



University of Central Florida

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Ring-Cavity Surface Emitting QCL with Higher Power and Excellent Beam Quality

Most commercially available quantum cascade lasers (QCLs) are edge-emitting, yet this invention from University of Central Florida involves ring-cavity surface-emitting QCLs (RCSE-QCLs) that are concentrically nested to combine power, coupled to insure coherent emission, and phase controlled with integrated optical delays to engineer the beam profile. This novel method obtains high-power continuous-wave coherent laser radiation at wavelengths from 4 to 20 micrometers and provides a new design approach of a power-scalable, chip-based, high-power, single aperture RSCE-QCL with outstanding beam quality ($M^2 < 1.2$) at infrared wavelengths. This device's output power is over 15W continuous-waves through a single aperture.

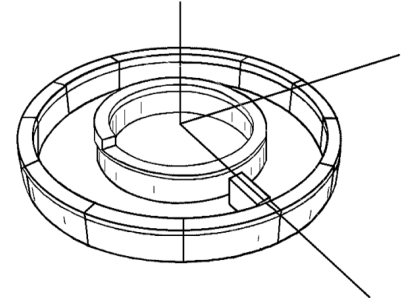
RSCE-QCLs provide large exit apertures with low power densities and stabilized emission wavelengths via second-order distributed feedback, from surface gratings that double as output couplers. Generally, RSCE-QCLs enable wafer-level fabrication and testing, which reduces piece work and handling, which in turn lowers manufacturing costs. Unlike RSCE-QCLs that emit non-Gaussian beams, nested concentric RSCE-QCLs emit more uniform radiation patterns.

Technical Details

This RSCE-QCL is comprised of a ring-shaped active region with first and second opposing facets, with at least one of the facets defining a radiation-emitting facet and is aligned with a ring-shaped phase shifter with a spiraled surface. A substrate is located adjacent to the ring-shaped active region and opposite of the emitting facet, and a ring-shaped phase shifter is located on the radiation emitting facet the ring-shaped active region.

UCF Inventor

Robert Peale, Ph.D.



A schematic diagram of a perspective view of another embodiment of concentric coupled RCSE-QCLs, each with ring-shaped spiral-wedge phase shifter

Benefits

- Outstanding beam quality
- High power
- Low cost design
- More uniform radiation pattern

Applications

- Chemical sensing
- Laser communications
- Infrared counter measures
- Ultra-trace gas sensors

Tech Field

Optics & Lasers

Keywords

quantum cascade laser, ring-cavity surface-emitting quantum cascade laser, QCL, RSCE-QCL, high-power continuous-wave, non-Gaussian laser beam, chemical sensing, laser communications, infrared counter measures, ultra-trace sensors

Patent Pending

If you or your company are interested in this opportunity, Contact:

Raju Nagaiah | 407.882.0593 | Raju@ucf.edu | Tech ID# 33010

UCF Office of Technology Transfer | 12201 Research Parkway, Suite 501, Orlando, FL 32826