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Correlated Atom Probe Tomography and optical spectroscopy analyses of nitride nanostructures

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In this seminar I will present our work on nanoscale analyses of nitride nanostructures such as InGaN/GaN quantum wells (QWs) in nanowires and GaN/AlN Stranski-Krastanov quantum dots (QDs). These nanostructures are investigated by correlating their structural properties assessed by Atomic Probe Tomography and STEM with their optical signature addressed by micro-photoluminescence and time-resolved photoluminescence. Experimental results are compared with 3D effective mass modeling, which account for the experimental 3D composition of the nanostructures. The multi-microscopy approach allows for studying different system dependent features, namely the effect of stacking faults on the optical properties of single InGaN/GaN QWs (illustrated in Fig. 1) and the influence of GaN/AlN QDs morphology and thickness fluctuations on transition energies, charge carriers localization, and biexciton-exciton cascade processes. The ensemble of the results obtained for the two III-N nanostructures systems shows how the developed approach ensures the best exploitation of the information obtained from the different analyses, allowing for a precision of characterization, which can be hardly matched by other techniques.