

2. INVENTORY OF LASERS (1/18/96)

Laser Type	Description	Serial Number
HeNe Laser (UNLV)	10 mW CW, Uniphase, model 1125P, mfg. 5/94, polarized beam, 0.632 μm , Class IIIb	1094805
HeNe Laser (UNLV)	10 mW CW, Uniphase, model 1125P, mfg. 6/94, polarized beam, 0.632 μm , Class IIIb	1107566
HeNe Laser (EG&G/DOE)	10 mW CW, Hughes, model 3224H-C, mfg. 12/80, 0.632 μm , Class IIIb	D510369 (Las Alamos 455212)
Tachisto TAC II (Converted CO ₂) (UNLV)	pulsed gaseous laser, TAC II System 400XR; Class IV Anticipated output: 3 J (2 J meas.) [Measurement by : Molelectron JD1000 Joulemeter Display detector: J50 s/n 121] Pulse duration: ~3-5 ns Pulse repetition rate: ~10 s ⁻¹	400009
Ruby Laser (EG&G/DOE)	Apollo Laser model 22 (oscillator) Class IV Output: 3J Duration: 10 ns	467

3.1 AUTHORIZED USERS

Group/Name	Capacity	Keys
Robert A. Schill, Jr. (Director)	Access to room. Access to equipment in cabinets. Access to use of laser and use of gas cabinets. Cabinets and laser are keyed. Machine shop.	Room. Lasers. Equipment Cabinets. Gas Cabinet. Machine shop.
Marc Popek Craig Nielsen (Staff)	Access to room. Access to equipment in cabinets. Access to use of laser and use of gas cabinets. Cabinets and laser are keyed. Machine shop.	Room. Lasers. Equipment Cabinets. Gas Cabinet. Machine shop.

Dr. Culbreth Dr. Venkat	Access to room.	
Mark Pippenger (ECE Technician)	Access to room under emergency conditions.	Room. Equipment Cabinets. Gas Cabinet.
Graduate Stud. (8 max.)	Access to room only. Used as an office.	Room only.
Janitor	Access to room only.	Master key.

3.2 KEY CONTROL POLICY

Only authorized users will have access to keys to the electromagnetics laboratory. Keys are collected by the department office from graduate students which graduate or no longer have the privilege of the laboratory. Keys are not issued by the university without permission of the director of the laboratory. Keys to the cabinets are controlled by Robert A. Schill, Jr. A copy of those keys exists with Mr. David Good the Electrical Engineering Department's technician. Keys to the lasers are locked up in the cabinet.

4.0 PROCEDURAL PROTOCOLS

The general purpose of the *laboratory* is to perform research, laboratory instruction, and demonstrations in the fields of electromagnetics and optics. Presently (1/30/96), the laboratory contains five working and one nonworking laser sources. In the future, it is anticipated that the laboratory will contain various low and high frequency radio wave sources and various high and low voltage sources. An rf shielding room and a high voltage source for the ruby laser exist as well.

The lasers will be employed in classroom instruction and demonstrations as a tool to characterize the physics and engineering principles of light.

Refer to Appendix 1 for Laboratory Operating Procedures for normal use of the lasers. Information on inspection and preparation, turn on, and turn off procedures are outlined.

4.4 HOUSEKEEPING

UNLV provided janitorial service provides normal housekeeping tasks. If the laser is operated in the evening hours and the janitors enter the room without regard for the warning lights outside of the laboratory, the emergency power shut-off switch will turn prevent the large CO₂ and ruby laser from being fired. The low power HeNe

lasers are operated behind the laser curtain. This area is isolated from individuals who enter the room. Verbal commands are sufficient to warn janitors of experiments in progress. Janitorial housekeeping usually occurs in the late evening hours and rarely conflicts with the use of the laboratory.

6.0 SPECIAL USE AUTHORIZATIONS

The electromagnetics laboratory is intended for both research and teaching. Class demonstrations and experiments are planned to be conducted in the future on various levels to K-12 and college students. Demonstrations or hands on experiments are intended to be performed in the laboratory under the guidance of myself or specially trained personnel. Students performing experiments in the laboratory and graduate students occupying an office in the laboratory will be required to sign a form indicating that they have read and will abide by the safety issues, procedures (laboratory operation & accident/incident reporting), and rules of the laboratory. Students viewing demonstrations within the laboratory will be either verbally informed or requested to sign a waiver regarding the rules and procedures of the laboratory. Students touring the laboratory must be under direct supervision and will be exempted from this. The responsible adult will be made aware of the rules, regulations and hazards of the laboratory before students will be able to enter the lab. Eyewear protection is required of all students viewing laser experiments which employ class 2 or higher lasers.

Copies of signed waiver forms will be retained for two years from the date of the individual's last presence in the laboratory. Names of all students viewing or touring the laboratory will be retained over this 3 mo. to a year period as well. Names of UNLV students and adults (18 yrs. and older) casually visiting the laboratory when the lasers and other sources are not in operation will not be recorded. Without direct authorization from Robert A. Schill, Jr., children of UNLV staff or UNLV students will not be allowed in the laboratory regardless of the status operation of the laboratory.

8.0 EYEWEAR, SIGNS AND LABELS

8.1 EYEWEAR

No.#	Use	Specs
2	CO ₂ Laser	Bilsom/GPT (Glendate Protective Technologies) No. 2215, LGS CO ₂ Laserguard, O.D. 10 at 10600 nm
5	He Ne Laser	Laserline, O.D. 2.0 at 6328 um

8.2.3 POSTED EYEWEAR REQs. AND OPTICAL DENSITIES

Eyewear requirements and optical densities are posted in the laboratory on the wall of the r.f. shielding room facing the doorway of the room. These are also indicated in the waiver form that are signed.

8.4 SIGNS

A laser warning sign for class IV visible and infrared light is posted near the entry of the laboratory in a laboratory window easily viewed from the hallway.

9.0 CHEMICAL HYGIENE PLAN

9.1 INVENTORY

Amount	Chemical
1 16 oz. bottle	Isopropyl Alcohol 91% (rubbing alcohol)
2 18 oz. bottles	Ethyl Alcohol 200%
2 12 oz. cans	Ultrajet [Non Residue Dust Remover] contains no CFCs
1 16 oz. bottle	Hydrogen Peroxide Topical Solution 3 % hydrogen peroxide (Local anti infective)
1 5.3 oz. tube	Dow Corning Vacuum Grease
1 5.3 oz. tube	Dow Corning 4 compound Silicon Dielectric

9.2 USAGE

The alcohol and ultrajet are used to clean optical equipment. The DOW Corning products are used as seals or lubricants for the lasers and optic equipment. The hydrogen peroxide is a local anti infective and is an anti-oxidant.

9.3 DISPOSAL PLAN

All chemical waste will be given to the department's technician Mr. David Good. He currently has a University approved waste disposal procedure and he is properly trained in these matters. His office is down the hall from the laboratory. It is anticipated that there will be virtually no chemical waste to be concerned about in the laboratory.

10.0 ACCIDENT/INCIDENT

10.1 POSTED WRITTEN PLAN

Enclosed is a copy of the posted written plan in case of an accident or incident.

10.2 REPORTING REQUIRED

A three ring binder with blank accident report forms are made available in the laboratory by the RIGHT TO KNOW binder. A copy of the report form is enclosed. Copies of waiver forms will be retained as well for a period of 3 to 12 mos beyond the date of the individual's use of the lab.

11.0 ELECTRICAL SAFETY

11.1 GROUNDING, SPECIAL WIRING, EXTENSION CORDS

A 220 V cable connects the RF shielding room to a circuit breaker box housed inside the laboratory. The wiring was performed by Operations and Maintenance on campus so that electrical codes are not violated. The breaker box contains a limiting circuit breaker of 30 A 205 V.

ALL wall outlets are controlled by an emergency cutoff switch. The laser sources and rf shielding room are powered by these outlets.

A power interlock is installed at the door and may be wired to more than one laser if need be. Presently, it is wired to the CO₂ laser.

11.2 CAPACITORS: EXPLOSION AND ELECTRICAL SHOCK PROTECTION POLICY

High voltage capacitors are employed to power both the CO₂ and ruby laser. The capacitor bank for the CO₂ laser is contained in the laser housing. A separate external 20 A, 115 V, 2 KW ruby power supply is needed to power the ruby laser. The high voltage capacitors are housed internal to this source. To prevent electrical shock, a high voltage dump stick exists inside the ruby power supply. When the power supply is opened for repair or setup purposes, the capacitors are bled with the probe. The following marked terminals are discharged: high voltage lamp connection, ground return lamp connection, pockels cell high voltage connection, coolant to head, and coolant return from head. These connections are color coded inside the supply with posted instructions on the inside of the back door of the supply. High voltage low resistance resistors also exist in the laboratory which are used to bleed the capacitor bank in the CO₂ laser when the laser casing needs to be removed and repairs or modifications are required. All systems are appropriately fused to the manufacturer's specifications thereby preventing capacitor explosions. The ruby power supply contains 3 fuses: 0.25 A 25V, 2A 250 V, and a 20 A (BUSS ABC 20). An interlock exists on the door of the supply. The CO₂ laser is limited by a 5 A fuse.

12.0 COMPRESSED GAS SAFETY

12.1 TANKS SECURED

Gas tanks are secured and housed in a gas cabinet located in the partition with the laser sources. The gas cabinet is locked for security reasons.

12.2 PROCEDURES

A set of written procedures exist on how the gas is to be used. This is located near the gas cabinet and is enclosed for convenience.

14.0 UTILITIES

14.1 ELECTRICAL POWER REQUIRED

It is anticipated that only one laser experiment will be conducted at a time with a class IV laser. As a result, the maximum power drawn from the outlet from the CO₂ is roughly about 500 W, the power drawn from the ruby source (115 V, 20 A) is roughly about 2.3 kW. These are worst case power estimates (as in the case of circuit faults) which will cause the fuses in the lasers to blow. Such power draws are therefore not to be expected as the powers required under normal conditions. Both lasers have been operated under normal 20 A circuit breakers. A separate 30 A 205 V fused outlet operates the rf shielding room. Each phase of a three phase line is wired into the wall outlets on the outlet line strip. Each wall outlet is powered by one phase of the line. The neighboring two outlets are powered by different phases.

Each phase is fused with a 20 A circuit breakers. The room has sufficient power to power the lasers and diagnostic equipment.

14.2 WATER

A small portable self contained water cooling system exists for the operation of the ruby laser. It requires about 2 gallons of water. The water is recycled for continuous use.

14.3 VENTILATION

Normal room ventilation is adequate. A separate ventilation duct leading to the outside through the exterior wall of the laboratory has been installed. The spent CO₂ laser gases are routed by way of plastic tubing along the wall out of normal reach to the installed duct.

14.4 LIGHTING

Lighting is adequate inside the r.f. shielding room, and on both side of the curtain partition isolating the laser sources from the rest of the laboratory.

14.5 DOOR LOCKS

Specially keyed door lock have been installed. This allows for controlled access to the room. The number of keys and personnel holding keys are monitored.

14.6 SWITCHES

Adequate light switches exist near the entrance way to the laboratory and to the rf shielding room. A fuse box also exists in the rf shielding room as well.

14.7 COMMUNICATIONS/PHONE

A phone with an outside local line exists in the laboratory.

WARNING:

THIS LABORATORY CONTAINS CLASS 2 OR HIGHER LASER SOURCES WHICH *REQUIRE* ADEQUATE SAFETY GOGGLES. GOGGLES ARE LABELED AND HOUSED IN THE CABINET MARKED. ASK THE LASER OPERATOR BEHIND THE CURTAIN FOR ACCESS TO THE CABINETS.

YOU MAY NOT PASS BEYOND THE CURTAINED AREA WITHOUT PROPER EYEWEAR WHEN EXPERIMENTS ARE IN PROGRESS OR WHEN THE LASERS ARE TURNED ON.

EYEWEAR REQUIREMENTS

**CO₂ LASER -- LGS CO2
LASERGARD GOGGLES
(O.D. 10 at 10.600 mm)**

**HeNe LASER -- LASERLINE
GOGGLES
(O.D. 2.0 at 0.6328 mm)**

**RUBY LASER -- NO GOGGLES
AVAILABLE. REMOTE
OPERATION *MUST* BE
PERFORMED IN THE
RADIO FREQUENCY
SHIELDING ROOM!!**

***REGULAR LABORATORY SAFETY
GLASSES--REQ. FOR SOLDERING
OR FOR VIEWING MOVING PARTS***