Master M2 thesis Project

Growth of efficient nanowire-based single-photon emitters for free-space communication

General Scope: Single-photon sources are a key component in the framework of quantum communication and computing. In particular, they are required for the transmission of a secret decryption key, intrinsically secured by the laws of quantum physics. Our group develops the growth and optical studies of CdSe quantum dots (QDs) embedded in bottom-up core-shell ZnSe nanowires (NWs), all grown by molecular beam epitaxy (MBE). We have shown that these QDs are able to emit single-photons up to room temperature. Moreover, their emission in the blue-green spectral range is particularly appropriate for both free air-space and underwater communication.

Subject: The master internship aims at controlling the growth of these CdSe/ZnSe NW-QDs in order to enhance their efficiency as single-photon emitters. That means: (i) optimizing the growth of core-shell type nanowire heterostructures in order to enhance the emission quantum yield, (ii) acquiring the control of the QD shape and purity to permit the emission of entangled photons.
The internship combines MBE growth, structural characterization (scanning electron microscopy) as well as optical characterization. It offers the opportunity to explore a broad range of basic physical phenomena (growth mechanisms, optical properties, etc.) at the nanometric scale, while contributing to the development of a device essential for the field of quantum communication and quantum information processing.

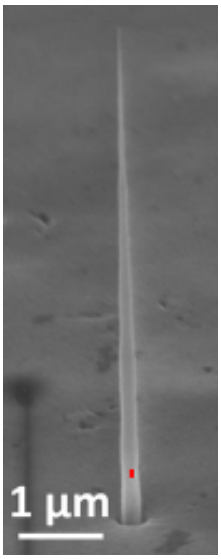

Fig. : CdSe QD (sketched in red) in a ZnSe nanowire.

Environment and collaborations: Our group "NanoPhysics and Semiconductors" is a joint CEA/CNRS team and the intern will interact closely with researchers of our group both in CEA-IRIG and in CNRS-NEEL.

Required skills: Nanosciences, material science, semiconductor physics, with interest for experiment and work in collaboration.

Starting date: February or March 2024
Duration: 4-5 months

Laboratory: CEA-Grenoble/PHELIQS/NPSC: www.pheliqs.fr/Pages/NPSC/Presentation.aspx

Contact: send your application (including CV) by e-mail to:

- Dr. Edith BELLET-AMALRIC: edith.bellet-amalric@cea.fr
- Prof. Kuntheak KHENG: kkheng@cea.fr

French Commission for Atomic Energy and Alternative Energies
Interdisciplinary Research Institute of Grenoble
Quantum Photonics, Electronics and Engineering Laboratory
17 av. des Martyrs – 38054 Grenoble cedex 9 – France