VPIphotonics contributes to PlasmoniAC

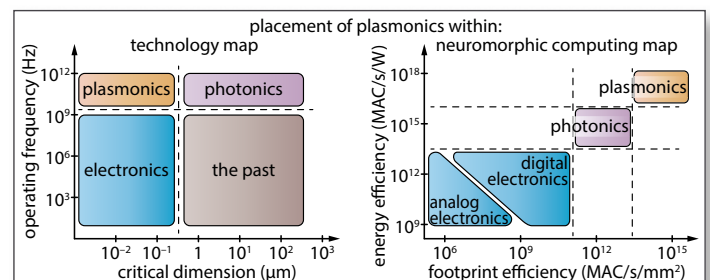Berlin, 2nd March 2020

Turning plasmons into neurons to revolutionize the landscape of brain-inspired computing through EU-funded PlasmoniAC research project

PlasmoniAC — "Energy- and Size-Efficient Ultra-Fast Plasmonic Circuits for Neuromorphic Computing Architectures" — is a new 3-year EU-funded project with a budget of almost 4 Million € under the H2020-ICT-06-2019: Unconventional Nanoelectronics Call, launched on January 1st, 2020, aiming to release a whole new class of energy- and size-efficient feed-forward and recurrent artificial plasmonic neurons with up to 100 GHz clock frequencies and 1 and 6 orders of magnitude better energy and footprint efficiencies, comparing to the current state-of-the art.

PlasmoniAC consortium is strategically compiled from strong industrial and academic organizations which will work synergistically and complementary along the PlasmoniAC value chain. Starting from material engineering and core fabrication technology providers through device and circuit manufacturers up to system testing suppliers and computing industry vendors, PlasmoniAC team includes four distinguished universities: Aristotle University of Thessaloniki (GR), University of Southampton (UK), Swiss Federal Institute of Technology in Zurich (CH), and University of Burgundy - Franche-Comté (FR), two renowned international R&D centers: French National Center for Scientific Research (FR) and Interuniversity Microelectronics Centre IMEC (BE), the European research branch of one of the world's largest computing technology developers and suppliers, IBM Research GmbH (CH), a dynamic SME with an excellent industrial and R&D track record, AMO GmbH (DE), one of the world's largest capital equipment supplier and vendor in the area of DataCom components and systems, Mellanox Technologies Ltd (IL), and one of the leading photonic software design houses, VPIphotonics GmbH (DE).

VPIphotonics will develop an add-on model library of plasmonic devices for use in VPIphotonics Design Suite. The goal is for users to be able to build and simulate neuromorphic circuits and evaluate the performance of plasmonic-based deep neural network architectures.

Following a holistic hardware/software co-design approach, PlasmoniAC targets the following objectives:

i) to elevate plasmonics into a computationally credible platform with Nx100 Gb/s bandwidth, μm^2-scale size and >10^{14} MAC/s/W computational energy efficiency, using CMOS compatible electro- and thermo-optic computational functions,

ii) to blend them via a powerful 3D cointegration platform employing photonic for interconnection, plasmonics for computations and nonvolatile memristor-based control of the neuron weights,

iii) to fabricate and demonstrate a whole new class of plasmonic neurons for feed-forward and recurrent neural networks, applying them towards IT security-oriented applications, and

iv) to embrace them into a properly adapted Deep Learning training model suite, ultimately delivering a neuromorphic plasmonic software design library.

As a coordinator, Aristotle University of Thessaloniki hosted the kick-off meeting on January 21-22, 2020 in Thessaloniki, Greece, gathering representatives of all partners in a highly inspiring atmosphere and announcing intensive collaboration within the network. With all members highly motivated, PlasmoniAC is now looking forward to the first results.

About Plasmonics

Computing industry is rapidly moving from a programming to a learning era, where the 10 GMAC/s/W (MAC, multiply–accumulate operation) digital energy efficiency wall of current CMOS electronics and von-Neumann architectures cannot keep the pace with the new computational power metrics required. A new computing paradigm based on non-von-Neumann layouts, collocating memory and processing units and relying on the working principles of the human brain, has already begun to unfold, leading to the development of large neuromorphic machines that already exceed the overall efficiency of classical platforms. However, the current technology of both electronics and photonics is encountering difficulties in simultaneously improving the computational power and the energy- and footprint-efficiency of neuromorphic circuitry.

Being at the dawn of neuromorphic computing, a future-proof solution that could dominate this landscape for many years to come should obviously rely on the best-performing and top-efficient technology mixture. This is exactly where plasmonics comes to offer what electronics and photonics lack, a natural platform for synergizing photonic-level bandwidths with electronic-level sizes within an ultra-high energy efficiency envelope.

Gathered around this idea, 10 partners from 7 countries have united in launching PlasmoniAC project, aiming to take advantage of these fundamental benefits towards deploying and demonstrating a neuromorphic plasmonic platform that can optimize speed, energy, and size efficiency across all its constituent circuitry by utilizing and advancing the best-in-class technology and material platforms.

The outcome of the PlasmoniAC project — a radically new neuromorphic plasmonic circuit technology — perfectly responds to the pressing industrial needs for high-speed, energy- and size-efficient low-cost neuromorphic chips, offering a unique chance for strengthening the competitiveness of European photonics industry and putting European companies at world-leading position in the global neuromorphic and Deep Learning market.

For further information, please visit http://www.plasmoniac.eu.

About VPIphotonics

VPIphotonics™ sets the industry standard for end-to-end photonic design automation comprising design, analysis and optimization of components, systems and networks. We provide professional simulation software supporting requirements of optoelectronics, integrated photonics and fiber optics applications, optical transmission system and network applications, as well as cost-optimized equipment configuration.

Our team of experts provides professional consulting services addressing customer-specific design, analysis and optimization requirements, and delivers training courses on adequate modeling techniques and advanced software capabilities.

VPIphotonics' award-winning off-the-shelf and customized solutions are used extensively in research and development, and by product design and marketing teams at hundreds of corporations worldwide for 20+ years.

Over 160 academic institutions joined our University Program enabling students, educators and researchers an easy access to VPIphotonics' latest modeling and design innovations.

For further information, please visit us at
www.VPIphotonics.com