Time & Location: March 31, 2020 at 11:00 AM in CREOL A203
Title: THIN-FILM LITHIUM NIOBATE INTEGRATED PHOTONICS ON SILICON FOR ELECTRO- AND NONLINEAR-OPTIC APPLICATIONS

In order to overcome the drawbacks associated with conventional bulk lithium niobate photonic, thin-film lithium-niobate-on-silicon has been pursued recently. This work presents contributions made to electro-, and nonlinear-optic applications of this technology. For electrooptic applications, detailed modeling and design guidelines of optical and radio-frequency parameters of ultracompact modulators are developed and their accuracy in predicting the high-speed performance of such devices have been verified by comparison with experimental results. Novel design techniques and pathways for ultrahigh-speed (sub-terahertz) operation of such modulators, achieving up to 400 GHz modulation bandwidth, are also presented. For optical interconnect applications, novel structures for ultralow-power consumption modulators are designed and fabricated. Coherent modulation schemes, such as quadrature phase shift keying, is also pursued on the same thin-film platform for advanced optical communication systems. For nonlinear-optic applications, fabrication integrability of thin-film lithium niobate and chalcogenide glass waveguides on a single silicon chip for future directions, such as on-chip self-referenced optical frequency comb generation, is experimentally demonstrated. That is a pathway for both second- and third-order optical nonlinearity occurring on lithium niobate and chalcogenide, respectively, is designed and presented. An innovative and robust foundry-compatible back-end-of-line integration method is also proposed, in order to integrate thin-film lithium niobate devices with silicon or silicon-nitride photonic circuitry. Overall, this work extends the capabilities of the thin-film lithium niobate technology for novel electro- and nonlinear-optic applications. Finally, extensions of the aforementioned results suitable for future work are discussed.

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Approved for distribution by Sasan Fathpour, Committee Chair, on March 13, 2020.

The public is welcome to attend.