Programmable Silicon Photonics for the Implementation of Topological Systems

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Abstract: Topological photonics offers a platform to explore both fundamental physics and applications in integrated photonics. In this talk we unveil our latest results on the implementation of topological models in programmable integrated photonic platforms. © 2024 The Author(s)

Topological photonics [1] offers a platform to study fascinating fundamental physics as well as new avenues to address integrated photonics technological challenges such as the scalability of quantum information systems [2-4] and laser arrays [5-8].
Topological photonic platforms generally rely on quasiperiodic photonic arrangements of waveguides or resonators that leverage spatial symmetries to engineer dispersion relations with topological properties. A hallmark of these dispersion relations is the appearance of topologically protected edge modes, that are localized at the interfaces between materials with different topologies and that show robustness to certain kind of disorder and imperfections. The majority of topological phototonic structures experimentally demonstrated so far have a static character, with the exception of a few demonstrations showing limited reconfigurability [9-11].

Recently, we have unveiled that programmable integrated photonic platforms [12,13] can be used as a nearly universal platform to implement a variety of topological models and to accurately characterize the robustness of topological edge modes to different kinds of disorder [14]. In this talk, we will present our most recent results using programmable silicon photonics to implement topological and non-hermitian models.

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