nextnano
Software for semiconductor nanodevices

2019-Sep-14

Interested in QuantumTech 2.0?

We have a **Research position** available on Numerical modeling of Electronic Flying Qubits

For our new FET-Open EU research project **UltraFastNano** (Electronic generation and detection in nanoelectronic devices at the picosecond scale), we are seeking a new team member with a strong interest in modeling the quantum physical properties of semiconductor nanodevices. You will be responsible for fast and predictive simulations of arbitrary geometries of electrostatically gated two-dimensional electron gases (2DEGs) using our nextnano software.

Your responsibilities

- Performing 3D Schrödinger-Poisson simulations of the electrostatics in gated 2DEGs that serve as single-electron transistors
- Optimization of the devices using machine learning algorithms
- Close interaction with the consortium partners and travel to project meetings
- Contributing to the development of our nextnano software
- Modeling of further exciting semiconductor devices (e.g. VCSELs, LEDs, Nanotransistors, Photodetectors, Quantum Cascade Lasers, …) and providing support to our customers

Your qualifications

- M.Sc. or PhD in Physics or Electrical Engineering with relevant experience in Theoretical Solid State Physics, Semiconductor Physics and Quantum Mechanics
- Programming Skills

nextnano GmbH is a spin-off from the Walter Schottky Institute of the Technische Universität München and develops software for the simulation of electronic and optoelectronic semiconductor nanodevices. Our software is used by thousands of researchers in more than 35 countries. Our office is located in the gate (Garchinger Technologie-und Gründerzentrum), Lichtenbergstr. 8, 85748 Garching b. München, on the TUM campus.

To find out more, please contact Dr. Stefan Birner, stefan.birner@nextnano.com, visit us for a cup of coffee and join us for lunch.

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Project summary

UltraFastNano

Electronic generation and detection in nanoelectronic devices at the picosecond scale

A key figure of merit of quantum technologies is the ratio between two characteristic times: the (decoherence) time during which a quantum state remains well defined and the time it takes for operating the device. Most technologies inherently work at the nano-second scale, hence concentrate on fighting decoherence processes. The goal of **UltraFastNano** is to pioneer new concepts at the crossroads between quantum optics and solid-state nanoelectronics at the pico-second scale, almost three orders of magnitude faster than other quantum technologies. Using fermionic flying excitations created with picosecond controlled voltage pulses at cryogenics temperatures (10 mK), we envision achieving full control of quantum excitations that propagate through electronic devices. A key deliverable of **UltraFastNano** is (i) the demonstration of the first electronic flying quantum bit, a paradigm-shifting approach to quantum computing and quantum communication. Besides, such a technology would enable major new applications such as (ii) electronic sources and detectors that operate at the picosecond scale; (iii) picosecond optoelectronic devices that convert between electronic and photon pulses; (iv) beyond state-of-the-art metrological measurement of the ampere. To achieve this vision, **UltraFastNano** will establish a unique unprecedented platform for creating, manipulating and detecting quasi-particles excitations at the single-electron level in semiconductor heterostructures. We will unlock two major technological bottlenecks: a picosecond on-demand coherent single particle source and the single-shot detection of propagating excitations at the discrete charge level. **UltraFastNano** gathers a team with complementary expertise in quantum nano-electronics, optics, nano-fabrication, microwave electronics, cryogenics, theoretical physics, applied mathematics and software engineering. The partners are internationally recognized for having played a key role in the emergence of the field.

Project partners

- Commissariat à l'énergie atomique et aux énergies alternatives (CEA), (a) Institute of Nanoscience and Cryogenics, Grenoble, France (Dr. Xavier Waintal, Theory) – Coordinator, (b) Service de Physique de l'Etat Condensé, Paris-Saclay, France (Dr. Christian Glattli, Experiment)
- nextnano GmbH, Garching b. München, Germany (Dr. Thomas Grange, Modeling)
- CNRS, Institut Néel, Grenoble, France (Dr. Christopher Bäuerle, Experiment)
- National Physical Laboratory (NPL), Quantum Science, London, United Kingdom (Dr. Masaya Kataoka, Experiment)
- Chalmers University of Technology, Department of Microtechnology and Nanoscience, Gothenburg, Sweden (Prof. Janine Splettstößer, Theory)

Project start: 2020-Jan-01. Duration: 4 years

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