UNIVERSITÀ DI PAVIA
Dipartimento di Fisica
"Alessandro Volta"

Avviso di seminario

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RECONFIGURABLE FEMTOSECOND-LASER-WRITTEN INTERFEROMETERS FOR (QUANTUM) PHOTONICS

Dipartimento di Fisica "Alessandro Volta"

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Abstract: The adoption of an integrated waveguide platform has enabled significant advances across a wide range of photonics applications, including high-bandwidth communications, small-volume sensing and neuromorphic computing. One field that has particularly benefited from this approach is quantum photonics, where the incomparable interferometric stability of monolithic waveguide circuits has made it possible to condense complex optical setups into a small footprint, thus opening the way to significant experimental milestones in recent years. In this context, femtosecond laser micromachining technology has played an important role. As a non-lithographic fabrication method, it allows for rapid prototyping of new circuit designs and offers unique three-dimensional capabilities, which makes it an attractive platform for the realization of photonic circuits with novel layouts and advanced functionalities.

We will discuss recent results in the realization of interferometric circuits written with femtosecond lasers, which can be dynamically reconfigured via thermo-optic phase shifters. Three-dimensional microstructuring of the substrate, enabled by our femtosecond laser micromachining technology, has further made it possible to combine high-fidelity circuit operation with remarkable energy efficiency, positioning our devices at the state of the art compared to more conventional approaches. Additionally, we will present new prospects for circuit actuation based on the elasto-optic effect, which enables phase modulation at frequencies reaching into the megahertz range.

Andrea Crespi earned an MSc in Physical Engineering (2008) and a PhD in Physics (2012) from Politecnico di Milano. From 2012 to 2015 he was a research fellow in Roberto Osellame's group at the Institute of Photonics and Nanotechnologies of the National Research Council (IFN-CNR). Since 2016 he has worked at Politecnico di Milano, becoming Associate Professor in 2022. His research focuses on femtosecond laser micromachining and direct laser writing of integrated optical circuits in glass. These circuits support sensing, optical simulation of quantum systems, and manipulation and processing of information encoded in quantum states of radiation.

