Wavelength conversion of high average power, continuous-wave, laser beams

Enabling generation of narrow-linewidth (< 1.5 cm⁻¹) lasers to address applications in the 1.2-1.8 μm, red-yellow and UV-B/C wavelength regions.

Using Raman technology, the invention builds on mature high power technologies such as cw Nd:YAG, Yb fibre lasers and optically pumped semiconductor lasers to provide new wavelengths in the continuous wave regime. High thermal conductivity Raman materials such as diamond are used to mitigate thermal lensing enabling operation over a very wide power range (e.g., >5 W) without compromising output beam quality.

The invention is suitable for tunable and fixed wavelength infrared or visible pump lasers to generate output across the wavelength ranges 1200-2000 nm and 545-750 nm. Efficient conversion to the visible and ultraviolet output may also be achieved using designs that include nonlinear conversion inside the Raman resonator.

There is potential for the invention to enable generation of greater output powers and a greater range of wavelengths than listed above.

The basic principle is illustrated below.

Key benefits

- Effective wavelength conversion of continuous wave or quasi-continuous wave pump lasers
- High output power
- Efficient conversion to Stokes wavelengths (infrared) or Stokes harmonics (yellow – red and UV-C)
- Applicable to fixed line or tunable pump laser

The combination of output power, narrow linewidth and wavelength agility is difficult to achieve with any other technology. The solution is a technology add-on to mature pump laser sources, and is potentially low cost.
Applications

- Science / astronomy: Atom cooling, spectroscopy, guidestars.
- Medical: Skin treatments, Ophthalmology, Urology.
- Laser display: Very large area projection TV and laser displays.

IP Status – patent information

An International patent application No. PCT/AU2013/000406 is pending and claims priority from a provisional patent application filed in the United States.

Commercial opportunity

Macquarie University seeks interest from any relevant organisation seeking further information or licensing opportunities.

Find out more

For more information on this technology, please contact Warren Bailey warren.bailey@mq.edu.au