Frequency-doubled degenerate laser is speckle-free green light source

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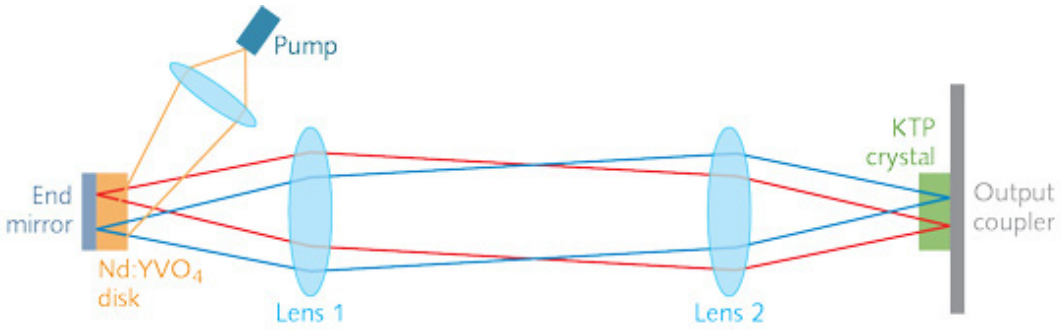
Laser-based projection displays from cinema-sized sources to picoprojectors combine the light from red, green, and blue lasers to achieve full-color projection. Speckle, a characteristic of narrowband lasers, degrades the viewing experience—because many laser-projection illuminators rely on wider-bandwidth blue and red laser diodes and a narrower-bandwidth green laser (for example, a frequency-doubled YAG laser), it is green that has traditionally been most difficult to despeckle. Now, a group from Yale University (New Haven, CT) and TRUMPF (Farmington, CT) has developed an intracavity frequency-doubled degenerate laser that has low spatial coherence (on the order of 3300 transverse modes) and thus low speckle. The researchers say the laser will be useful both for biomedical imaging (for example, fluorescence excitation for microscopy) and full-color projection displays.



The laser is so-called "degenerate" because its cavity is carefully designed so that there are many mutually incoherent modes for which lasing is equally likely. It consists of a frequency-doubled diode-pumped neodymium (Nd)-vanadate (YVO_4) disk in contact with a heat sink, and intracavity frequency-doubled using a potassium titanyl phosphate (KTP) crystal with a large angular bandwidth for type II phase matching. Using fluorescence imaging through a microscope as a check, the researchers compared the new green light source to a conventional frequency-doubled diode-pumped solid-state (DPSS) laser—while

the conventional source produced fringes and rings in the image, the low-coherence source produced an artifact-free image. *Reference: S. F. Liew et al.,* arXiv:1609.05534v1 *(Sept. 18, 2016).*