1.5µm SINGLE-PHOTON EMISSION FROM GaSb QUANTUM DOT EXCITED RESONANTLY WITH A SEMICONDUCTOR LASER

Teemu Hakkarainen[1], Arttu Hietalahti[2], Joonas Hilska[1], Sanna Ranta[1], Emmi Kantola[2], Markus Peil[1], Abhiroop Chellu[1], Lea Kopf[3], Jaime Moreno Zuleta[3], Robert Fickler[3], Jussi-Pekka Penttinen[2], Mircea Guina[1]

[1] Optoelectronics Research Centre, Physics Unit, Tampere University, Tampere, Finland, [2] VEXLUM Oy, Tampere, Finland, [3] Experimental Quantum Optics Group, Physics Unit Tampere University, Tampere, Finland

Vertical external cavity surface-emitting lasers (VECSEL) have already been successfully used for quantum experiments based on ion and atom systems, where the main desired features are narrow lin-ewidth, low noise, and stability [1]. Here we are exposing the broad tuning capability of the VEXLUM VALO single-frequency laser platform for the excitation of recently developed GaSb-based semicon-ductor quantum dots created by filling droplet-etched nanoholes [2,3] which can provide single-photon emission in the 3rd telecom widow [4]. We show that the broad tuning range of the VECSEL allows accessing both quasi-resonant excitation to the p-shell of the quantum dot and phonon-assisted resonant excitation of the ground state excitons. Both excitation schemes allow direct excitation of a single quantum dot and elimination of complex charge relaxation paths in the surrounding semicon-ductor matrix [4,5], thus improving the charge stability of the quantum dot. Consequently, we observe pure spectral properties with predominant emission from a positive trion, and high single-photon puri-ty. These results pave way for the new applications of VECSELs in quantum dot spectroscopy and quantum photonic devices based on a single quantum dot acting as a source of non-classical light, which are fields largely dominated by more complex and large laser systems such as Ti-sapphire lasers and optical parameteric oscillators.