

## Interface Phonon Mediated Quantum Cascade Terahertz Emitter

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We present evidence for Terahertz (THz) emission from electrically injected GaAs/AlGaAs quantum cascade structures employing interface phonons for depopulation. In a three-level multi-quantum well system, the lower two electronic levels, shown in Fig. 1, are designed to be in resonance specifically with one of the LO phonon modes in the layered system. The possibility of attaining population inversion between levels  $|3\rangle$  and  $|2\rangle$  is improved due to the extremely fast interface phonon-mediated depopulation of level  $|2\rangle$ . We employ *phonon wavefunction engineering* for the design of such devices, by exploiting the presence of specific interface phonons. Results of theoretical simulations, indicating the benefits of utilizing the higher energy AlAs-like interface phonons for depopulation will be shown. Fig. 2 shows the grating-coupled surface emission spectra for a particular sample, which was designed for emission at 16 meV ( $\sim 3.8$  THz). Spectra were taken at  $T = 60$  K using a Fourier Transform Spectrometer in the step-scan mode, for different applied voltages. It can be seen from Fig.2 that at the optimal bias, the emission becomes more prominent and narrower. Results of ongoing work to develop an intersubband THz laser will also be present.

