

Nano Seminar Series

Wed., March 13, 2019 12:00 – 1:00 pm 1005 DOW



Characterization, Modeling, and Design of N-polar GaN Devices for mm-Wave Power

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Abstract: The millimeter-wave frequency spectrum is in increasing demand for wireless applications including communication and radar. Nitrogen-polar GaN devices at UCSB have now shown transformative performance with record-breaking power density of 8 W/mm and excellent efficiency in the W-band (75-110 GHz) frequency range. This talk will discuss some of UCSB's work on deep recess N-polar GaN MISHEMTs which has enabled this performance. The focus will be on this researcher's contribution to UCSB's N-polar GaN device program which has been to develop new methods to characterize and model these devices in a way which provides quick and insightful feedback for designing improved devices. This is achieved by providing unambiguous evaluations of large-signal performance by load pull at extremely high frequency, and using accurately extracted equivalent circuit models to identify which specific aspects of the device can be adjusted to realize improvements in performance. These methods led to improvement in the efficiency at 94 GHz from 17% to 28%, while the power density was increased to 8 W/mm. New characterization and modeling techniques are underway to understand and improve the linearity of the device, because distortion in amplifiers is of increasing importance for complex digital modulation schemes employed in modern communication systems.

Biography: Matthew Guidry obtained his BS, MS, and PhD degrees in Electrical and Computer Engineering from UCSB in 2008, 2014, and 2018 respectively. His PhD was completed under Professor Umesh K. Mishra with a thesis on the characterization, modeling, and design of N-polar GaN mm-wave devices. He is currently employed as a Postdoctoral researcher at UCSB working on new characterization methods and designs of novel devices targeting improvements in linearity, frequency response, and power density. At UCSB he is also employed as the manager of Professor Mishra's and York's high-frequency measurement laboratory which is used by 6 UCSB research groups and multiple companies. He also currently works at Toyon Research Corporation on the design of GaN devices for tunable RF applications and for local oscillator generation at mm- and sub-mm-wave frequencies. He has also worked at HRL Laboratories with projects focused on RF and microwave circuits and sensing. His research interests include metrology, development of new characterization techniques and system, physical and empirical device modeling, and the application of these methods to design and understand novel semiconductor devices.



Pizza provided.

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