Advanced Tunable Long-Wavelength Vertical-Cavity Semiconductor Optical Amplifiers
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BRIEF DESCRIPTION
A tunable long-wavelength vertical semiconductor optical amplifier (VCSOA) that is tunable over a wide wavelength range.

BACKGROUND
Current telecommunication systems rely on optical fibers to transfer data. This form of data transmission allows for cellular phone calls, satellites to deliver television and data services, and for the use of wires to transmit voice, data, and video. Optical amplifiers are required to transmit and amplify the data through the optical fibers in such communications systems. However, optical amplifiers are typically expensive devices. Additionally, these amplifiers are rarely tunable, and when they are, they are not tunable over a large range making it necessary to use multiple amplifiers further increasing costs. Long-wavelength vertical-cavity semiconductor optical amplifiers (VCSOAs) are used in fiber-optic communication systems as an alternative due to their low-costs. However, current VCSOAs are not tunable, requiring multiple VCSOAs to be used. And so, there is a need for tunable optical amplifiers and for tunable VCSOAs that will allow for reduced system costs.

DESCRIPTION
Researchers at the University of California, Santa Barbara have developed a tunable VCSOA which is tunable over a wide wavelength range. The device allows for tuning ranges greater than those that can be achieved by other techniques. A tunable VCSOA can act as a tunable filter, with the added benefit of optical gain, which allows the device to make up for its own insertion loss. By adding a tuning capability, via a microelectromechanical systems (MEMS) actuator, the resonant tunable VCSOA can be used in a reconfigurable optical network, which will allow for expansion of such a network without replacing the amplifier elements. Through the addition of the MEMS-based tuning mechanism, tunable VCSOAs can be precisely adjusted to match the wavelength of the input signal, allowing for higher gain at the desired signal wavelength. Tunable VCSOAs are useful in large networks, such as metro-area networks, as well as in fiber-to-the-home (also known as fiber-to-the-premises) applications.

ADVANTAGES
- High coupling efficiency to optical fiber
- Small form factor
- Low power consumption
- Potential to fabricate two-dimensional arrays
- Ability to test devices on wafer without the need for cleaving
- Compatibility with low-cost manufacturing and packaging techniques
- Amplification at any desired wavelength through alteration of the active material composition

APPLICATIONS
- Useful in large networks: metro-area networks, fiber-to-the-home/fiber-to-the-premises applications
- Can be used in any application where a compact, low-cost, single-channel amplifier is needed: amplifying tunable filters, switches, detectors, modulators, or preamplifiers of buses.

PATENT STATUS
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ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Epitaxial Laser Integration on Silicon Based Substrates
- Integrated Bidirectional Optical Amplifier (BOA) for Optical Interconnects
- A Hybrid Silicon Laser-Quantum Well Intermixing Wafer Bonded Integration Platform
- Integrated Reconfigurable Circulator
- Ring Resonator-Based Optical Isolator and Circulator
- Integrated Dielectric Waveguide and Semiconductor Layer
- Heterogeneously Integrated GaN on Si Photonic Integrated Circuits
- Loss Modulated Silicon Evanescent Lasers
- Fused Vertical Couplers
- Unipolar Light Emitting Devices On Silicon Based Substrates