

## Neuromorphic Computing using QD-Networks (NeuroQNet)

Initiative: Integration molekularer Komponenten in funktionale makroskopische Systeme (beendet, nur noch

Fortsetzungsanträge)

Bewilligung: 01.12.2015

Laufzeit: 3 Jahre

Projekt-Website: [www.neuroqnet.com](http://www.neuroqnet.com)

The goal of this project is to develop a new nanophotonics based platform for neuro-inspired information processing. Dense arrays of semiconductor microlasers and single photon sources with quantum dots in the active layer will take a role comparable to neurons in the brain. Neuron-connectivity is being established via diffractive coupling by an external spatial light modulator. Similar to the brain's primary sensory cortex, computation is provided by induced macroscopic network-dynamics, which allows for efficient information processing with diverse applications such as pattern classification, nonlinear prediction and ultra-fast control loops. A particularly attractive aspect of the scheme is that it merges the inherently parallel concepts of reservoir computing and photonics within a compact and scalable physical machine learning implementation. As such, an ultra-fast (GHz bandwidth) and versatile platform complementary to recent large-scale electronic approaches (e.g. human brain project, IBM or Google) will be developed.

### Projektbeteiligte

#### **Prof. Dr. Stephan Reitzenstein**

Technische Universität Berlin

Fakultät II

Institut für Festkörperphysik

Sekretariat EW 5-3

Berlin

#### **Daniel Brunner**

CNRS - Centre National de la Recherche

Scientifique

Département d'Optique

Institut FEMTO-ST

UMR CNRS 6174

Office N1-BUR-04

Besancon (cedex)

Frankreich

## Open Access-Publikationen

Resonance fluorescence of a site-controlled quantum dot realized by the buried stressor growth technique

Developing a photonic hardware platform for brain-inspired computing based on 5 x 5 VCSEL arrays

Development of Highly Homogenous Quantum Dot Micropillar Arrays for Optical Reservoir

Computing

Reinforcement learning in a large-scale photonic recurrent neural network

Boolean learning under noise-perturbations in hardware neural networks