MACQUARIE University

High brightness pulsed Raman laser

BACKGROUND

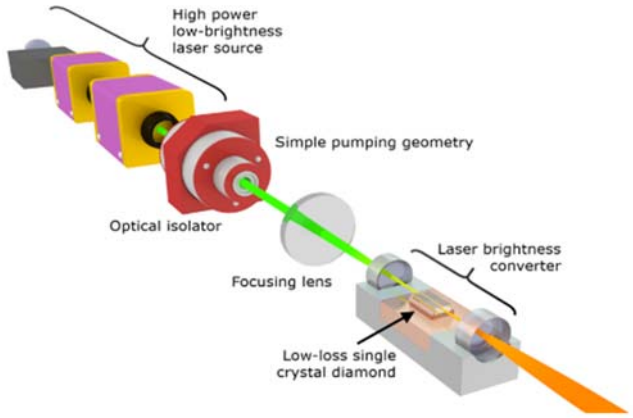
High brightness, diffraction limited laser beams at precise wavelengths with a small footprint and reasonable cost are required for a range of defence, material processing, and ranging and remote sensing applications, particularly in the eye-safe 1.4 µm to 1.8 µm region of the spectrum.

It is challenging to scale many current laser technologies to higher powers with high brightness beams because of adverse thermal effects from unavoidable thermally-poor laser materials and significant thermal loading. For example, conventional pulsed eye-safe laser technologies such as optical parametric oscillators and erbium doped solid-state lasers have degraded efficiencies and beam quality when scaling to powers above about 10 W.

OUR SOLUTION

Using diamond Raman technology, a pump beam can be efficiently converted to a longer wavelength output beam using 1 or more Stokes shifts of the Raman medium. For example, a 1.06 µm laser pump beam can be efficiently converted to a 1.48 µm output beam.

New Raman technology has demonstrated conversion of high power, low brightness pump beams into brighter wavelength-converted output beams using a simple external resonator. The brightness is improved with record, several-fold increases, and overall power conversion efficiencies of 50% are typical. The general concept and design of our "brightness converter" is shown schematically below. Through the use of diamond's excellent thermal conductivity, and the intrinsic benefits of the Raman process, high quality beams are maintained even for very high output powers.



To date, proof of concept experimentation has been conducted to demonstrate the characteristics of a Raman brightness conversion targeting the spectrally eye-safe region. These demonstrations were performed at average power levels above 16 W, and there is potential for much higher powers. The brightness of the pulsed eye-safe laser surpasses the previous record by more than a factor of three.

Future work is planned to achieve much higher powers using more powerful pump lasers. Plans are also underway to explore the limits for beam quality and brightness enhancement, and understand how pump brightness influences efficiency.

ADVANTAGES
High average power with high brightness
Conversion from low to high quality beams
Polarised output laser beam
Applicable to a range of pump options
Simple add-on laser architecture

The principle of this invention may be applied to pump lasers at wavelengths in the UV (e.g. using 355 nm pumps) and visible spectral regions, as well as in the infrared.

APPLICATIONS

- ✓ Civil security, defence and aerospace
- ✓ Laser range finding
- ✓ LIDAR
- ✓ Remote sensing

INVENTORS

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INTELLECTUAL PROPERTY POSITION

WO2015/103667 "*A method and a system for converting an input light beam into an output light beam*"

WOULD YOU LIKE TO KNOW MORE?

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