

# I K M Reaz Rahman

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## EDUCATION

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

## RESEARCH INTEREST

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

## RESEARCH EXPERIENCE

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**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.

**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**

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**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. **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>
4. **I. K. M. R. Rahman**, S. Z. Uddin, H. Kim, N. Higashitarumizu, and A. Javey, “Low Voltage AC Electroluminescence in Silicon MOS Capacitors.” *Applied Physics Letters* 121.19 (2022): 193502.  
<https://doi.org/10.1063/5.0120507>
5. 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>
6. D. Zhang, Y. Li, J. Geng, H. M. Kim, M. Ma, S. Wang, I. Kim, T. W. Wijaya, N. Higashitarumizu, **I. K. M. R. Rahman**, D. Urmossy, J. Bullock, A. Ozcan, and A. Javey, “Spectral kernel machines with electrically tunable photodetectors.” *Science* 390.6776 (2025): 902-911.  
<https://doi.org/10.1126/science.ady6571>
7. 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<sub>2</sub>.” *Nano Letters* 22.13 (2022): 5316-5321.  
<https://doi.org/10.1021/acs.nanolett.2c01311>
8. 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<sub>2</sub> *p*-Type Transistors with Highly Stable,

CMOS-Compatible Dopants.” *Nano Letters* 24.43 (2024): 13528-13533.  
<https://doi.org/10.1021/acs.nanolett.4c02948>

9. 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>
10. S. Wang, N. Higashitarumizu, H. Kim, T. Wijaya, **I. K. M. R. Rahman**, S. Wang, E. Della Gaspera, J. Bullock, and A. Javey, “Broadband Infrared Carbon Nanotube Linear Photodetector Arrays.” submitted in *Nano Letters*.
11. K. Byeon, **I. K. M. R. Rahman**, I. Kim, H. Park, and A. Javey, “Quantitative Characterization of ZrO<sub>2</sub> Gate Dielectric Interface with Tellurium.” *Applied Physics Letters* 126.23 (2025).  
<https://doi.org/10.1063/5.0267586>
12. **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>
13. **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>
14. 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>
15. **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: oza048-811.  
<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

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**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 microelectronic 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

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### **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

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**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

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**Ali Javey**, Professor, University of California, Berkeley. Email: [ajavey@berkeley.edu](mailto:ajavey@berkeley.edu)  
**Joel Ager**, Staff Scientist, Lawrence Berkeley National Laboratory. Email: [jwager@lbl.gov](mailto:jwager@lbl.gov)  
**Naoki Higashitarumizu**, Assistant Professor, Nanyang Technological University, Singapore.  
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