PhD position in collaborative international project:

Neuromorphic Computing using QD-Networks

In the frame of the Volkswagen Foundation project "Neuromorphic Computing using QD-Networks" (NeuroQNet II), we are searching for a motivated PhD candidate with expertise in integrated photonics and interest in neural networks / artificial intelligence. NeuroQNet II is the continuation of the highly successful NeuroQNet I project and investigates integrated photonic neural networks based on optical waveguides and arrays of quantum dot micropillar lasers. The field of artificial intelligence and photonic neural networks is currently experiencing significant attention, and the members of the NeuroQNet consortium (Dr. Brunner, Prof. Reitzenstein) are internationally leading experts in this field.

The PhD project will take place at the FEMTO-ST CNRS institute in Besancon (supervision Dr. Brunner, https://members.femto-st.fr/daniel-brunner). Work will consist of realizing a scalable integrated photonic platform for large scale neural networks where the micro-lasers act as photonic neurons [1-3]. For that we will employ cutting edge 3D nano-fabrication techniques. This technology will then be applied to arrays of high performance semiconductor lasers [4], developed in the group of Prof. Stephan Reitzenstein at the Technical University Berlin, Germany (https://www.ifkp.tu-berlin.de/menue/arbeitsgruppen/ag_reitzenstein/mitarbeiter/). Combined this will create a fully integrated neural network operating at a record speed of 20 GHz. In terms of number of neurons, bandwidth, integration density and potentially energy efficiency the architecture will be orders of magnitude beyond any currently available system on a global level.

The project is supported by the Volkswagen Foundation, which is known for competitive and highly attractive funding. Education and training in leading edge optical and neural network techniques are a set of skills which currently are in high demand and would equip the student for life after the PhD. During their PhD, the student will attend international conferences and workshops and have the opportunity to network with collaborating institutions. Candidates should have excellent knowledge of and experience with photonic fabrication. Additional expertise with free-space optics is an advantage.

Interested candidates please contact us via email:

- Daniel Brunner: daniel.brunner@femto-st.fr

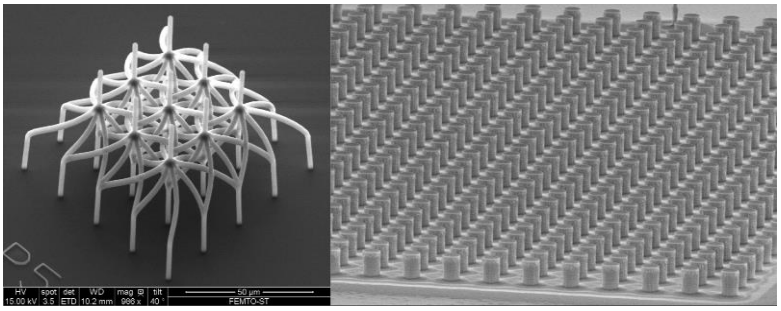

Figure 1. Photonic neural networks based on 3D waveguides and arrays of semiconductor lasers. The left panel shows an SEM image of the photonic waveguide networks, the right of the arrays of quantum dot micropillar lasers.

[1] Brunner, D.; et al.; "Parallel photonic information processing at GByte/s data rates using transient states," Nature Communications 4, 1364 (2013). **[2]** Bueno, J.; et al. ; "Reinforcement learning in a large-scale photonic recurrent neural network," Optica 5, 756 (2018). **[3]** Heuser, T.; et al.; "Fabrication of dense diameter-tuned quantum dot micropillar arrays for applications in photonic information processing," APL Photonics 3, 116103 (2018).