3.4 Diode-Pumped 491 nm Laser Based on Frequency Doubling in $KNbO_3$

(D. Fluck and T. Pliska)

Frequency doubling of near infrared laser diodes (LDs) offers the potential of a robust and reliable blue laser source. $KNbO_3$ crystals are very attractive for frequency doubling of near infrared LDs into the blue-green spectral range due to their high nonlinear optical coefficients and the favourable noncritical phase-matching possibilities for wavelengths between 853 nm and 895 nm in a-cut $KNbO_3$ crystals and between 978 nm and 1017 nm in b-cut crystals by temperature tuning from 10 ^oC to 100 ^oC. Second-harmonic generation by frequency doubling of LDs in $KNbO_3$ has been demonstrated in single-pass, resonant and waveguide configurations. Resonant schemes have been proven to be highly efficient, but are relatively complex. The second-harmonic output power from single-pass and waveguide frequency doubling schemes has been limited in the past by the relatively low power available from single-mode narrow linewidth LDs. Recently, over 1 Watt of CW output power has been demonstrated in a nearly diffraction limited beam from a monolithically integrated master oscillator power amplifier which allowed efficient generation of blue-green light by single-pass SHG in $KNbO_3$ crystals.

We demonstrated a compact continuous-wave blue-green laser by direct frequency doubling a monolithically integrated master oscillator power amplifier laser diode in a $KNbO_3$ crystal. More than 15 mW of diffraction limited second-harmonic light at 491 nm was generated with a fundamental power of 950 mW incident on a 17 mm long crystal. The blue-green laser radiation is 100 % polarised and has a frequency linewidth of ~33 GHz. The root-mean-square fluctuations of the second-harmonic output power is as low as 0.1 % and the power drift is less than 1 % over ten hours of operation.