All-Solid-State Coherent Sodium Resonance Light Source: toward Stable Lidar Observation

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Diode-pumped solid-state lasers are attractive and useful for light detection and ranging (LIDAR) because of the high stability of output power and longer operation life. We developed an optical system for sodium LIDAR using an all-solid-state coherent light source pumped with diode lasers at Tromsø, Norway. Although the system is operated from 1000 to 2000 hours per year, we have not replaced the diode lasers for seven years since the installation of the LIDAR system. On the other hand, the replacement of flashlamps is required within a month in continuous running of flashlamp-pumped solid-state lasers.

In this study, we report on an all-solid-state, single frequency, pulsed coherent sodium D_2 resonance light source for the sodium LIDAR. The sodium D_2 resonance light is generated in sum-frequency mixing using laser-diode-pumped Nd:YAG lasers. One of the Nd:YAG lasers is operated at near 1064 nm and the other is operated at near 1319 nm. The sum frequency is precisely tuned around the sodium D_2 resonance line with the tuning of the wavelengths using tunable seed lasers for injection locking. The output power at the sodium D_2 resonance line reached 4.2 W at a repetition rate of 1 kHz. In the presentation, we will explain various technologies, which are useful for different types of LIDARs, form the basis for the sodium D_2 resonance light source in detail.