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Temporal Wavelength Multiplexing of a Quantum Cascade Laser¹

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Electrical Engineering, Princeton University — Quantum cascade (QC) laser based sensor systems in the mid-infrared wavelength range (3-30 μm) have applications in environmental, industrial and medical trace gas sensing. QC laser- based spectroscopic techniques have been developed by several research groups. However, more research work is needed to make these techniques more compact and field deployable. One approach to compactness is to have spectral versatility from a single device. Here we report work on a QC laser based system that is both temporally and wavelength multiplexed, that is, it can emit two different wavelengths at two alternate time slots. A bi-directional and multi-wavelength QC laser source that emits at 10.2 μm wavelength for positive polarity current and 8.6 μm for negative polarity current is used. A system is designed so that a single pulsed current source is the input to a pulse-alternator circuit that flips the polarity of every other pulse. The output of the circuit is connected to the bi-directional and multi-wavelength QC laser to emit two different wavelengths for alternate pulses. Contributions by Gary Shu at the beginning of the work are acknowledged.

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