

Neuromorphic Computing using QD-Networks II (NeuroQNet II) (extension)

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

Fortsetzungsanträge)

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Laufzeit: 3 Jahre

NeuroQNet II will establish (i) an universal platform for nonlinear photonic networks, and (ii) a revolutionary concept for 3D integrated photonic networks. With respect to (i) the capabilities of the nanophotonic hardware platform developed in NeuroQNet I will be advanced. The current quantum dot micropillar arrays (QDMPA) are well suited for photonic reservoir computing (RC), yet the non-ideal spectral homogeneity and optical gain frustrate other high-impact applications like coherent annealing computing and coherent beam combining. Fundamentally, these applications are based on identical architectures as photonic RC: coupling between the individual lasers and / or optical injection. Thus, the photonic hardware platform will be optimized to demonstrate coherent annealing and to investigate the possibility of coherent beam combining for the first time in a coupled microlaser system. Secondly, regarding (ii) the project aims to improve neuromorphic photonic circuits through integration into 3D photonic waveguides via nanoscribe 3D printing. Such an architecture will be of extremely far-reaching impact. In the currently employed 2D-only substrates, the integration of networks is not scalable. Leveraging the scaling between 2D-emitters and 3D-connections will overcome this bottleneck to crucially enhance the computation power of neuromorphic systems.

Projektbeteiligte

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[Three-dimensional waveguide interconnects for scalable integration of photonic neural networks](#)

[Optical Neural Networks: The 3D connection](#)

[3D printed multimode-splitters for photonic interconnects](#)