Integrated photonics for artificial intelligence and neuromorphic computing

Modern electronic technologies are fast approaching the limits of power processing. New methods for processing the massive generation of data stemming from the exponential growth of internet applications are necessary for artificial intelligence applications. The EU-funded PHOENICS project aims to lay the foundations for a disruptive neuromorphic computing platform based on hybrid photonic integrated circuits. Project partners have demonstrated the significant potential a photonic
approach can offer by establishing a new brain-inspired computing paradigm using phase-change materials. By implementing scalable systems based on foundry processing for creating bio-mimicking material platforms, PHOENICS will provide a new generation of photonic hardware accelerators for neuromorphic processing and develop a strong ecosystem for photonic computing.

**Objective**

Modern societies and economies increasingly depend on the massive generation of data resulting from the exponential growth of internet applications. Drastically enhanced computational performance is in particular needed for a plethora of applications in artificial intelligence (AI) which necessitate unprecedented processing power, memory and communication bandwidth. This demand cannot be met by modern digital electronic technologies that are rapidly approaching their physical limits. The PHOENICS consortium will break through these barriers and lay the foundation for a disruptive neuromorphic compute platform based on hybrid photonic integrated circuits. By providing access to parallelized neuromorphic processing using wavelength division multiplexing, the PHOENICS consortium will harness exceptional scaling potential not available to electronic systems and will deliver multiply-accumulate (MAC) performance at 3.2 PetaMAC/s at an energy cost of 50 FemtoJoule/MAC. Building on a hybrid architecture with substantial potential for future upscaling, the PHOENICS project aims at implementing a disruptive architecture which outperforms state-of-the-art electronic neuromorphic hardware.

The consortium partners have shown the significant technological potential that a photonic approach can offer by establishing a new brain-inspired computing paradigm using phase-change-materials. By implementing scalable systems based on foundry processing for creating bio-mimicking material platforms, the PHOENICS consortium will provide a new generation of photonic hardware accelerators for neuromorphic processing and develop a strong ecosystem for photonic computing. The PHOENICS technology will thereby directly impact today’s technology and likewise address future needs for high bandwidth and low latency compute systems for AI.

**Fields of science**

natural sciences ➔ computer and information sciences ➔ artificial intelligence
natural sciences ➔ computer and information sciences ➔ internet
natural sciences ➔ biological sciences ➔ ecology ➔ ecosystems

**Programme(s)**
H2020-EU.1.2. - EXCELLENT SCIENCE - Future and Emerging Technologies (FET)  
H2020-EU.1.2.2. - FET Proactive  

**Topic(s)**  
FETPROACT-09-2020 - Neuromorphic computing technologies  

**Call for proposal**  
H2020-FETPROACT-2018-2020  

See other projects for this call  

**Sub call**  
H2020-FETPROACT-2020-01  

**Funding Scheme**  
RIA - Research and Innovation action  

**Coordinator**  

WESTFAELISCHE WILHELMS-UNIVERSITAET MUENSTER  
Net EU contribution  
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Activity type  
Higher or Secondary Education Establishments  

Links  
Contact the organisation  
Website  
Participation in EU R&I programmes  
HORIZON collaboration network
### Participants (9)

<table>
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<th>Organisation</th>
<th>Net EU contribution</th>
<th>Address</th>
<th>Region</th>
<th>Activity type</th>
</tr>
</thead>
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<tr>
<td><strong>THE UNIVERSITY OF EXETER</strong></td>
<td>€ 423,821.25</td>
<td>The Queen’s Drive Northcote House, EX4 4QJ Exeter</td>
<td>South West (England) ➔ Devon ➔ Devon CC</td>
<td>Higher or Secondary Education Establishments</td>
</tr>
<tr>
<td><strong>ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE</strong></td>
<td>€ 740,000.00</td>
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<td>Schweiz/Suisse/Svizzera ➔ Région Lémanique ➔ Vaud</td>
<td>Higher or Secondary Education Establishments</td>
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</tbody>
</table>
NANOSCRIBE GMBH

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€ 0,00

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€ 0,00

MICROR SYSTEMS SARL
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Activity type
Private for-profit entities (excluding Higher or Secondary Education Establishments)

Links
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Non-EU contribution
€ 0,00

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Activity type
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Links
Contact the organisation
Participation in EU R&I programmes
HORIZON collaboration network

Non-EU contribution
€ 0,00

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