Spectra-Physics OPAL Optical Parametrics Oscillator Laser

Standard Operating Procedure

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1 Emergency Contact informations

Name and Description	Contact Information
UM Emergency (Fire-Police-Rescue) - 24 hour Call Immediately for any Emergency Including Injured or Sick Person Chemical Spill or Fire	#911
Environmental Safety(Main Office) Biosafety, Environmental Affairs, Occupational Safety and Health, Radiation Safety, Risk Managemen	301-405-3960
Laser Safety Officer (Steve Hand) Program Consultation and Administration	301-405-3985
University Health Center Occupational Health Medical Consultation and Evaluation	301-314-8172
Workers' Compensation Office	301-314-8171
Facilities Management, Work Control Repair of Facility Equipment Deficiencies, e.g. fume hoods, emergency eyewashes, ventilation, etc	301-405-2222
Professor Thomas E. Murphy Laboratory P.I.	301-405-3602 tem@umd.edu

2 Basic identification

- Vendor: Spectra-Physics
- Model: OPAL -1.3
- Serial Number: 1130
- Optical power: >250mW @ 1500nm
- Repetition rate: 82MHz
- Pulse Width: <130fs
- Bandwidth: >15nm
- Beam diameter:<2 mm
- Laser Classification: Class IV
- Location: 5'x12' optical table at the back of the laboratory(Fig. 1)
- Beam propagating direction: along the long side of the optical table at a height of 14.5cm above the optical table, both signal and idler beams comes out from the side away from Tsunami. If configured, residue pump beam of 810nm will come out from the side that is facing the Tsunami system

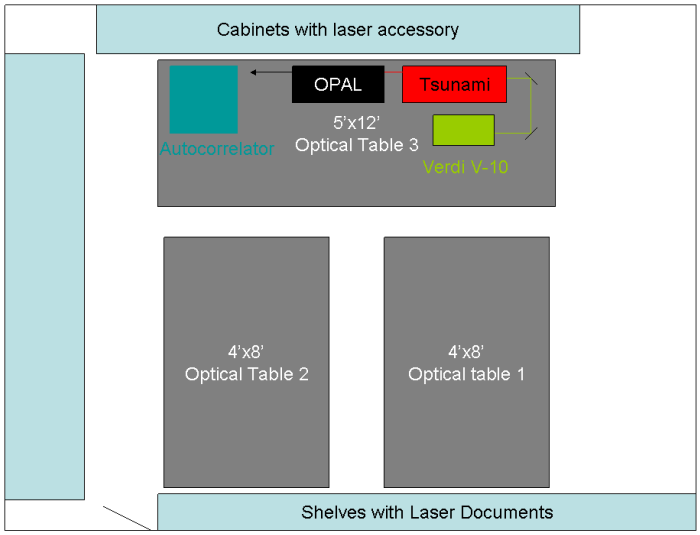

Fig. 1: Location of Lasers and documents

3 Laser Safety

The Spectra-Physics OPAL system is an Optical parametric oscillator(OPO) capable of generating 250mW@1.5μm with tuning range from 1.35 to 1.60μm at signal beam and from 1.60 to 2.1μm at the idler beam of 150mW. Direct and scattered light of the laser beam is capable of causing permanent damage to eye if left unprotected. Fire hazard is possible if direct or scattered beam hit a combustible material. To ensure the safety of the user and coworkers in the laboratory, the following precaution is highly recommended:

- For alignment purpose, an eyewear of OD>5@800nm is required
- For normal operation without enclosure, an eyewear of OD>3@1500nm is required
- Enclose the laser beam path if possible
- All output from OPAL system are invisible except for the residual pump beam. Ensure others in the laboratory are informed of its beam path.
- Maintain the beam height at the default height if possible.
- Move any combustible material away from the beam path
- Maintain a designated rapid egress
- Caution when using combustible gases and liquids in the area of the laser

- Avoid direct exposure to the laser light. The intensity of the beam can easily cause flesh burns or ignite clothing
- Turn off the Tsunami's pump laser when not in used
- To reduce possibility of eye damage, maintian a high ambient light level in the laser operation area during normal operation.
- Unless for alignment purpose, keep the protective cover on the laser at all times
- Avoid reflective objects such as jewelry and watch while using the laser
- Use infrared sensor and infrared scope in alignment

4 Location of eyewear, documents and related accessories

- Laser eyewear to be available, kept in file cabinet next to laser
- Printed manual at the file cabinet at the other side of laboratory
- Additional mirrors and other parts in black Spectral-Physics box kept in file cabinet next to laser
- 3910 regulator/filter purge unit in file cabinet next to laser
- Spectrum analyzer: Reed Instrument Laser Spectrum Analyzer plus oscilloscope
  - Optical head on optical table 3, controller and oscilloscope on table 3 rack right above the laser
- High power photodetector: Spectral Physics Thermocoupler Photodetector
  - On table 3, next to laser
- Low power photodetector(<1W):
  - HP Lightwave multimeter 8153A on rack of optical table 1
  - HP 81521B freespace Ge photodiode in "Power Sensor module" drawer of the cabinet next to laser
- Autocorrelator, oscilloscope and function generator
  - on table 3

5 Operating Authorization

To access this laser, one needs to take the Laser Safety Online Training program available on http://www.des.umd.edu/risk_comm/edu/guide.html, obtain training from an experienced user of the laser and obtain the approval of the Laboratory PI.

6 Maintanence

Unless for planned power outtage and temporaly relocation, never turn off the OPAL power supply. The OPAL uses an LBO crystal for its frequency conversion. To avoid damaging the crystal, it is required that the LBO crystal be maintained at roughly150^oC at all time.

OPAL temperature tuning setting is stored on an PCMCIA card inside the controller box. To prevent lost of this information, the PCMCIA card has a battery on it that need to be replaced every 2-3 years. The specific battery used on this OPAL system is *BR2325*. Note that the OPAL system *cannot be turned off when replacing this battery*, follow the instruction on appendix D in the manual.

It is recommended to replace the output coupler M1 with a high reflector *G0380-002* during alignment process. This mirror is usually kept in the Spectra-physics accessory box in file cabinet next to table 3.

After alignment, be sure to move the waveplate back to its default position.

Do not use Acetone or Methanol on cleaning the crystal. It is recommended that *the crystal should not be cleaned unless absolutely necessary.* In such case, use a spectrophotometric grade hydrocarbon solvent such as *toluene* or *xylene*. Follow the instructions in the manual on how to clean this crystal.

7 Operation

Follow the Operation section in Tsunami SOP. Ensure that the Tsunami LED bar is full, its output power is 2W and its bandwidth is $\sim 800nm$@810nm before using the OPAL system. Set the signal beam wavelength to 1.5μm. Press the button corresponds to "Setup" and then press "Scan Length". The laser should start lasing when it moves to the right position. Optimize the output power by adjusting M1 and M7, then change the signal wavelength to the desired wavelength and optimize output power again.

Occasionally, the OPAL could fail to find the right oscillation length. In such cases, do not try to realign the system. Instead, check Tsunami output to see if there is any anormality. If Tsunami seem working perfectly, go to the "Diagnostics" menu from the "Main" menu, then select "Manual Control". Move the cursor to Motor, turn off the loop, and then move M1 mirror slowly. If necessary, remove the cover of OPAL, and place a business card at the point where scattered beams from the crystal are. When the M1 moved to the right location, you will be able to see a green flash on the business card. If all these

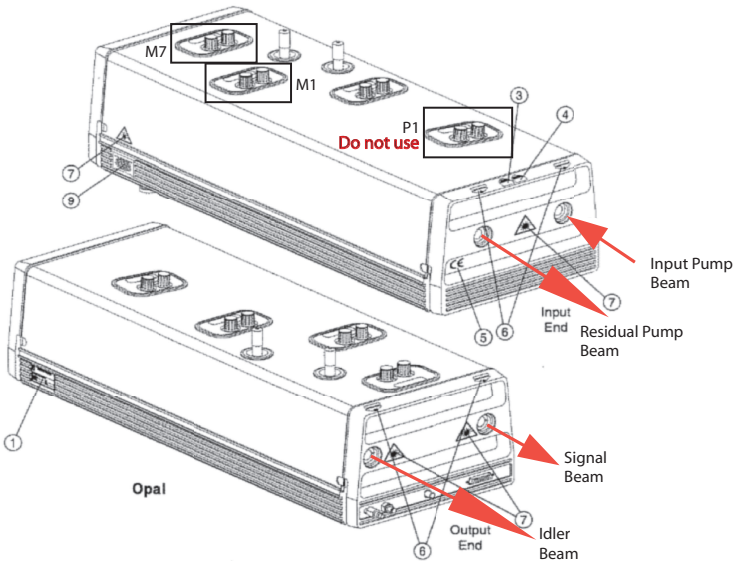

Fig. 2: Opal Head Controls

steps failed, replace the output coupler by high reflector *G0380-002* then adjust M1, M7 mirrors and move M1 until you see the green flash. Switch back to output coupler when done.

The P1 mirror adjustment is too coarse for optimizing OPAL. Since the crystal is small, it is highly possible that you would move the beam to the edge of the crystal, which will damage the crystal if left unnoticed. *Do not use P1 adjustment except for initial alignment.*

Check the output wavelength of OPAL, if it is off by >3nm, follow appendix C on the manual to recalibrate the grating in OPAL.

If wavelength of < 1500nm is required, the OPAL system would have to be purged. Refer to Fig 3-7 in Pg 3-7 of the manual for more detail.