Solid State Technology and Devices Seminar

Integrated Optical Coherence Tomography: continuous physiological monitoring and the era of *Homo augmentus*

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Abstract: The current Internet of Things (IoT) era, bolstered by the rapid expansion of 5G networks, seeks to integrate every place, thing, and person into a connected global network of everything. By the time we reach the 6G era 10 years in the future, the level of hyper-connectivity we're witnessing today will move beyond simply linking "things," extending directly to the human body and mind. This era of *Homo augmentus* will in turn drive unprecedented levels of human and economic productivity. At Nokia Bell Labs, we are developing the devices and artificial intelligence that will seamlessly integrate human physiology into this network to create the future Augmented Human. This involves developing innovative materials, devices, and machine learning techniques that can continuously and non-invasively interface, sense, and actuate the human body. In this talk, I will describe our recent work on integrated Optical Coherence Tomography (OCT), one of the technologies of *Homo augmentus* that we believe will allow for continuous access to our physiological health. Leveraging integrated photonic and MEMs technologies, we have developed the world's first chip-scale swept-source OCT system, achieving 100dB sensitivity at 100kHz A-scan rate and have packaged this into a battery-powered portable device for remote diagnostics. Along with core hardware advances, I will overview the algorithmic and AI techniques we have developed to harness this platform for continuous biophysical monitoring. Finally, I will highlight a novel biochemical sensing technique we have pioneered that leverages OCT and bio-optical transducers to extract chemical information in 3D tissue environments. We believe this platform will form the foundation of future advanced remote health diagnostics such as at-home wound monitoring and infectious disease screening.

Bio: Dr. Michael S. Eggleston received his B.S. degree in Electrical Engineering and Physics from Iowa State University and his Ph.D. in Electrical Engineering from UC Berkeley. In 2015, he joined Nokia Bell Labs in Murray Hill, NJ where he currently leads the Data and Devices Group. An optical device physicist at heart, Michael's research has included investigation into ultra-wideband wireless technologies, solar cells, environmental sensing, optical coherence tomography, low-power optical interconnects and devices, and integrated multi-wavelength lasers. His current research interests are in the creation of technologies that seamlessly integrate human physiology into the digital world. This includes work in battery-less sensing, non-invasive biochemical monitoring, and human-machine interfaces.