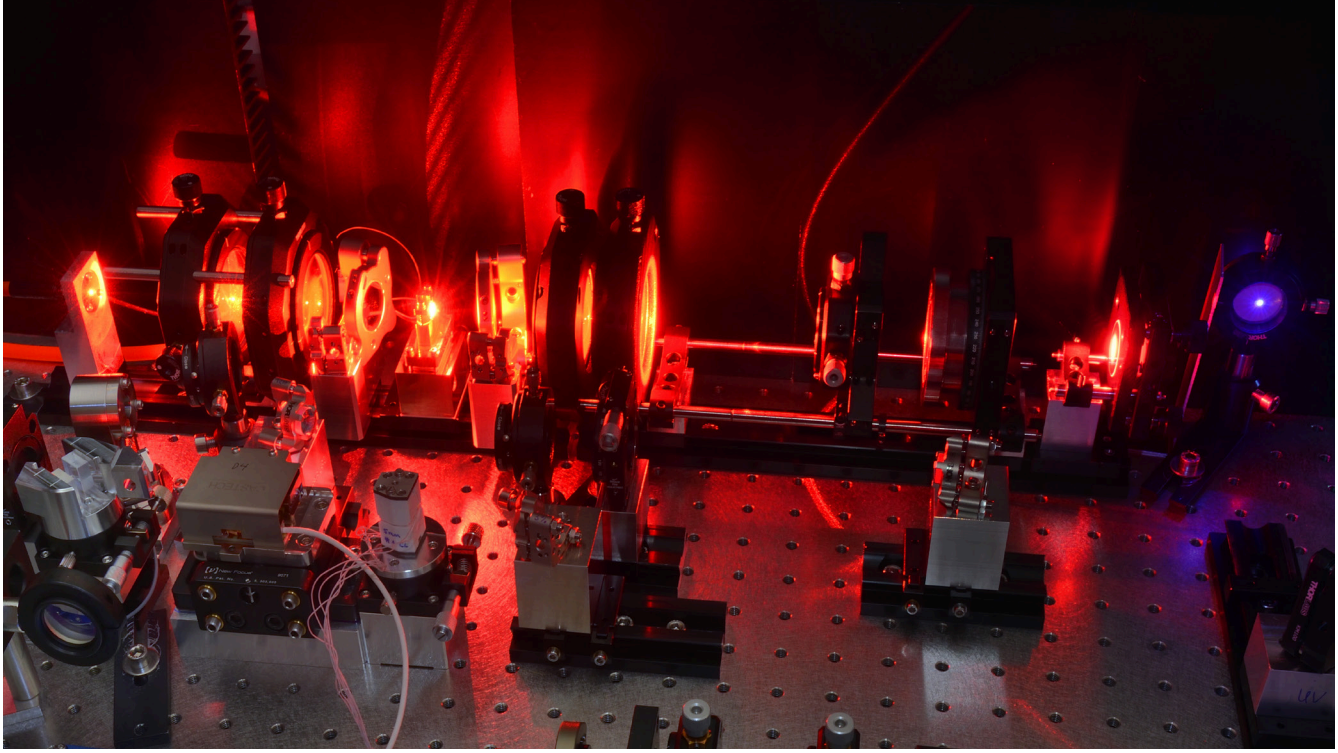

1 Diode-pumped alexandrite laser emitting in the UV in laboratory setup.

Highly efficient UV laser for daylight-capable atmospheric LIDAR

Since the impact of anthropogenic emissions on the climate is increasing, it has become ever more important to better understand and monitor atmospheric processes. The Leibniz Institute of Atmospheric Physics (IAP) concentrates on measuring wind and temperature profiles of the atmosphere up to an altitude of 120 km. Mobile resonance LIDAR systems are mainly used for this purpose. Combining several such systems with overlapping observation areas creates a network with unrivaled resolution and area coverage. The data acquired is sometimes collected continuously over long periods of time under difficult environmental conditions, such as in polar or tropical regions, or in remote locations. LIDAR systems must therefore not only be robust, compact and easy to transport, but also work autonomously and require low-maintenance. When adapted wavelengths in the UV range are used, measurements can be conducted under daylight conditions without reduced resolution caused by the solar background.

Concept for efficient frequency conversion

Using a diode-pumped alexandrite laser that has already been tested in compact LIDAR systems, Fraunhofer ILT developed a concept that continues to meet the high spectral requirements. By efficiently doubling the frequency, the institute was able to achieve the target wavelength in the UV, the iron resonance at 386 nm, and demonstrated that it is suitable as a LIDAR emitter.

Implementation in LIDAR system for measurement campaign

The laser achieves an average power of 1.5 W at 500 Hz in the UV with a very high electro-optical efficiency of 2 percent. The line width is extremely narrow-banded due to seeding and cavity length control in order to scan the resonance line. Two prototypes will be built, integrated into two LIDAR systems and tested with measurements across Europe. Since the alexandrite laser is tunable, additional resonance wavelengths in the UV can also be addressed with little effort, which means that the altitude range can be extended even further and the effects of space weather on the atmosphere can be measured directly. The work is being carried out as part of the EU project EULIAA under the funding code 101086317.

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