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Coherent nonlinear photonics: from attojoule to quantum

Monday, 23 September 2019 10:00 (45 minutes)

Looming technical challenges for both general- and special-purpose computation provide strong motivation to revisit device and architecture concepts for all-optical information processing. Communication bottlenecks and power constraints in conventional multi-core processor design are driving increasing interest in on-chip and chip-to-chip optical interconnect, while unique features of all-optical approaches make them attractive for edge computing and distributed sensor networks as well. One can already see, however, that demands for high speed and ultra-low power consumption are driving us to the picosecond-attojoule switching regime in which the quantum nature of optical fields becomes prominent. In this talk I will discuss our group's recent work to develop modeling infrastructure and autonomous coherent feedback control methods for quantum nonlinear photonics. I will illustrate the utility of these tools via circuit-design case studies for both quantum and ultra-low power classical all-optical information processing. I will conclude by discussing emerging challenges in expanding the toolbox to incorporate systematic model reduction and to accommodate broadband signal formats, as motivated by ongoing experiments in quantum nonlinear optics with integrated nanostructures and ultra-fast pump fields.

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