A simplified fiber-based high-power diode laser system

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Abstract

Since the advent of semiconductor lasers in the 1960s, they have found many applications in various fields of research. In the majority of experiments in this field, semiconductor diode lasers are used in an extended cavity diode laser (ECDL) configuration [1, 2] which offers a large mode-hop free range, increased lasing power and decreased line-width. Due to the increasing complexity of laser cooling and BEC experiments, there is a need to provide a substantial amount of optical power to the various aspect of the experiment, such as cooling, re-pumping, imaging and optical pumping beams. Many ECDL lasers cannot provide adequate power to perform such tasks simultaneously. Therefore, an optical amplification system needs to be implemented in order to increase the optical power available for the experiment while maintaining the optical properties such as line-width and beam quality.

The main focus of this poster will be on a novel amplification system, which is based on operating a semiconductor tapered amplifier in a novel double-pass configuration. This results in a 1 W semiconductor tapered amplifier to output 600 mW of usable power from a low power seed beam of 0.5 mW while still maintaining the parameter of the injection light.

As well as this novel amplification technique, a complete laser system suitable for BEC experiments with Rb atoms will be described. This will include the locking of an ECDL Littrow configuration laser system to hyperfine atomic transitions using a Doppler-free saturated absorption spectroscopy technique. Another important technique employed is the rf modulation [3, 4, 5] of a slave laser diode at 6.8 GHz which stimulates the Rb-87 re-pumping transition necessary for laser cooling.

This work is a ongoing endeavor and in are currently investigating incorporating the rf modulation described above, into a high power tapered laser system.

Keywords: diode laser, tapered amplifier, microwave generated repumper

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