Postdoctoral Research Position in Electro-Optical Modulator Development for Laser Communication Systems

Location: Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Institute of Ion Beam Physics and Materials Research, Dresden, Germany
Collaborating Institution: TUD Dresden University of Technology, Faculty of Mechanical Science and Engineering, Institute of Aerospace Engineering
Contract Duration: 2 years (starting April-May 2026)
Funding: German Aerospace Center (DLR)

Project Overview

We invite applications for a postdoctoral position within a joint research project between the Helmholtz-Zentrum Dresden-Rossendorf (HZDR) and the Dresden University of Technology (TUD), funded by the German Aerospace Center (DLR). The project aims to develop and characterize a novel electro-optical modulator-based system to enable laser communication between low-orbit satellites and ground stations.

Unlike conventional laser communication systems, modulating retroreflectors (MRRs) offer significant advantages by eliminating the need for on-board lasers and complex alignment mechanisms, thus reducing size, weight, and power consumption. This approach makes high-speed laser communication feasible even for nanosatellites.
The developed system will function simultaneously as a communication, tracking, and identification platform. The modulator, based on the quantum-confined Stark effect (QCSE), will allow control of the semiconductor absorption characteristics via applied voltage. A laboratory prototype will be fabricated and tested under various environmental conditions to assess its suitability for space applications, including the development of a thermal control system for nanoscale quantum structures.

Responsibilities

The successful candidate will:

- Design electro-optical modulators based on band structure and optical absorption calculations (using nextnano software).
- Participate in the fabrication of III–V semiconductor-based structures at HZDR.
- Conduct structural and optical characterization (e.g., XRD, transmission spectroscopy).
- Perform device processing using photolithography and cleanroom techniques.
- Test and analyze device performance under relevant environmental conditions.
- Collaborate closely with partners at TUD in the design, testing, and system integration phases.

Qualifications

- PhD in semiconductor physics, materials science, electrical engineering, or a closely related field.
- Strong background in semiconductor physics and optoelectronic device principles.
- Proven experience with device processing and cleanroom fabrication techniques.
- Experience with structural and optical characterization methods (XRD, spectroscopy, etc.).
- Knowledge of simulation tools (e.g., nextnano) is advantageous.
- Excellent communication skills and the ability to work in a multidisciplinary team.

We Offer

- A two-year postdoctoral position at one of Germany's leading research centers.
- Access to state-of-the-art cleanroom and materials characterization facilities.
- Close collaboration with researchers at HZDR and TUD.
- An opportunity to contribute to cutting-edge research in satellite communication technology and semiconductor device innovation.

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