

ARTIFICIAL INTELLIGENCE

DM 630/ST MicroElectronics - Design of Advanced Silicon Photonics Components for Datacom

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] STMICROELECTRONICS S.R.L. [P.iva/CF:00951900968] Politecnico di TORINO [P.iva/CF:00518460019]
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Context of the research activity	The project, in collaboration with STMicroelectronics, focuses on the design of integrated optical devices based on Silicon Photonics technology to improve the performance and efficiency of communication networks in data centres, with particular attention to Wavelength Division Multiplexing systems. Progetto finanziato dal PNRR a valere sul DM 630/2024 - CUP: E14D24002330004
Objectives	The project focuses on the design of integrated optical devices based on Silicon Photonics (SiP) technology to improve the performance and efficiency of communication networks in data centres, with particular attention to Wavelength Division Multiplexing (WDM) systems. These new devices are essential to ensure the performance scaling needed to meet the projected traffic growth related to the explosion of AI applications. SiP technology enables miniaturization and functional integration, reducing costs and power consumption while increasing network capacity and reliability. These components are also an enabling solution for the development of photonic computing and neuromorphic networks, which are fundamental for the future development of AI. The design of these devices will be based on the experience accumulated at Politecnico di Torino, which has developed solid methodologies, including the use of machine learning, for the analysis and design of SiP components. The research activity will be carried out in collaboration with an industrial partner, the Italian division of STMicroelectronics, which has a strong experience in the design and fabrication of SiP devices, complementing the knowledge of Politecnico's team. The activity will start with an extensive review of the state-of-the-art on SiP

based components, followed by a training part on the software tools used for the simulation, analysis, and design of optical integrated circuits. The PhD candidate will then work on the design of innovative integrated components, in particular all-optical switches and circuits for optical computing. The project aligns with the PNRR themes of digital transition and the need for technological innovation, aiming to create a solid foundation for the development of advanced optical technologies. The local environment in which STMicroelectronics and Politecnico operate has a strong industrial and technological tradition, evidenced by a growing interest in the photonic sector.

Skills and competencies for the development of the activity

The candidate to this PhD position must have the following skills:

- Fundamental of semiconductor materials;
- Fundamental of integrated optics;
- Fundamental of technological processes;
- Experience on simulation tools, both general purpose (e.g. MATLAB) and specific for photonic integrated circuits.