I K M Reaz Rahman

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Education

2021 - present	PhD in Electrical and Electronics Engineering	
	University of California, Berkeley	(GPA: 3.96/4.00)
2020	Master of Science in Electrical and Electronic Engineering	
	Bangladesh University of Engineering and Technology	(GPA: 3.92/4.00)
2017	Bachelor of Science in Electrical and Electronic Engineering	
	Bangladesh University of Engineering and Technology	(GPA: 3.96/4.00)

Research Interest

Physcial electronics | Field effect transistor | Optoelectronics | Nanofabrication | Thin film depositon
Material characterization | Quantum transport | Cryogenic measurement

Research Experience

UC Berkeley & Lawrence Berkeley National Laboratory Aug 2021 - present

Supervisor: Prof. Ali Javey, UC Berkeley

Aligning the crystal orientation of Tellurium using nanoscale templates

- Investigated the effect of nanoscale confinement on the alignment of one-dimensional tellurium chains.
- Examined quantum transport properties enabled by the aligned crystal structure
- Demonstrated deterministic wafer-scale patterning of tellurium quantum wires
- Uniformity in crystal orientation opens pathways for reducing device variability

Performance limits of Tellurium-based semiconductors

- Investigated thermally stable contacts to tellurium for seamless integration with silicon CMOS technology
- Identified ruthenium as a thermally stable contact and assessed how thermal annealing affects the performance of tellurium transistors

Electrically pumped single photon emitters

- Demonstrating single photon emission from electrical charge injection
- Deterministically placing single photon emitters on a chip-scale

Gated Photoluminescence in Quantum Dot Thin Films

- Optimized device structures to enable effective gating of quantum dot thin films
- Analyzed recombination pathways in quantum dots under charge injection conditions

Electroluminescence in Silicon MOS Capacitors

- Fabricated MOS devices within a CMOS-compatible framework
- Performed optical and electrical characterization of key device performance metrics
- Studied hot carrier recombination leading to emission, highlighting the potential for an all-silicon light source.

Bangladesh University of Engineering and Technology Sep 2016 - Mar 2021

Supervisor: Dr. Quazi D. M. Khosru, BUET

Electrostatic Characterization and Drain Current Modeling of Inversion Type InGaAs Gate-All-Around MOSFET

- Developed a continuous solution to the quasi–2D Poisson equation, incorporating short-channel non-ideal effects
- Investigated how device dimension scaling influences electrical transport properties

A Rigorous Investigation of GaN Double Channel MOS-HEMT

- Developed a self-consistent solution to the Schrödinger–Poisson equation, enabling analysis of spatial carrier density distribution and formulation of drain current that accounts for inter-channel coupling
- Investigated both electrostatic behavior and electrical transport properties using the resulting analytical model

Publications

Journal Articles

1. **I. K. M. R. Rahman**, S. Dhuey, M. Jamal, T. Kim, N. Higashitarumizu, S. Virasawmy, A. Kemelbay, G. Ohkatsu, A. Nirmale, I. Kim, H. M. Kim, K. C. Bustillo, J. W. Ager, D. C. Chrzan, M. Scott, Y. Majima, and A. Javey, "Deterministic Patterning and Alignment of Tellurium Quantum Wires using Nanoscale Templates." manuscript submitted.
2. **I. K. M. R. Rahman**, T. Kim, I. Kim, N. Higashitarumizu, S. Wang, S. Wang, H. M. Kim, J. Bullock, V. Altoe, J. W. Ager, D. C. Chrzan, and A. Javey, "Thermally Stable Ruthenium Contact for Robust p-Type Tellurium Transistors." *Nano Letters* 25.10 (2025): 3956-3963. https://doi.org/10.1021/acs.nanolett.4c06553
3. J. Geng, D. Zhang, I. Kim, H. M. Kim, N. Higashitarumizu, **I. K. M. R. Rahman**, L. Lam, J. W. Ager, A. V. Davydov, S. Krylyuk, and A. Javey, "Unusually Strong Near-Infrared Photoluminescence of Highly Transparent Bulk InSe Flakes." *Advanced Functional Materials* 35.3 (2025): 2413672. https://doi.org/10.1002/adfm.202413672
4. K. Byeon, **I. K. M. R. Rahman**, I. Kim, H. Park, and A. Javey, "Quantitative Characterization of ZrO_2 Gate Dielectric Interface with Tellurium." *Applied Physics Letters* 126.23 (2025). https://doi.org/10.1063/5.0267586
5. I. Kim, N. Higashitarumizu, **I. K. M. R. Rahman**, S. Wang, H. M. Kim, J. Geng, R. R. Prabhakar, J. W. Ager, and A. Javey, "Low Contact Resistance WSe_2 p-Type Transistors with Highly Stable, CMOS-Compatible Dopants." *Nano Letters* 24.43 (2024): 13528-13533. https://doi.org/10.1021/acs.nanolett.4c02948
6. **I. K. M. R. Rahman**, S. Z. Uddin, M. Yeh, N. Higashitarumizu, J. Kim, Q. Li, H. Lee, K. Lee, H. Kim, C. Park, J. Lim, J. W. Ager, and A. Javey, "Gate Controlled Excitonic Emission in Quantum Dot Thin Films." *Nano Letters* 23.22 (2023): 10164-10170. https://doi.org/10.1021/acs.nanolett.3c02456
7. N. Higashitarumizu, S. Z. Uddin, D. Weinberg, N. S. Azar, **I. K. M. R. Rahman**, V. Wang, K. B. Crozier, E. Rabani, and A. Javey, "Anomalous thickness dependence of photoluminescence quantum yield in black phosphorous." *Nature Nanotechnology* 18.5 (2023): 507-513. https://doi.org/10.1038/s41565-023-01335-0
8. **I. K. M. R. Rahman**, S. Z. Uddin, H. Kim, N. Higashitarumizu, and A. Javey, "Low Voltage AC Electroluminescence in Silicon MOS Capactors." *Applied Physics Letters* 121.19 (2022): 193502. https://doi.org/10.1063/5.0120507

9. S. Z. Uddin, N. Higashitarumizu, H. Kim, **I. K. M. R. Rahman**, and A. Javey, "Efficiency roll-off free electroluminescence from mo "Efficiency Roll-Off Free Electroluminescence from Monolayer WSe_2." *Nano Letters* 22.13 (2022): 5316-5321.
https://doi.org/10.1021/acs.nanolett.2c01311

10. **I. K. M. R. Rahman**, M. I. Khan, and Q. D. M. Khosru, "Analytical drain current and performance evaluation for inversion type InGaAs gate-all-around MOSFET." *AIP Advances* 11.6 (2021): 065108.
https://doi.org/10.1063/5.0052718

11. **I. K. M. R. Rahman**, M. I. Khan, and Q. D. M. Khosru, "Electrostatic characterization and threshold voltage modeling of inversion type InGaAs gate-all-around MOSFET." *Journal of Computational Electronics* 20.4 (2021): 1504-1512.
https://doi.org/10.1007/s10825-021-01716-5

12. M. I. Khan, **I. K. M. R. Rahman**, and Q. D. M. Khosru, "Surface potential-based analytical modeling of electrostatic and transport phenomena of GaN nanowire junctionless MOSFET," *IEEE Transactions on Electron Devices* 67.9 (2020): 3568-3576.
https://doi.org/10.1109/TED.2020.3011645

13. **I. K. M. R. Rahman**, M. I. Khan, and Q. D. M. Khosru, "A rigorous investigation of electrostatic and transport phenomena of GaN double-channel HEMT." *IEEE Transactions on Electron Devices* 66.7 (2019): 2923-2931.
https://doi.org/10.1109/TED.2019.2915837

Conference Proceedings

1. M. Jamal, **I. K. M. R. Rahman**, A. Javey, and M. C. Scott, "Structural Analysis of Growth-Controlled Tellurium using Scanning Electron Nanodiffraction." Microscopy and Microanalysis 31, Supplement_1, 2025: ozaf048-811.
https://doi.org/10.1093/mam/ozaf048.811

2. M. I. Khan, **I. K. M. R. Rahman**, and Q. D. M. Khosru, "Analytical Modeling of Capacitance-Voltage Characteristics of GaN Nanowire Junctionless MOSFET." 2020 *IEEE 20th International Conference on Nanotechnology* (IEEE-NANO). IEEE, 2020.
https://doi.org/10.1109/NANO47656.2020.9183461

3. **I. K. M. R. Rahman**, M. I. Khan, M. Mahdia, and Q. D. M. Khosru, "Analytical modeling of electrostatic characteristics of enhancement mode GaN double channel HEMT." 2018 *IEEE 13th Nanotechnology Materials and Devices Conference* (NMDC). IEEE, 2018.
https://doi.org/10.1109/NMDC.2018.8605851

Technical Skills

Skillset
Microfabrication | Nanofabrication | Physical vapor deposition | Electrical characterization | SEM | AFM | Raman spectroscopy | Optical spectroscopy | Cryogenic deposition | Cryogenic measurement
Programming Languages
Matlab | Python | Verilog | Latex
Software
TCAD: Sentaurus Device | Lumerical | COMSOL Multiphysics

Teaching Experience

UC Berkeley (Graduate Teaching Instructor) Aug 2021 - present

Integrated-Circuit Devices

This is an advanced undergraduate/graduate course that introduces the concept of MOS devices and heterojunction transistors

Microfabrication Technology

This course is designed to provide first-hand fabrication experience to students in a cleanroom in which they fabricate and later characterize the transport behavior and yield of different mircoelectronic devices

Bangladesh University of Engineering and Technology July 2018 - Aug 2021

- Instructed theory course of electric machinery fundamentals
- Instructed laboratory courses on electronic circuits, control systems, VLSI and numerical techniques

Relevant Coursework

Graduate Courses (UC Berkeley)

- Integrated-Circuit Devices (EE230A), Introduction to Optical Engineering (EE218A), Lightwave Devices (EE232), Introduction to Microelectromechanical Systems (EE247A)

Undergraduate Courses

- Solid State Devices, Compound Semiconductor and Heterojunction Devices, Semiconductor Device Theory, MOS Devices, Optoelectronics, Power Electronics, Control Systems, Electronics (I + II), Energy Conversion, VLSI, Microprocessor and Interfacing, Measurement and Instrumentation, Communication Theory, Digital Signal Processing

Work Experience

Affiliate Aug 2021 - present
Lawrence Berkeley National Laboratory

Assistant Professor Mar 2021 - present (on leave)
Bangladesh University of Engineering and Technology

Lecturer July 2018 - Mar 2021
Bangladesh University of Engineering and Technology

Educational and Outreach Coordinator 2019 - 2021
IEEE ED/SSCS Bangladesh Chapter

References

Ali Javey, Professor, University of California, Berkeley. Email: ajavey@berkeley.edu
Joel Ager, Staff Scientist, Lawrence Berkeley National Laboratory. Email: jwager@lbl.gov
Mary Scott, Assistant Professor, University of California, Berkeley. Email: mary.scott@berkeley.edu