ASSESSMENT OF INTERFACE ROUGHNESS PARAMETERS IN QUANTUM CASCADE LASERS

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During this seminar I will give an overview of my work in the field of Quantum Cascade Lasers (QCLs) and present in more details the work I am conducting at the Quantum Optoelectronics Group of ETH Zürich.

In a QCL, the radiative transition is a so called Intersubband Transition (ISBT). ISB energy levels arise from quantum confinement created by combining semiconductors with different bandgaps. The cascade scheme stems from the repetition of the same layer sequence, called the period. In each of those, the electron undergoes an ISBT and is then transported to the next period. Thus, unlike other semiconductor lasers, QCLs rely on bandgap engineering rather than the intrinsic materials properties. It illustrates why the control of the heterostructure such as the layer thicknesses, compositions, interface sharpness are so crucial.
Currently my work focuses on developing an approach to tackle the main limitation of mid-infrared QCLs: the interface roughness. However, before trying actively to improve interface quality, we need a reliable quantitative method to measure interface roughness parameters. Up to now, they are fitted by assuming an interface roughness model for the height fluctuation correlation function. During this seminar, I will present in detail an approach to determine interface roughness parameters, based on the treatment of atomic resolution Scanning Transmission Electron Microscopy (STEM) images.