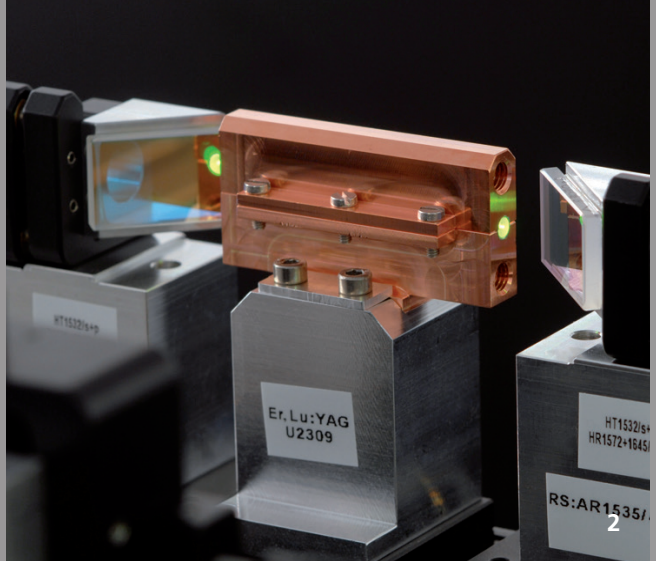

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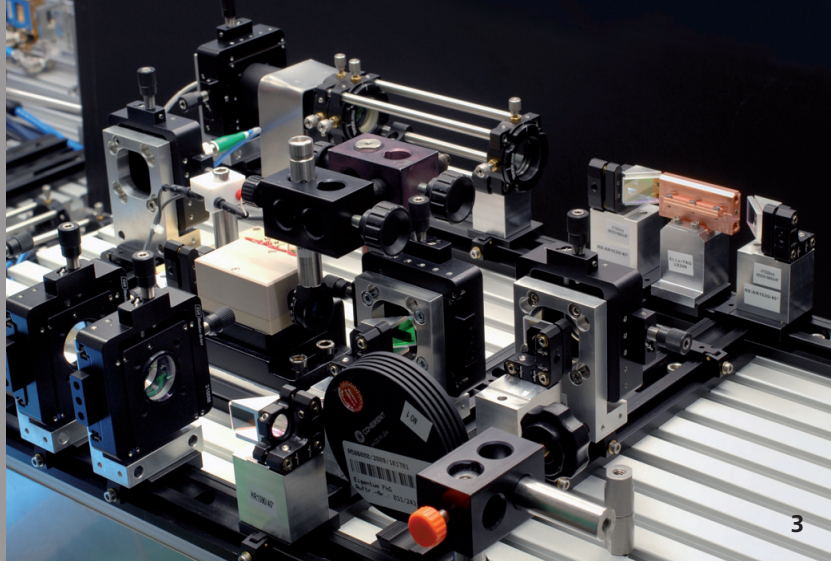

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RESONANTLY DIODE-PUMPED ER:YLUAG LASER

Task

Satellite-based Lidar systems lend themselves to the global and stable measurement of methane concentrations in the atmosphere and have been, for example, developed for the joint German-French climate mission »Merlin«. A solid-state laser based on an erbium-doped garnet crystal can constitute the laser beam source of such a system. This application requires narrow-band Q-switched laser pulses at a repetition rate of 100 Hz with < 100 ns pulse duration, 1645 nm wavelength and a diffraction-limited beam profile.

Method

A rod-shaped laser crystal of Er:YLuAG is resonantly pumped – i.e. pump light absorption takes place between the same electronic multiplets as laser light emission – on both ends with spectrally stabilized fiber-coupled diode laser modules continuously at 1532 nm. Laser pulses are generated with a Pockels cell and a thin-film polarizer.

Result

Fraunhofer ILT has measured laser pulses with pulse energy of 5.1 mJ and pulse durations of 80 ns at a wavelength of 1645 nm and a repetition rate of 100 Hz. With respect to the incident pump power, the slope efficiency is 15 percent, which is in the same range as a previously designed system with high brightness fiber lasers as a pump source. Currently an INNOSLAB amplifier is being built for the scaling of the pulse energy.

Applications

In addition to its use in metrology, laser radiation with wavelengths around 1.6 µm is suitable for medical applications. Furthermore, it could be used to process materials transparent in the visible wavelength range. This laser can be operated continuously or at higher repetition rates in the kHz range, whereby the optical efficiency is also significantly larger.

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2 Pumped laser crystal.

3 Er:YLuAG laser oscillator.