Millijoules high master-slave pulse ratio
532 nm picosecond laser

Zhao You

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Introduction - Backgrounds

Applications of all-solid-state short pulse lasers:

- Material cutting & forming
- Micro processing
- Medical equipment
- Space exploration
Nanosecond
• Serious thermal effects
• High edge burr
• High etching width
• Can not meet the requirements of etching width

Picosecond
• Short action time
• Less edge burr
• Low price
• Easy maintenance
• Batch production
• Low production cost

Femtosecond
• Short action time
• Less edge burr
• High price
• Poor stability
• Complex structure
• High maintenance costs

Femtosecond laser processing
Picosecond laser processing
Nanosecond laser processing
Experimental Configuration — SESAM mode-locking
**SESAM mode-locking results**

Fig. 1 Waveform of CW mode-locked pulses

Fig. 2 Autocorrelation curves of the mode-locked pulse

Fig. 3 Spectrogram
**Experimental Configuration**

- MOI is a magneto optic isolator.
- PC is a BBO crystal Electro-Optical (EO) Pockels Cell.
- Nd:YAG rod is pumped with CW laser diodes.
The LBO crystal is coated with 1064 nm AR coating on the incident surface and 532 & 1064 nm AR coated on the other surface. M9 is a beam splitting lens that is AR-coated at 1064 and HR-coated at 532 nm. Garbage is used to absorb the rest of infrared light.
Experimental Result

(a) Regenerative pulse sequence at 1 kHz

(b) Single pulse
Experimental Result

Output beam profile for the amplified pulse

Autocorrelation curve of the output pulse
Experimental Result

Power stability measured in long term operation (22.4 hours)
picosecond laser system
Working state of system in SLR

Laser returns from the satellite
Summary

- We have developed a high master-slave pulse ratio 532 nm picosecond laser on the magnitude of millijoules.
- The system combines the techniques of SESAM passively mode-locking, regenerative amplifier, and LBO crystal frequency doubling.
- The output pulses of the system have good beam quality and high stability that in continuous operation for more than 22.4 hours without failure.
- Through the actual ranging, we draw the conclusion that this system is capable to be applied in SLR.
Acknowledgement

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Introduction of GK Laser Technology Co., Ltd.

- Founded in 2002.
- A high-tech enterprise under holding of Chinese Academy of Sciences (CAS).
- National Torching Plan Key High-Tech Enterprise in 2012.
- Beijing international science and technology cooperation base of advanced semiconductor pump laser technology (2014).
Introduction of GK Laser Technology Co., Ltd.

- The First Class Prize of Beijing Science and Technology Progress Award (Municipal)
- The Second Class Prize of National Science and Technology Progress Award (National).
Introduction of GK Laser Technology Co., Ltd.

- More than 1,200 square meters of clean workshop and with semiconductor laser production lines.
- Producing a variety of lasers is more than thousands of sets per year.
- We has a group of more than 40 researchers, including 11 senior professional titles, 13 doctors and 23 masters.
- 6 talents have been selected by Leading Talent of Scientific Beijing, New Science and Technology Star, The Excellent Talent of Beijing and Zhongguancun Leading Talent.
National Engineering Research For DPSSL

(Established in 2011)

- Optical engineering national key disciplines and disciplines.
- Postdoctoral working station and mobile station.
- Open project (The new technology of laser, materials research etc.)
Partial products of GK Laser Technology Co., Ltd.

Laser pump module
Lamp & LD pumped laser
Laser amplifier
Laser illuminator
Laser range findor
Laser cutting machine
Laser marking machine
Laser power supply
The successful bid rate of our picosecond laser in the domestic is up to 30%.

Our clients include Peking University, Zhejiang University, Shenzhen University, and Chinese National Astronomical Observatory of China Academy of Engineering Physics etc.
## Partial picosecond products & parameters

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<thead>
<tr>
<th>Property</th>
<th>Specification</th>
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<tr>
<td>Wavelength (nm)</td>
<td>1064</td>
</tr>
<tr>
<td>Repetition Rate (kHz)</td>
<td>10-500</td>
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<tr>
<td>Power (W)</td>
<td>30</td>
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<tr>
<td>Energy (µJ)</td>
<td>120</td>
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<tr>
<td>Beam Diameter (mm)</td>
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<tr>
<td><strong>Beam Specifications</strong></td>
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<tr>
<td>Pulse Width (ps)</td>
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<td>Spatial Mode</td>
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<tr>
<td>M²</td>
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<tr>
<td>Power Stability (RMS)</td>
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<td>Cooling Method</td>
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<td>Dimensions Laser Head (mm)</td>
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<td>Controller Size (U)</td>
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<td>Working Temperature(°C)</td>
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![Image of laser equipment and graphs](image-url)
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<th>Products</th>
<th>Energy (mJ)</th>
<th>Beam Diameter (mm)</th>
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<th>Divergence (mrad)</th>
<th>Ellipticity</th>
<th>Pointing Stability (µrad)</th>
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<td></td>
<td>1064/532</td>
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<td>≤2</td>
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<td>TEM_{00} M^2&lt;1.5 M^2&lt;6</td>
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<td>Horizontal (or others)</td>
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