

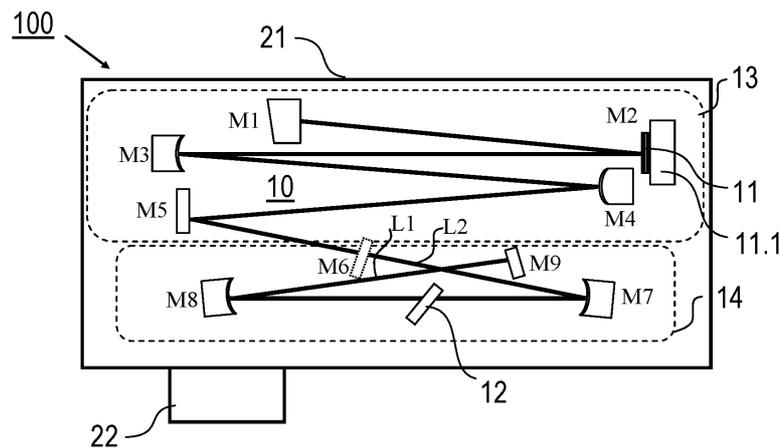
Technology Offer

Laser device with kerr effect based mode-locking and operation thereof

Ref.-No.: 1202-4422-WT

Abstract

A laser device (100), configured for generating laser pulses, has a laser resonator (10) with a gain disk medium (11) and a Kerr medium (12). The laser resonator (10) includes a first mode shaping section (13) which is adapted for shaping a circulating electric field coupled into the gain disk medium (11), and a second mode shaping section (14), which is adapted for shaping the circulating electric field coupled into the Kerr medium (12) independently of the electric field shaping in the first mode shaping section (13). Furthermore, a method of generating laser pulses (1) using a laser resonator (10) with a gain disk medium (11) and a Kerr medium (12) is described.



Technology

At the moment, thin disk oscillators are the most promising way of achieving high powers and high energy pulses simultaneously from a compact table top system. But until now no thin disk laser generating emission-bandwidth-limited pulses or even beyond the emission-bandwidth-limit at high power level has been realized yet.

The objective of the invention is to provide an improved laser device being capable of avoiding disadvantages of conventional techniques. In particular, the laser device is to be capable of creating laser pulses with increased pulse energies and/or decreased pulse durations, in particular with a compact design having a large operation stability. Furthermore, the objective of the invention is to provide an improved method of creating laser pulses being capable of avoiding disadvantages of conventional techniques. In particular, the laser pulses are to be created with increased pulse energy and/or decreased pulse duration, in particular with large stability on a timescale of hours or more.



Advantages

- Small sensitivity to thermal lens of the gain disk medium and dispersive optics,
- ability of thermal compensation in cavity,
- small misalignment sensitivity of the cavity,
- large mode diameters in the gain disk medium approximately equal to the pump spot in the disk gain medium and large sizes over the cavity reduce nonlinear effects in air (especially critical for long cavities) and avoid damage of optics,
- a certain (settable) beam size is provided in the Kerr medium, wherein this beam size can be varied to influence the focusing strength according to the approximation formula $f=w^2/(4n_2I_0L)$ (w is the beam waist, n_2 is the nonlinear index, I_0 is the peak intensity and L is the length of the Kerr medium),
- beam size variation further allows to provide certain amount of nonlinearity in the Kerr medium to achieve stable mode locking,
- cavity is most sensitive to Kerr effect near the stability edge. Typically KLM laser is operated near the one of the stability edges. Compromise between such operating point and reliable performance has been found with the invention.

Patent Information

US patent (US9318867) granted in April 2016.

EP patent (EP2764589) granted in August 2014, validated in DE, GB, FR, CH.

Literature

1. High-power Kerr-lens mode-locked Yb:YAG thin-disk oscillator in the positive dispersion regime
O. Pronin, J. Brons, C. Grasse, V. Pervak, G. Boehm, M. Amann, A. Apolonskiy, V. Kalashnikov, F. Krausz
Optics Letters 37, 3543 (2012)

Contact

PD Dr Wolfgang Tröger

Senior Patent- & License Manager
Physicist

Phone: +49 (0)89 / 29 09 19 - 27
eMail: troeger@max-planck-innovation.de