

Abstract Submitted
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Compact Four-Wavelength Quantum Cascade Laser Source for Multi-Wavelength Spectroscopic Systems FATIMA TOOR, SCOTT HOWARD, CLAIRE GMACHL, Princeton University — Quantum cascade laser (QCL) technology in the mid-infrared wavelength range has great potential for applications in environmental trace gas sensing. QCL-based spectroscopic techniques have been developed by several research groups [1]. However, more research work is needed to make QCL-based spectroscopic techniques more sensitive while being compact and field deployable. Here we propose a QCL source that can emit four wavelengths of light at ambient temperature and can be mounted on a single chip. The four QCL wavelengths are $\lambda = 7\mu\text{m}$, $9\mu\text{m}$, $11\mu\text{m}$ and $13\mu\text{m}$ essentially covering the second atmospheric transmission window. The four-wavelength QCL source is designed using a heterogeneous cascade design with two wavelengths each combined in one waveguide. For each two wavelength device, the number of active region and injector stages for the two QCLs are optimized such that each wavelength has equal laser threshold current density. This work was supported in part by MIRTHER (NSF-ERC). [1] Kosterev A., Tittel F. K., “Chemical sensors based on quantum cascade lasers.” *IEEE JQE Special Issue on QC Lasers*, 38 (2002): 582-591

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