UNIVERSITÀ DEGLI STUDI
DI TRENTO
Dipartimento di Fisica

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Università Politecnico di Bari

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Aula Seminari Fisica – Polo 0

Silicon Photonics for Biosensing and Navigation: Microring Sensors, Quasi-BIC Metasurfaces, and Chip-Scale Interferometric Gyros

Abstract:

Photonics offers a unique route to compact, field-deployable sensors by translating minute perturbations of the optical path into measurable spectral signatures. In this seminar I will overview the Micro Nano Sensor Group's recent work at Politecnico di Bari on three converging lines of research. First, we develop silicon-on-insulator microring platforms for label-free biosensing, including systematic comparisons of ring configurations and multiplexed architectures aimed at point-of-care detection of relevant biomarkers. Second, we design and experimentally validate all-dielectric metasurfaces that support quasi-bound states in the continuum (quasi-BICs), enabling extreme linewidth narrowing and strong near-field localization. We exploit symmetry-breaking strategies in slotted geometries to engineer resonances in the near-infrared telecom band and outline pathways to push the same physics toward the visible through material and geometry scaling. Third, we explore the miniaturization of interferometric optical gyroscopes by leveraging silicon photonics and integrated micro-optics, discussing key performance limits, packaging, and signal-processing requirements for navigation-grade operation in small platforms. The talk will conclude with an outlook on unifying device design, readout electronics, and data analytics to accelerate translation from laboratory prototypes to robust, manufacturable photonic systems.

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