

Nikhil Tilak

Email nikhiltilak1991@gmail.com
Phone +1 (732)-500-6319

GitHub github.com/NikhilTilak
LinkedIn linkedin.com/in/nikhil-tilak

Education

PhD in Physics & Astronomy, Rutgers University, Piscataway, New Jersey, USA. 2015-April 2023 (expected)
Advisor: Prof. Eva Andrei.

B. Tech. in Engineering Physics, Indian Institute of Technology, Guwahati, Assam, India. 2010-2014

Research Projects

1. [Structure and Electronic Properties of Parallel Twisted MoS₂ Bilayers](#)
Studied lattice-relaxation, moiré potentials and interfacial ferroelectricity in marginally twisted MoS₂ bilayers using Scanning Tunneling Microscopy (STM) and Piezoresponse Force Microscopy (PFM).
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. [STM characterization of Charge Density Wave state in 1T-TaS₂](#)
Investigated the incommensurate and commensurate CDW phases in 1T-TaS₂. Used Graphene as a cover to protect TaS₂ surface from degradation.
4. [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. System was optimized to reduce heat-load to increase cryogen efficiency.
5. [Chemical Vapor Deposition Growth of monolayer 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

- ❖ [2D material device fabrication](#)
Expertise in making multilayer vdW heterostructures. Electrical contact fabrication using e-beam lithography, thermal metal deposition, reactive ion etching, wet etching etc. Experienced in working with air-sensitive materials inside an inert gas filled glovebox.
- ❖ [Characterization techniques](#)
Scanning Tunneling Microscopy (STM), Atomic Force Microscopy (Topography, Kelvin Probe Force Microscopy, Electrostatic Force Microscopy, Piezoresponse Force Microscopy), Raman Spectroscopy, Optical microscopy.
- ❖ [Vacuum and Cryogenic techniques](#)
Expert at design, construction and maintenance of ultra/high vacuum chambers and cryogenic temperature measurement apparatus. Highly experienced in helium leak detection.
- ❖ [Mechanical and Electronics](#)
Soldering, Brazing, CAD, Machining (Drilling, Lathe, Milling), Arduino based circuits.
- ❖ [Data Analysis and Programming](#)
Python 3, Origin, LabVIEW, Mathematica, C/C++. Experienced in machine learning and deep learning using scikit-learn, TensorFlow etc.

Publications ([google scholar](#))

1. **Moiré potentials, lattice relaxation and layer polarization in marginally twisted MoS₂ bilayers**, *ACS Nano Letters* [N Tilak](#), G Li, T Taniguchi, K Watanabe, EY Andrei (2022) ([link](#))
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 peer-review).
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](#)

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.”

Reviewer for

ACS Nano, ACS Nano Letters, NPJ Quantum materials

Teaching Experience

1. [Teaching Assistant, Rutgers University, NJ, USA. \(Fall 2015- Spring 2018\)](#)
TA for extended analytical Physics (115), analytical Physics (123&124), Intro Solid State Physics (406), Graduate Quantum Mechanics 1 (501), Electromagnetism (385) and Classical Physics Lab (276)
2. [Physics Faculty, 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).

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)