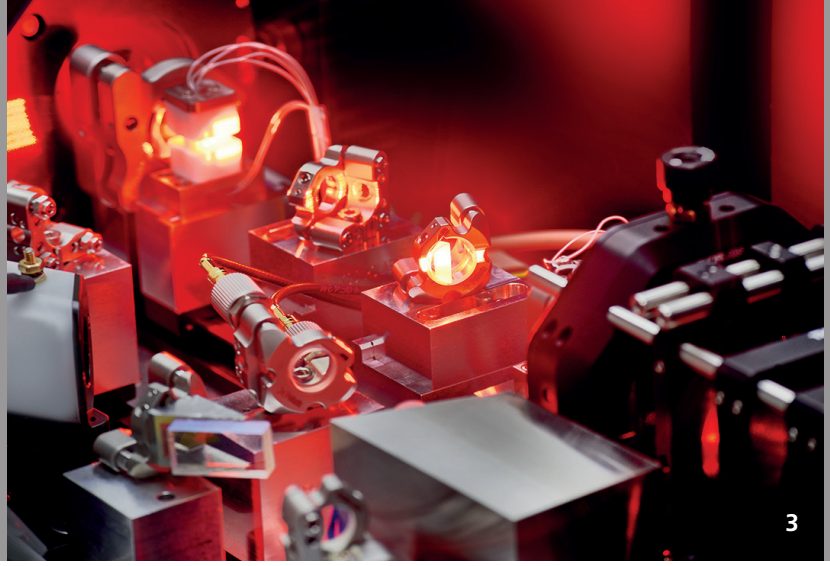

DIODE-PUMPED ALEXANDRITE LASER FOR LIDAR MISSIONS IN THE ATMOSPHERE

Task

To measure the temperature profiles of the atmosphere at altitudes between 80 and 110 km, the Leibniz-Institute of Atmospheric Physics e.V. (IAP) uses mobile resonance LIDAR systems. For this, the Doppler width of a metal resonance line is determined spectroscopically as a measure for the temperature. The laser-emitters are flash lamp-pumped Alexandrite ring lasers in Q-switched single-frequency operation. Since the laser is operated in remote locations with partially harsh environmental conditions, both the maintenance-free operating time and plug-in efficiency need to be increased. To this end, Fraunhofer ILT has developed a technology demonstrator with which the IAP is now investigating the use of diode-pumped Alexandrite lasers in atmospheric research.

Method

The demonstrator is a Q-switched Alexandrite ring laser. Two commercial diode laser modules serve as a pump source, which can emit up to 40 W average power at 638 nm in continuous operation. Laser operation in stable single-frequency mode has been achieved by »seeding« with a narrow-band diode laser and electronically controlling the cavity length. The wavelength of the seeder is used to continuously tune the output wavelength of the Alexandrite laser in the range of potassium resonance. After completion in the laboratory, the laser was integrated into a mobile IAP lab, which, in addition to the peripheral devices of the laser, also contains the entire LIDAR technology.

Results

In single-mode operation ($M^2 < 1.2$), the laser emits pulses with an energy of 1.1 mJ at a repetition rate of 150 Hz and a wavelength of 770 nm. The pulse duration is 410 ns at a spectral bandwidth of less than 10 MHz. The laser has already successfully carried out initial measurements in the atmosphere up to altitudes of more than 100 km.

Applications

In the research project »ALISE« (grant number 50RP1605) funded by the Federal Ministry for Economic Affairs and Energy (BMWi), ILT and IAP are currently investigating the potential of such lasers for satellite-based atmospheric research with global coverage.

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3 Diode-pumped Alexandrite ring laser.