Unites States.
- Designed an interactive Dashboard using Dash/Plotly which was deployed to Heroku.

Publications (google scholar)

1. Moiré potentials, lattice relaxation and layer polarization in marginally twisted MoS_2 bilayers. N Tilak, G Li, T Taniguchi, K Watanabe, EY Andrei (2022) (link to preprint. currently under review)
2. Flat band carrier confinement in magic-angle twisted bilayer graphene. *Nature Communications* **12**, 4180, N Tilak, X Lai, S Wu, Z Zhang, M Xu, RA Ribeiro, PC Canfield, EY Andrei (2021). link
3. Charge Density Wave Vortex Lattice Observed in Graphene-Passivated 1T-TaS_2 by Ambient Scanning Tunneling Microscopy, *ACS Nano Letters* MA Altvater, N Tilak, S Rao, G Li, CJ Won, SW Cheong, EY Andrei (2021). link
4. Observation of a topological defect lattice in the charge density wave of 1T-TaS_2, Appl. Phys. Lett. 119, 121601 (2021) MA Altvater, N Tilak, S Rao, G Li, CJ Won, SW Cheong, EY. Andrei link
5. Revealing the Charge Density Wave Proximity Effect in Graphene on 1T-TaS2 MA. Altvater, S Hung, N Tilak, C-J Won, G Li, SW Cheong, CH Chung, HT Jeng and EY. Andrei (under review at *Nature Materials).*
6. Catalyst free growth of ZnO nanowires on graphene and graphene oxide and its enhanced Photoluminescence and Photoresponse. *IOP Nanotechnology* RK Biroju, N Tilak, G Rajender, S Dhara, PK Giri (2015). link

Reviewer for-

ACS Nano, Nano Letters, NPJ Quantum materials

Conference Talks

1. Moiré bands in twisted MoS_2 homobilayers (APS March Meeting 2022, Chicago)
2. Observation of charging peaks near the flat band in magic-angle twisted bilayer Graphene (APS March Meeting 2021, Virtual)
3. A method for controllably inducing ultra-high strain in suspended 2D materials (APS March Meeting 2018, Los Angeles)

Recent Honors

- David C. Langreth Graduate Development Award (2017)
  "Presented annually to an especially promising early-stage graduate student by the Department of Physics and Astronomy at Rutgers."

Leadership and Mentorship

- Directly mentored five undergraduate students leading to successful transitions to Graduate school and industry.
- Student representative on the Graduate Studies and Life Committee (AY 2018-19)
- Vice President of the Physics and Astronomy Graduate Student Organization. (AY 2016-17)