Long wavelength superlattice Terahertz Quantum Cascade Lasers

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Loss coupled distributed feedback quantum cascade lasers (QCLs) are demonstrated. The operating principle is based on the tunnelling of the guided surface plasmon mode across a thin first order metal grating placed on top of the active region. Depending on the grating periodicity, single mode operation is achieved between 2.62 and 2.69 THz with a side-mode suppression of 20 dB. The grating coupling constant is shown to be controllable by changing the thickness of the metal layer.

Next, we shall show how, by optimising the fabrication of double-metal waveguides using dry etching, the performance of previously demonstrated superlattice QCLs at \( f = 2.8 \) and 1.9 THz (\( \lambda = 107 \) and 155 \( \mu \)m) could be improved, reaching operation in pulsed(continuous wave) mode up to maximum temperatures of 100K(90K) and 90K(77K) respectively.

The last part of the talk will focus on the experimental study of gain formation in the active region of a 2.9 THz superlattice QCL, by presenting new results obtained with a system of two coupled ridge cavities.