UNIVERSITA' DEGLI STUDI DI PAVIA

DOTTORATO DI RICERCA IN FISICA

# *COLLOQUIA 2015-2016*

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# Integrated waveguide photonics circuits for quantum simulation and beyond


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**Abstract**: Quantum information is having a beneficial impact in the design of new strategies to simulate complex systems. As first envisaged by Feynman, nothing can beat a quantum system in simulating another quantum system. Nowadays quantum simulators are getting to the level of real devices, constituted by a quantum system that can be controlled in its preparation, evolution and measurement and whose dynamics can implement that of the target quantum system we want to simulate. In this context, photonics quantum technologies are expected to play an instrumental role in the realization of controlled quantum systems capable, in their evolution, to simulate a given complex system.

In this Colloquium I will present some of the main results obtained in this field by using integrated waveguide optical circuits, that represent the hardware of a quantum simulator. These systems are constituted by interferometer arrays of beam splitters and phase shifters fabricated on single integrated platforms and have the potential of speeding-up the evolution from lab systems to the next generation of quantum optical devices for real-world applications. Using the mobility of photons we are able to create arbitrary interconnections within these systems and to mimic the main features of quantum phenomena of increasing complexity.