Seminarankündigung

Dienstag, 14. Juli 2015
17:15 Uhr

WSI, Seminarraum S 101

"High power THz quantum cascade lasers based on novel materials and designs"

Quantum cascade lasers (QCLs) are most successful quantum devices which cover a broad spectral range from the infrared to the THz. However, their operation is still limited in terms of operating temperature, output power and beam properties. Therefore, we investigate new materials system and active regions designs. We use InGaAs/GaAsSb due to the lower effective mass and lower conduction band offset. We have achieved record operating temperatures despite the large interface roughness asymmetries in this material. We quantify this asymmetry by studying symmetrically designed active regions. This is used to choose the proper operating direction and doping profile. We will also report on the fabrication of laterally structured active regions to reduce intersubband scattering. Another strategy to improve the performance is to increase the number of cascades in the active region. However, due to the epitaxial growth the maximum active region thickness is limited to around 10–15 µm. To circumvent this growth problem we developed a direct wafer-bonding technique to increase the thickness of the active region by stacking the same active region. With these devices we reach record output power levels of almost 1 Watt and a significantly improved far field. This performance allows to perform real time THz imaging using micro bolometer cameras. The unique properties of QCLs allows the fabrication of double metal micro-cavities. They show very low threshold currents and coupling between them shows an interesting behavior. From weak to strong coupling with an unexpected dependence due the existence of an exceptional point.

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