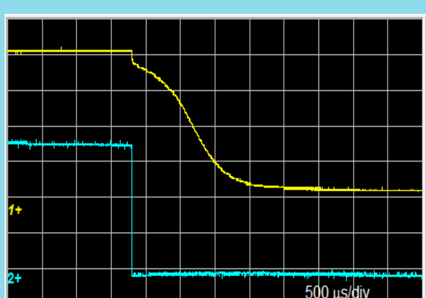
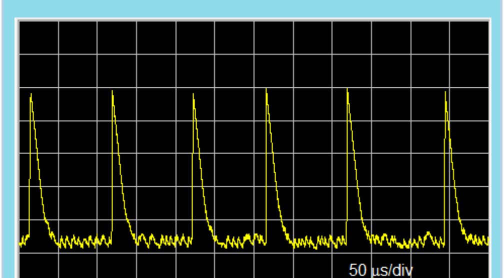
Construct, Conduct & Comprehend Physics Experiments

LEOI-50A Diode-Pumped Solid-State Laser Demonstrator-Enhanced Model

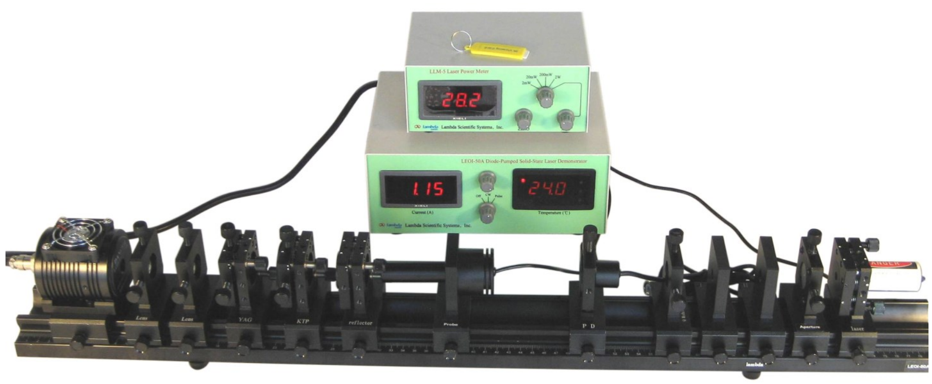
- *Laser diode pumping output of 2 W at 808 nm with TE cooling for temperature control*
- *Variable pumping current with multi-parameter adjustment mechanism*
- *Optional Q-switching approach*
- *Including alignment diode laser and wideband optical power meter*
- *Laser safety googles for OD4+ protection against 808 nm and 1064 nm laser radiation*



Fluorescence decay of YAG excited by 808 nm



Q-switched laser output



LEOI-50A is designed for teaching nonlinear optical experiments at universities and colleges. It can help students understand the theory of a diode-pumped solid-state (DPSS) laser with frequency doubling technique. A solid-state laser with Nd: YAG as the gain material, which is pumped by a semiconductor laser at 808 nm, emits infrared light at 1.064 µm. By incorporating a KTP crystal into the laser cavity to generate frequency-doubled green light, it is possible to observe frequency doubling phenomenon, and measure frequency doubling efficiency, phase matching angle and other basic parameters. By placing an absorptive material into the cavity to alter gain amount, Q-factor can be changed.

Experimental Contents

A. Characterization of 808 nm laser diode
1. Plot electro-optic curve, and determine threshold current and gain slope.
2. Wavelength tuning to absorption peak of YAG crystal.
3. Fluorescence lifetime measurement of YAG material excited by 808 nm laser.

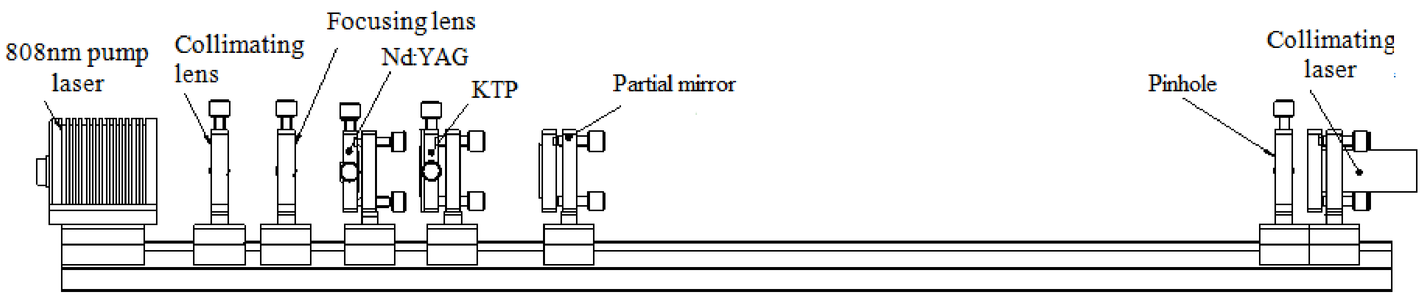
B. 1064 nm laser generation from YAG crystal pumped by 808 nm laser diode
1. Mode matching: observe relationship between pump laser spot & output power of 1064 nm laser.
2. Wavelength matching: change 808 nm laser wavelength while observing output power of 1064 nm laser.
3. Input-output efficiency testing: change 808 nm laser power while measuring output power of 1064 nm laser.

C. Frequency-doubling technology
1. Observe transverse mode of 532 nm laser.
2. Acquire relationship between 532 nm laser output power and pumping power.
3. Angle matching: adjust angle of KTP crystal in cavity and find the best matching angle.

D. Q-switching technology (optional)
1. Q-switching: place Q-switching material into cavity to observe pulse waveform change of 1064 nm laser.
2. Q-switching: change 808nm laser power to observe change of pulse width & frequency of Q-switched laser.
3. Fluorescence lifetime: change 808nm laser power to measure fluorescence lifetime of Q-switching material.

Parts & Specifications

Optical bench	Length: 0.8 m	1
Laser diode	2 W at 808 nm with TE cooling	1
Laser diode driver	0 ~ 3 A with temperature controller	1
Diode laser	4 mW at 650 nm with 2-D adjustable holder	1
Collimating lens	Incl 2-D adjustable holder, ± 2.5 mm	1
Focusing lens	Incl 2-D adjustable holder, ± 2.5 mm	1
YAG crystal	Incl 4-D adjustable holder	1
KTP crystal	Incl 5-D adjustable holder	1
Laser power meter	2 mW/20 mW/200 mW/2 W	1
Partial reflecting mirror	Radius of curvature: 250 mm; reflectance: 95%	1
Interference filter	Passband wavelength: 1064 nm	1
Infrared viewing card		1
Pin-hole plate		1
Laser safety goggle	OD = 4+ for 808 nm and 1064 nm	1
Passive Q-switching crystal (optional)	Cr^{4+}:YAG	1
Power cord		2



Schematic of system

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