Integrated Lithium Niobate Photonic Platform and Applications

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Lithium niobate (LN) is an "old" material with many applications in optical and microwave technologies, owing to its unique properties that include large second order nonlinear susceptibility, large piezoelectric response, and wide optical transparency window. Conventional discrete LN components, the workhorse of the optoelectronic industry for many decades, have reached their limits, however. I will present integrated LN photonic platform [1], featuring strong light confinement and dense integration, that has the potential to revolutionize optical communication networks and microwave photonic systems, as well as enable realization of quantum photonic circuits. Examples include high bandwidth, low voltage, and low loss electro-optic (EO) modulators [2], EO frequency combs [3,4] and frequency domain shifters/ beam splitters [5]. Quantum photonic circuits suitable for microwave-to-optical transduction [6] integration with diamond color centers [7] will also be discussed.

I will also share my experiences teaching *ES 50: Introduction to Electrical Engineering* at Harvard. The main course objectives are to introduce students to the exciting world of electrical engineering, to empower them with the ability to build and program gizmos that sense and actuate the physical world, and to explain how many of the electronic devices we use every day work. Examples of the final projects that students have proposed and built at the end of this semester-long class can be found at ES 50 YouTube Channel [8].

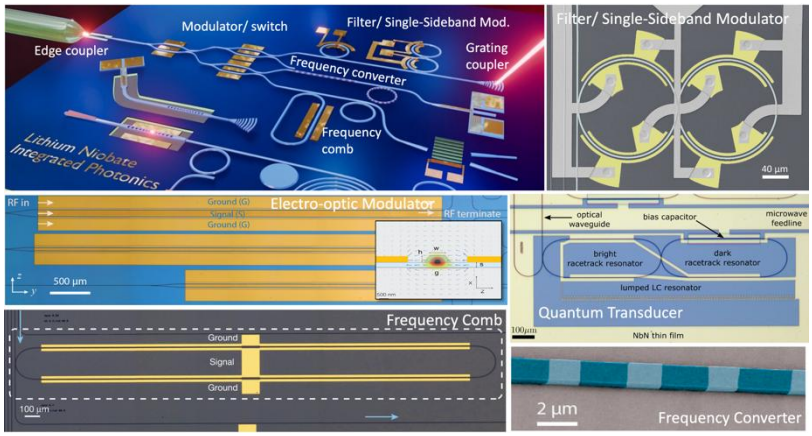

Figure 1. Integrated thin film lithium niobate photonic platform [1] pioneered by PI has been used to demonstrate state of the art modulators [2, 6], frequency combs [4], quantum transducers [8] and frequency converters [7].

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8. https://www.youtube.com/@harvardes50