



## ECE GUEST SPEAKER



### Siddhartha Ghosh

MIT Lincoln Laboratory  
Lexington

## Integrated Acoustic Wave Microsystems for Nonreciprocal RF Photonic Signal

Friday, January 17

136 ISEC  
11 am

### Abstract:

Acoustic waves are well-suited for a variety of signal processing applications including RF filtering and optical modulation. Advances in material and fabrication capabilities have enabled the demonstration of chip-scale subsystems in which phonons can exhibit strong interactions with a variety of other physical domains. This talk will discuss developments in two of these areas, specifically acousto-electric (AE) amplification and acousto-optic modulation in piezoelectric materials.

Recently, non-reciprocal and switchable delay lines have generated great interest for applications in full duplex radio networks. As a result, AE-based approaches to mitigating signal interference in the RF front end have been sought. Here we will consider the development of a low sheet density AlGaIn/GaN heterostructure on sapphire substrates to demonstrate AE amplification of Rayleigh waves. In addition, the use of atomic layer deposition (ALD) assisted wafer bonding technology is demonstrated for integrating thin film silicon on bulk lithium niobate to produce stronger non-reciprocity. These results are showcased with regard to implementation in analog correlators with large processing gain.

In addition, we will discuss the development of piezoelectrically-actuated acousto-optic modulators in the aluminum nitride (AlN) material system. Optical coupling to AlN thin films is demonstrated in the telecommunications bands, enabling monolithic integration of photonic and bulk acoustic resonators. Overlap of these fields enables efficient conversion from RF to optical frequencies, with applications in integrated microwave photonics and quantum information transfer.

### Bio:

Siddhartha Ghosh is currently a member of the technical staff in the RF Technology Group at MIT Lincoln Laboratory, Lexington, MA. He received the B.S. degree in from Cornell University in 2007, the M.S.E. degree from the University of Pennsylvania in 2011 and the Ph.D. degree from Carnegie Mellon University in 2015, all in electrical engineering. From 2007 to 2009 he was a Hardware Engineer with Lockheed Martin Corporation in Syracuse, NY. He is the author of 20 journal and conference publications and co-inventor of an issued patent. Since 2018, he has served on the Technical Program Committee (TPC) for the IEEE International Frequency Control Symposium. His research interests include piezoelectric MEMS, optomechanical resonators, oscillator-based computing and acousto-electronic devices.