Title: “Tiny-but-tough” Gallium Nitride Nanoelectronics for Extreme Harsh Environments

Abstract:
Gallium nitride (GaN) nanoelectronics have operated at temperatures as high as 1000°C making it a viable platform for robust space-grade (“tiny-but-tough”) electronics and nano-satellites. In addition, there has been a tremendous amount of research and industrial investment in GaN as it is positioned to replace silicon in the billion-dollar (USD) power electronics industry, as well as the post-Moore microelectronics universe. Furthermore, the 2014 Nobel Prize in physics was awarded for pioneering research in GaN that led to the realization of the energy-efficient blue light-emitting diode (LED). Even with these major technological breakthroughs, we have just begun the “GaN revolution.” New communities are adopting this nanoelectronic platform for a multitude of emerging device applications including the following: sensing, energy harvesting, actuation, and communication. In this talk, we will review and discuss the benefits of GaN’s two-dimensional electron gas (2DEG) over silicon’s p-n junction for space exploration applications (e.g., radiation-hardened, temperature-tolerant Venus probes). In addition, we will discuss recent results that advance this nanoelectronic device platform for extreme-environment Internet-of-things (IoT) systems for combustion and down-hole monitoring.