Ultrafast Quantum and Classical Nonlinear Nanophotonic Circuits

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Ultrafast sciences and technologies are founded on the principles of ultrashort-pulse nonlinear optics. Until now, their discrete and bulky nature has hindered the utilization of their vast functionalities for many applications, ranging from sensing to computing and quantum information processing. In the past few years, nanophotonic lithium niobate (LN) has emerged as one of the most promising platforms for integrated photonics, characterized by strong quadratic nonlinearity. In this talk, I will present recent experimental progress in the realization and utilization of ultrafast nonlinear devices in nanophotonic LN, which outperform their table-top counterparts. These advancements include intense optical parametric amplification [1], ultrafast ultra-low-energy all-optical switching [2], few-cycle vacuum squeezing [3], ultrafast laser mode-locking [4], ultrabroadband coherent light sources [5,6], generation of two-cycle pulses [7], and topological soliton combs [8]. I will also discuss ongoing efforts toward the miniaturization of ultrafast technologies and the development of chip-scale ultrafast nanophotonic circuits in both the classical and quantum regimes.

References

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