

Kexin (Kathy) Li

Research Interests

Nanoelectronic devices; GaN devices and circuits; Device-circuit co-design and optimization; Analog and digital IC design; Cryogenic device modeling for quantum computing.

Education

- 2019–2022 **Ph.D, ECE, University of Illinois Urbana-Champaign**, Champaign, IL, USA
Advisor: Prof. Shaloo Rakheja. Research area: Nanotechnology, Semiconductor Device Physics.
Thesis title: Modeling and simulation of III-nitride devices for next generation communications and quantum computing
Committee: Prof. Shaloo Rakheja, Prof. Can Bayram, Prof. Elyse Rosenbaum, Prof. Xiuling Li (UT Austin)
- 2015–2019 **Ph.D candidate, M.Eng., Computer Engineering, New York University**, New York, USA
Quantum Nanoelectronics Lab, Advisor: Prof. Shaloo Rakheja.
- 2013–2014 **M.Sc., Analog and Digital IC Design, Imperial College London**, London, UK (Merit Degree)
Advisor: Dr. David Thomas. Thesis: Automatic pipeline creation for numerical computing in FPGAs.
- 2008–2012 **B.Eng., Electronic, Science and Technology, Southeast University**, Nanjing, China
Thesis: Detection and analysis the structure of Alanine and Polypeptide using RFID.

Research Experience

- 2022 - 2023 **Postdoctoral Research Scientist, CoSMIC Lab, Columbia University**, New York City, NY
Advisor: Prof. Harish Krishnaswamy
- Summer 2020 **Research Intern, Mitsubishi Electric Research Laboratories (MERL)**, Cambridge, MA
- Summer 2019 Applied Physics Group, Host: Dr. Koon Hoo Teo
- 2016-2019 **Research Assistant, Quantum Nanoelectronics Lab, New York University**
Project: Compact modeling of III-V semiconductor devices for high-frequency and high-power applications,
Advisor: Dr. Shaloo Rakheja
- Fall 2015 **Research Assistant, NYU Nano Lab, New York University**
Project: VLSI custom layout design for ADC, Mentor: Dr. Bayan Nasri

Awards and Honors

- 2022 **Rising Stars in EECS**
- 2015 ECE Academic Achievement Award. New York University
- 2014 Graduate with Merit. Imperial College London
- 2013 Graduate with Distinction. University of Bristol
- 2011 Third place, "National Mathematical Modeling Competition. Southeast University
- 2011 Champion, the "Smart Car Competition." Southeast University
- 2010 GuoWei Electronic Scholarship. Southeast University

Patents

- U.1 Lars F. Voss, Adam M. Conway, Karen M. Dowling, David Hall, Shaloo Rakheja, **Kexin Li**. **Pulse Compression Photoconductive Semiconductor Switches**. *US Patent, App No. 17502681, 2021.*
(In collaboration with Lawrence Livermore National Laboratory)

Publications

Journal Publications

- J.7 Ashwin Tunga, **Kexin Li**, Ethan White, Nicholas Miller, Matt Grupen, John Albrecht, Shaloo Rakheja. **A comparison of a commercial hydrodynamics TCAD solver and Fermi kinetics transport convergence for GaN HEMTs.** *Journal of Applied Physics (JAP 2022)*. DOI: 10.1063/5.0118104
(Featured as Editor's Pick, in collaboration with Air Force Research Laboratory)
- J.6 Saptarshi Mukherjee, Karen M Dowling, Yicong Dong, **Kexin Li**, Adam Conway, Shaloo Rakheja, Lars Voss. **A Prony-based curve-fitting method for characterization of RF pulses from optoelectronic devices.** *IEEE Signal Processing Letters (SPL 2021)*. DOI: 10.1109/LSP.2021.3135795
(In collaboration with Lawrence Livermore National Laboratory)
- J.5 Koon Hoo Teo, Yuhao Zhang, Nadim Chowdhury, Shaloo Rakheja, Rui Ma, Qingyun Xie, Eiji Yagyu, Koji Yamanaka, **Kexin Li**, Tomás Palacios. **Emerging GaN technologies for power, RF, digital, and quantum computing applications: Recent advances and prospects.** *Journal of Applied Physics (JAP 2021)*. DOI:10.1063/5.0061555
(In collaboration with Mitsubishi Electric Research Laboratories)
- J.4 Shaloo Rakheja, **Kexin Li**, Karen M. Dowling, Adam M. Conway, Lars F. Voss. **Design and simulation of near-terahertz GaN photoconductive switches—operation in the negative differential mobility regime and pulse compression.** *IEEE Journal of the Electron Devices Society (J-EDS 2021)*. DOI:10.1109/JEDS.2021.3077761
- J.3 **Kexin Li**, Shaloo Rakheja. **Modeling and simulation of quasi-ballistic III-Nitride transistors.** *International Journal of High Speed Electronics and Systems, Special Issue on Wide Bandgap Semiconductor Electronics and Devices (2019)*. DOI:10.1142/S0129156419400111
- J.2 **Kexin Li**, Shaloo Rakheja. **A unified charge-current analytic model for ultra-scaled III-Nitride high electron mobility transistors.** *Journal of Applied Physics (JAP 2019)*. DOI:10.1063/1.5064385
- J.1 **Kexin Li**, Shaloo Rakheja. **An analytic current-voltage model for quasi-ballistic III-nitride high electron mobility transistors.** *Journal of Applied Physics (JAP 2018)*. DOI:10.1063/1.5025339
(Sponsored by Boeing)

Conference Proceedings

- C.10 **Kexin Li**, Hari Vemuri, Armagan Dascucus, and Harish Krishnaswamy. **Characterization and Modeling of 40nm-gate GaN-HEMT Technology for RF Circuits Design.** (In submission)
- C.9 Hari Vemuri, Armagan Dascucus, **Kexin Li**, Jose Bahamode and Harish Krishnaswamy. **Wideband switched-capacitor and switched-transmission line circulators in 40 nm GaN technology.** (In submission)
- C.8 **Kexin Li**, Takashi Matsuda, Eiji Yagyu, Koon Hoo Teo, Shaloo Rakheja. **Trapping Phenomena in GaN HEMTs with Fe- and C-doped Buffer.** *80th Device Research Conference, Columbus, OH. (DRC 2022)*. DOI: 10.1109/DRC55272.2022.9855817
- C.7 **Kexin Li**, Shaloo Rakheja. **Physical modeling of Quasi-ballistic GaN HEMTs operating at cryogenic temperatures.** *The Compound Semiconductor Week, Ann Arbor, MI. (CSW 2022)*. DOI: 10.1109/CSW55288.2022.9930446
- C.6 **Kexin Li**, Eiji Yagyu, Hisashi Saito, Koon Hoo Teo, Shaloo Rakheja. **Compact modeling of gate leakage phenomenon in GaN HEMTs.** *IEEE International Conference on Simulation of Semiconductor Processes and Devices (SISPAD 2020)*. DOI:10.23919/SISPAD49475.2020.9241666
- C.5 **Kexin Li**, Shaloo Rakheja. **A unified charge-current compact model of gallium nitride transistors for RF and digital applications.** *IEEE Electron Devices Technology and Manufacturing, Singapore. (EDTM 2019)*. DOI:10.1109/EDTM.2019.8731282
- C.4 **Kexin Li**, Shaloo Rakheja. **A unified current-voltage and charge-voltage model of quasi-ballistic III-nitrideHEMTs for RF applications.** *IEEE 76th Device Research Conference, Santa Barbara, CA. (DRC 2018)*. DOI: 10.1109/DRC.2018.8442193

- C.3 **Kexin Li, Shaloo Rakheja. Analytic modeling of nonlinear current conduction in access regions of III-Nitride HEMTs.** Materials Research Society Fall Meeting, Boston, MA. (MRS 2018). DOI: 10.1557/adv.2017.632
- C.2 **Kexin Li, Shaloo Rakheja. Optimal III-nitride HEMTs – from materials and device design to compact model of the 2DEG charge density.** OPTO, the optoelectronics, photonic materials and devices conference, San Francisco, CA. (SPIE 2017). *International Society for Optics and Photonics* DOI: 10.1117/12.2251582
- C.1 Shaloo Rakheja, **Kexin Li. Graphene-based plasma wave interconnects for on-chip communication in the terahertz band.** IEEE Fifth Berkeley Symposium on Energy Efficient Electronic Systems & Steep Transistors Workshop, (2017). DOI: 10.1109/E3S.2017.8246185

Technical Report

MERL TR2019-160 **Kexin Li, Koon Hoo Teo. Gate leakage mechanisms and modeling in GaN based high electron mobility transistors – literature survey.** *Tech. Rep., Mitsubishi Electric Research Laboratories, 2019.*

Oral Conference Presentation/ Poster presentation

- P.13 **Modeling and simulation of III-Nitride devices and circuits: for next generation communications and quantum computing.** *EECS Rising Stars*, Austin, TX
- P.12 **Trapping Phenomena in GaN HEMTs with Fe- and C-doped buffer.** *IEEE 80th Device Research Conference (DRC)*, Columbus, OH
- P.11 **Physical modeling of Quasi-ballistic GaN HEMTs operating at cryogenic temperature.** *The Compound Semiconductor Week (CSW)*, Ann Arbor, MI
- P.10 **Compact modeling of gate leakage phenomenon in GaN HEMTs.** *International Conference on Simulation of Semiconductor Processes and Devices (SISPAD)*, Virtual conference
- P.9 **A unified static-dynamic analytic model for ultra-scaled III-nitride high electron mobility transistor.** *Design Automation Conference (DAC)*, Las Vegas, NV
- P.8 **A unified static-dynamic analytic model for ultra-scaled III-nitride high electron mobility transistor.** *ECEDHA*, Tuscon, AZ
- P.7 **A unified charge-current compact model of GaN transistor for RF and digital application.** *Electron Devices Technology and Manufacturing (EDTM)*, Singapore
- P.6 **Design and modeling of III-Nitride HEMTs for extremely linear RF operation.** *Materials Research Society (MRS)*, Boston, MA
- P.5 **A unified current-voltage and charge-voltage model of quasi-ballistic III-nitride HEMTs for RF applications.** *76th Device Research Conference (DRC)*, Santa Barbara, CA
- P.4 **An analytic current-voltage model for quasi-ballistic III-nitride high electron mobility transistors.** *Annual Scientist Symposium*, NYC, NY
- P.3 **Analytic modeling of nonlinear current conduction in access regions of III-Nitride HEMTs.** *Materials Research Society (MRS)*, Boston, MA
- P.2 **Optimal III-nitride HEMTs – from materials and device design to compact model of the 2DEG charge density.** *International Society for Optics and Photonics*, San Francisco, CA
- P.1 **Challenges and opportunities in modeling gallium nitride high electron mobility transistors— from numerical simulations to compact transistor model.** *International Workshop on Nitride Semiconductors*, Orlando, FL

Teaching Experience

Fall 2021 **Teaching Assistant**, *Introduction to Electric and Electronic Circuits*, UIUC
 Fall 2018 **Teaching Assistant**, *Introduction to VLSI (Graduate)*, New York University
 Spring 2018 **Teaching Assistant**, *Nanoelectronic Devices (Graduate)*, New York University

Spring 2016 **Teaching Assistant**, *Introduction to VLSI (Undergraduate)*, New York University

Research Mentoring

Summer 2022 **Bohao Wu (PhD - UIUC)**, *Project: Reliability of GaN HEMTs: TCAD simulation and compact modeling*

Fall 2021 **Ashwin Tunga (PhD - UIUC)**, *Project: TCAD simulation of GaN based HEMTs*

Spring 2020 **Yicong Dong (MSc - UIUC)**, *Project: Photoconductive semiconductor switches*

First Employer: Ph.D. program at University of Illinois Urbana-Champaign

Summer 2019 **Linyi Huang (MSc - NYU)**, *Project: GaAs based photoconductive semiconductor switches*

First Employer: Ph.D. program at Rutgers university

Academic Service

2023 Applied Physics Letters (Invited Reviewer)

2022 Journal of Semiconductors (Invited Reviewer)

2021 IEEE Transactions on Electron Devices (Invited Reviewer)

2021 Device Research Conference (External Reviewer)

2019 ACM/IEEE Design Automation Conference (External Reviewer)

Skills

Programming

C/C++, Python, Bash scripts, Matlab, Verilog-A, Verilog, VHDL, SystemC.

Tools

Cadence (Genus, Virtuoso, Spectre), ModelSim, Synopsys Sentaurus TCAD, Keysight ADS.