5 March 2019Energy-efficient graphene and ITO-based MZI and absorption modulators (Conference Presentation)
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Abstract
With success of silicon photonics having mature to foundry-readiness, the intrinsic limitations of the weak electro-optic effects in Silicon limit further device development. To overcome this, heterogeneous integration of emerging electrooptic materials into Si or SiN platforms are a promising path to deliver <1fJ/bit device-level efficiency, 50+Ghz fast switching, and <10's um^2 compact footprints. Graphene's Pauli blocking enables intriguing opportunities for device performance to include broadband absorption, unity-strong index modulation, low contact resistance. Similarly, ITO has shown ENZ behavior, and tunability for EOMs or EAMs. Here we review recent modulator advances all heterogeneously integrated on Si or SiN such as a) a DBR-enabled photonic 60 GHz graphene EAM, b) a hybrid plasmon graphene EAM of 100aJ/bit efficiency, d) the first ITO-based MZI showing a VpL = 0.52 V-mm, and e) a plasmonic ITO MZI with a record low VpL = 11 V-um. We conclude by discussing modulator scaling laws for a roadmap to achieve 10's aJ/bit devices.