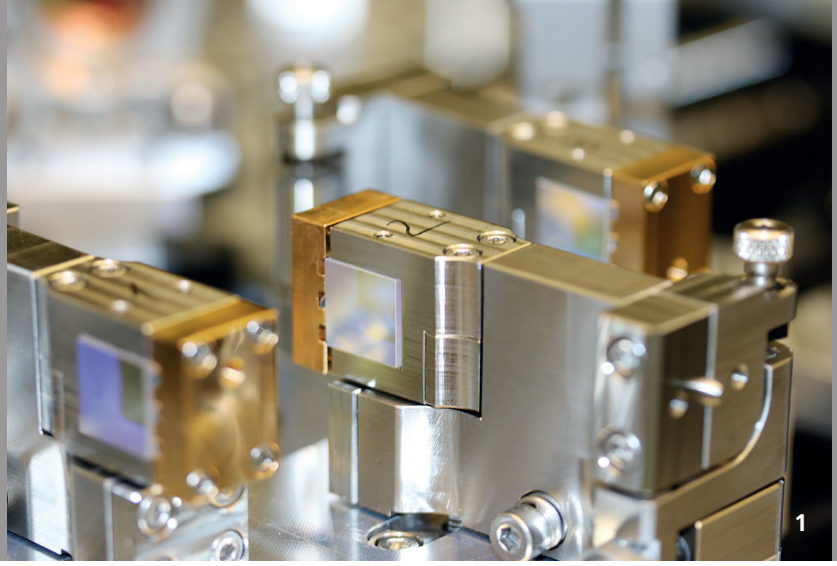

POWER SCALING PARAMETRIC CONVERTERS FOR LIDT MEASUREMENTS AT 1645 NM

Task

Satellite-supported LIDAR systems shall be used to detect the concentration of trace gases in the earth's atmosphere globally. Required for this, however, are lasers with a pulse energy from a few to a few hundred millijoules at a pulse repetition rate of approximately 100 Hz and a wavelength adapted to the measurement task in order to achieve a good signal-to-noise ratio. For example, a laser with a parametric frequency converter is currently being developed at Fraunhofer ILT for the Franco-German climate control mission »MERLIN«. This laser generates a pulse energy of 9 mJ at a wavelength of 1645 nm for measuring atmospheric methane concentrations. In further LIDAR missions, the scalability of parametric frequency converters in the range > 100 mJ should be demonstrated. The newly developed beam source will continue to be used for the qualification of optics for the MERLIN mission in an LIDT (Laser-induced Damage Threshold) measuring station.

Method

To demonstrate the scalability, Fraunhofer ILT has developed a longitudinal single-mode MOPA system with 500 mJ at a repetition rate of 100 Hz and a pulse duration of 30 ns at 1064 nm. In order to reach pulse energies > 100 mJ, an optical parametric oscillator (OPO) is operated with part of the pump pulse energy, the output pulses of which are amplified at 1645 nm in an optical parametric amplifier (OPA).

Results

Fraunhofer ILT has demonstrated that the system described here, based on KTP crystals, can generate pulse energies > 110 mJ. The pulse duration is approximately 20 ns. The converter can be operated in a longitudinal single-mode via a cavity length control.

Applications

In the future, the entire system consisting of pumps and converters will be used in a measuring station for the qualification of optical components for the »MERLIN« mission. Furthermore, the output characteristics of the converter are suitable for future LIDAR missions to measure trace gases, such as methane. The optical design can also be used for frequency conversion in other wavelength ranges. Thereby, a great number of climatically relevant gases can be detected.

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1 OPA converter stage.