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Kexin 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 candidate, 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 **MSc., 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 Fall - **Postdoctoral Fellow**, *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

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.8 **Kexin Li**, Shaloo Rakheja. **Physical modeling of quasi-ballistic GaN HEMTs operating at cryogenic temperatures.** [In Preparation for *IEEE Transactions on Electron Devices (2022)*]

J.7 **Kexin Li***, Ashwin Tunga*, Matthew Grupen, Nicholas Miller, Shaloo Rakheja. **A comparison of a commercial TCAD solver and Fermi kinetics transport.** [* Co-first authors, In Preparation for *Journal of Applied Physics (2022)*]

(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 (2021);*

(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 (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.** *Journal of the Electron Devices Society (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 (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 (2018); DOI:10.1063/1.5025339*

(Sponsored by Boeing)

Conference Proceedings

C.8 **Kexin Li**, Matsuda Takashi, Eiji Yagyu, Koon Hoo Teo, Shaloo Rakheja. **Trapping Phenomena in GaN HEMTs with Fe- and C-doped Buffer.** *Device Research Conference (DRC 2022);*

C.7 **Kexin Li**, Shaloo Rakheja. **Physical modeling of Quasi-ballistic GaN HEMTs operating at cryogenic temperatures.** *The Compound Semiconductor Week (CSW 2022);*

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, (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 Metting, Boston, (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, (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.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*, Singapore

P.6 **Design and modeling of III-Nitride HEMTs for extremely linear RF operation.** *Materials Research Society*, Boston, MA

P.5 **A unified current-voltage and charge-voltage model of quasi-ballistic III-nitrideHEMTs for RF applications.** *76th Device Research Conference*, 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*, 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

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**.