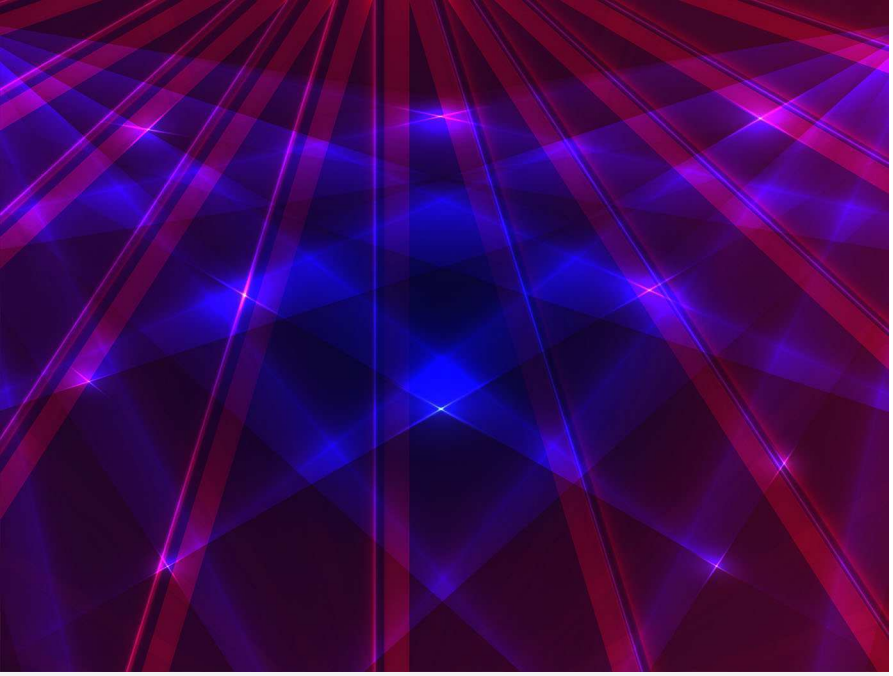


National Aeronautics and Space Administration

technology solution

Optics

Conversion of Type of Quantum Well Structure

Conversion of Type of Quantum Well Material Structure for Increase in Optical Gain

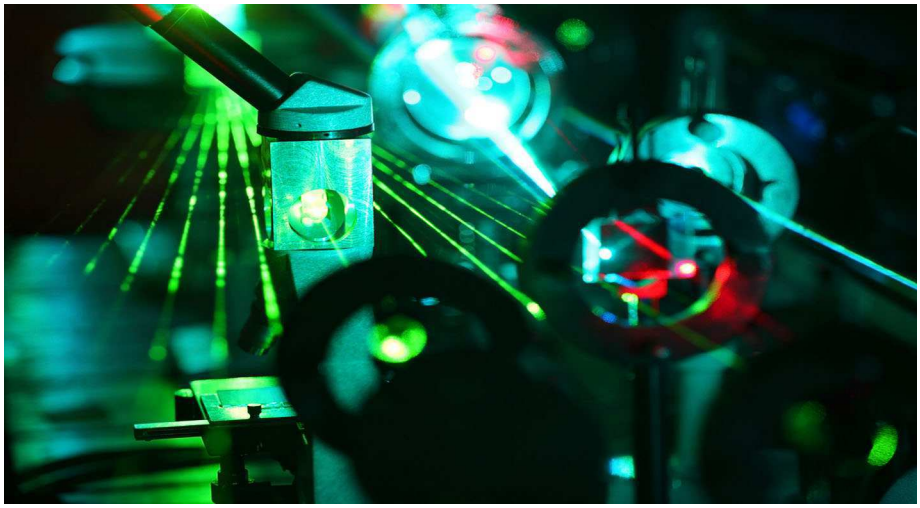
A semiconductor quantum well (QW) can be broadly classified as Type 1 or Type2. Electron and hole wave functions overlap substantially in Type 1, where as in Type 2 they do not. NASA has created a unique approach for converting a Type 2 QW semiconductor material in to a Type 1 material. This conversion allows for a huge increase of optical gain in semiconductor QWs. The type of conversion achieved renders many semiconductor QWs, previously considered unsuited for laser applications, into excellent laser structures in the mid-wave infrared (MWIR) wavelength range from 3 to 5 microns.The MWIR laser sources are very important for trace gas monitoring, such as pollution monitoring, medical diagnostics, explosive detection, and military countermeasures. Laser sat MWIR are important for many applications, such as trace-gas monitoring. The NASA-developed method produces a highly efficient quantum well structure that can be used for both detectors and lasers, giving it the ability to be utilized in a variety of commercial applications.

BENEFITS

- Huge increase of optical gain in semiconductor quantum wells
- Highly efficient quantum well structure that can be used for both detectors and lasers
- Easy conversion of Type 2 semiconductor quantum wells into Type 1
- Adds a new class of material base for MWIR generation

THE TECHNOLOGY

This approach allows conversion of a Type 2 QW materia linto a Type 1 QW material by positioning a narrow, second layer (undoped), a third layer (active,electron-rich), and a narrow fourth laye r(undoped) between first and fifth conventional, uniformly doped (III-V) layers. The third layer acts as a sink or attract or for holes produced in the first and fifth layers so that overlap of electron and hole wave functions in layer 1/3 and layer1/5 interfaces is increased. The semiconductor structure thus produced is useful as a laser material and as an incident light detector material in various wavelength regions, such as a mid-infrared region. Optical gains in the transverse magnetic mode can be almost ten times those of other semiconductor material systems in devices used to generate MWIR radiation.



Beams of laser in a lab

APPLICATIONS

The technology has several potential applications:

- Medical Diagnostics
- Military Intelligence
- Remote Monitoring Systems
- Trace Gas Monitoring
- Research Laboratories

PUBLICATIONS

Patent No: 7,286,573

More Information

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