STIPENDIJA ZA DOKTORSKE STUDIJE

U OKVIRU ERASMUS MUNDUSA

Za studente zemalja Zapadnog Balkana nudi se jedna pozicija za doktorske studije, na temu:

Nanophotonic systems for reconfigurable ultra-fast signal processing

Doktorske studije se rade dve do dve i po godine u Karlsruheu (Karlsruhe Institut of Technologie – KIT) i pola godine do godinu dana u Barceloni (Institute of Photonic Sciences - ICFO).

Doktorske studije finansira ERASMUS MUNDUS.

Za sve informacije u vezi potrebne dokumentacije i načina apliciranja kandidati treba da se obrate Caroli Moosmann na email carola.moosmann@kit.edu.

Uslov za upis su završene master studije, a poželjno je da je kandidat završio osnovne/master studije na Odseku za fizičku elektroniku.

Opis PhD projekta

Nanophotonic systems for reconfigurable ultra-fast signal processing

Main supervisor: ***Prof. Christian Koos***

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Co-supervisor: ***Prof. Valerio Bruneri***

Institute of Photonic Sciences (ICFO), Barcelona, Spain

World-wide data traffic is doubling every 18 months. Scaling today's device and network technologies will soon be insufficient to sustain this development, particularly when regarding power consumption. Already today, information and communication technology (ICT) accounts for more than 10 % of the total electric power consumption in most industrialized countries. Energy efficiency in data communications must hence be significantly improved within the next years.

This project aims at novel nanophotonic systems that enable low-power optical signal processing of Terabit/s data streams. We have recently demonstrated demultiplexing of a 26 Tbit/s signal by an all-optical implementation of a fast Fourier transform (FFT) [1] . This experiment, however, was based on discrete optical elements such as delay interferometers, and functionality was limited to the FFT. In the current project, we will investigate novel concepts for fully integrated optical signal processors which can be electronically reconfigured to perform various different signal processing tasks. Such systems can be built from a cascaded array of tunable, but structurally identical 'unit cells' [2] , [3] . To decrease foot print and power consumption, we will use silicon-organic hybrid (SOH) integration to realize the systems. In this approach, nanophotonic silicon-on-insulator waveguides are combined with functional organic cladding materials such as electro-optic polymers or liquid crystals, Figure 1(b) [4] . The SOH technique has previously been used to realize broadband electro-optic modulators with more than 60 GHz of bandwidth and ultra-fast all-optical demultiplexers operating at data rates of 170 Gbit/s [4] , [5] .
We are looking for ambitious candidates holding a Master degree in electrical engineering or physics. Applicants should have both a strong theoretical background and experimental skills, and should be able to work within an international team.

Work plan:

The work program comprises several steps:

- ***Theoretical investigation and evaluation of different photonic signal processing concepts (KIT)***
- ***Definition and design of a silicon-organic hybrid demonstrator system (KIT)***
- ***Fabrication and Characterization of silicon chip (KIT/ICFO)***
- ***Hybridization of silicon structures with functional organic materials (ICFO)***
- ***Characterization of fabricated SOH structures and functional testing (ICFO/KIT)***

References:

- ***Hillerkuss, D. et al .: 26 Tbit s-1 line-rate super-channel transmission utilizing all-optical fast Fourier transform processing. Nat ure Photonics 5, 364-371 ,(2011).***

- ***Ibrahim, S.-E et al. 'Fully Reconfigurable Silicon Photonic Lattice Filters with Four Cascaded Unit Cells, in 'Optical Fiber Communication Conference (OFC)', paper OWJ5, (2010).***

- ***Dowling, E. et al. , 'Lightwave lattice filters for optically multiplexed communication systems', Lightwave Technology, Journal of 12(3), 471 -486 (1994).***

- ***Alloatti, L. et al. , '42.7 Gbit/s electro-optic modulator in silicon technology', Opt. Express 19 (12), 11841—11851, (2011).***

- ***Koos, C. et al. , 'All-optical high-speed signal processing with silicon-organic hybrid slot waveguides', Nature Photonics 3 (4), 216-219, (2009).***