14. Title: Inter-Landau Level Scattering Processes in Magnetic Field Assisted THz Quantum Cascade Laser
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    Abstract: We present a detailed analysis of GaAs/AlGaAs terahertz quantum cascade laser in the presence of an intense external magnetic field. One of the objectives in further development of THz quantum cascade laser is the realization of structures operating at higher temperatures. This is difficult to obtain as the operating photon emission energy is smaller than the longitudinal-optical phonon energy in the semiconductor material. With increased temperature, electrons in the upper radiative state gain sufficient in-plane energy to emit an longitudinal-optical phonon, which represents a non-radiative scattering and reduces the optical gain. By applying strong magnetic field, two-dimensional continuous energy subbands become split into series of discrete Landau levels, and at particular values of B it is possible to quench these non-radiative channels. Numerical simulations are performed on two-well design quantum cascade laser operating at 4.6 THz, implemented in CaAs/Al0.15Ga0.85As, and the magnetic field is perpendicular to the epitaxial layers. Strong oscillations of carrier lifetimes for the upper state of the laser transition, as a function of magnetic field are observed, which can be attributed to interface roughness scattering and longitudinal-optical phonon scattering between Landau levels.