

**THz quantum cascade lasers: THz time-domain spectroscopy study**

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We have combined few-cycle THz spectroscopy with quantum cascade technology to perform unique measurements of a terahertz gain medium. This approach allows to obtain information on the energy and population dynamics within the quantized energy levels as well as on the optical properties of the waveguide resonator. For biased QCLs we observe THz amplification that is dependent on the bias current density. This dependence is very helpful in understanding the detailed mechanisms of population inversion and the gain dynamics during laser operation.

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