

Nikhil Tilak

Email nikhiltalak1991@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 (11th and 12th 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 MoS₂ Bilayers](#)

Investigated lattice-relaxation, moiré potentials and interfacial ferroelectricity in twisted MoS₂ 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

Machine Learning and Data Science 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 United 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 MoS₂ bilayers. [N Tilak](#), G Li, T Taniguchi, K Watanabe, EY Andrei (2022) (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-TaS₂ 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-TaS₂, *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

ACS Nano, Nano Letters, NPJ Quantum materials

Conference Talks

1. Moiré bands in twisted MoS₂ 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)