1 Content

2 Area of Application

These laboratory regulations are valid for working in the Laboratory of Nano-Optics, in the Department of Physics, Faculty IV at the University of Siegen.

3 Responsible Persons

Professor Mario Agio is the responsible supervisor of the Laboratory of Nano-Optics. His responsibilities include ensuring the entrepreneurial duties and working conditions act (Arbeitsschutzgesetz) and ordinance on hazardous substances (Gefahrstoffverordnung). The following named persons are contact persons for the laboratory:

Name	Task
Jan Krause/Assegid Flatae	Training of employees and students in the mechanical workshop when needed.
Jan Krause	Procurement and distribution of personal protective equipment, refilling any used first aid equipment in the workshop.
Assegid Flatae	Preparation of operating instructions for hazardous substances and machines.
Mario Agio/Assegid Flatae	Evaluation of the the risk assessment and approval.
Jan Krause	Arrange the necessary regular inspections of machines, safety devices, and waste and unused materials and devices removal protocols.
Jan Krause	Initiation / implementation of the test of the portable electrical equipment and gas sources.

4 Conduct in case of technical faults

- In the event of any malfunction of machinery, the responsible supervisors must be contacted immediately.
- Disruptions to the technical infrastructure (gas, water, electricity, sewage, ventilation, etc.) must be reported to the central control center (ZLT) of the university (Tel -4321) without delay.

5 Tidiness and cleanliness

- Order and cleanliness are important foundations of occupational safety.
- All used materials should be cleaned after use and cleared in the appropriate cabinets etc.
- Equipment that is no longer required must be dismantled; temporarily unused equipment must be placed in a condition that excludes hazards (e.g. ventilation of glass vacuum vessels).
- It is best to avoid placing materials on the floor throughout the laboratory so that there are no tripping hazards. Connecting cables (electricity, water, gas, telephone, test leads) should be routed above the traffic areas (at a minimum height of 2 m). If this is not possible, they must be covered with cable bridges.
- Spilled liquids must be absorbed immediately.
- The storage of required materials at the workplace must be carried out in such a way that there are no increased hazards (especially risks of cuts and stabs).
- Especially above 1.4 m height, all materials should be stored in such a way that they do not fall accidentally but can be removed safely.
- At the end of work, the used equipment (if possible) should be switched off, cleaned and stowed so that the cleaning staff can safely clean the laboratory. If this cannot be guaranteed, a message to Department 5.4 (Tel 3280) is required so that the room is taken off the cleaning list.

6 Access Permission

- Access to the laboratories is only permitted with the expressed permission of the responsible persons.
- Persons who are not affiliated with the laboratory may only be present in a laboratory with the permission of the person responsible for the laboratory in question or in the company of a laboratory worker.
- Unauthorized persons are to be expelled from the laboratory rooms.

7 Operating hours

Operation in the laboratory is only permitted at the following times:

- Monday to Saturday from 07:00 until 22:00
- Working on Sunday and public holidays is prohibited!

For activities outside of these times, the expressed consent of the responsible persons is required. For these times, make sure that:

- First responders are available at all times.
- Personnel is available, who could instruct the rescue service.

8 First Aid

8.1 First aid equipment

The locations of the nearest first aid kits as well as the nearest emergency terminal are noted on the emergency notice on the laboratory doors.

8.2 First responders

There is a list of the closest first responders on the emergency call sign on the laboratory doors.

8.3 Emergency/conduct in case of accident

In case of emergencies / accidents, the following procedure should be followed:

1. **Ensure self-protection!**
2. Secure the danger area or take people out of danger area.
3. Consult first responder / paramedic, if necessary place emergency call.

   Emergeny call: to the university's central control centre, emergency no. (0271 / 740) 2111.
   who will redirect the emergency call to the rescue service and organizes further measures, such as
   - Informing the Rescue Assistant of the University,
   - Opening of the entrance gates for the rescue service,
   - Informing the caretaker who will instruct the rescue services,
   - Notify more First responders.

   Outside the duty of the ZLT (Mon-Fri 06:00-22.00, Sat. 08-12:00) this emergency number is forwarded to the security service, which then causes the alarm of the external rescue workers. The briefing of the rescue service as well as the alerting of first aiders must be organized in this time!

   If the number cannot be reached, the fire-brigade and rescue control center must be contacted directly from all internal telephones at 6-112.
4. Provide first aid, care for injured persons.
5. Alert and guide Emergency Service (if necessary via caretaker/porter).
6. In the event of accidents involving hazardous substances, information on the hazardous substance (e.g. safety data sheet) must be given to the rescue service.
7. Inform your supervisor.
8. All injuries (incl. minor injuries) must be documented in the first aid book!
9. If it is necessary to consult a doctor or in case of absence from work for more than 3 days, the responsible person for Laboratories must prepare an accident report. This report will be sent first to department 1.1 and then on to Unfallkasse NRW.
10. Refill any used first aid equipment. All refill materials can be obtained at department 1.1 (Tel. -3311 or -5771)

8.4 Emergency showers

- The emergency showers are located in room ENC-C 015.
- The emergency showers are used for the first "rough decontamination" (maximum 3 minutes) in case of extensive contact with hazardous substances. They can also be used to extinguish a person who is on fire.
- Longer periods of use should be avoided as the injured person may suffer hypothermia; also water damage could be caused.
- Further decontamination / rinsing takes place at the hospital.
- The emergency showers have to be checked monthly (responsible person: see section. 3).

8.5 Eye shower

- The eye showers are located at the sink in room ENC-C 015.
- After exposure to hazardous substances, rinse eyes under running water for at least 10 minutes. The eyelids are to be kept open, contact lenses are to be removed as far as this is possible.
- If there is no eye wash available, an eye can also be rinsed under a normal tap. The head should be held in such a way that the water does not flow towards the second eye.
- The eye showers have to be checked monthly (responsible person: see section 3).

9 Fire protection

More details concerning fire protection can be found in part A and B of fire protection regulations (Brandschutzordnung) of the University of Siegen.

9.1 Emergency/conduct in case of fire

Always:

- Ensure self-protection!
- EMERGENCY CALL -2111 (ZLT) or press emergency button (on the corridor).
- If possible switch off experimental set-ups and energy sources (emergency stop, fuse).
- In case of incipient fires try to put out the fire with suitable extinguishing agents.
- Keep distance to electrical equipment / voltage sources!
- In case of larger fires please exit the area quickly but calmly
  whilst
  - closing doors and windows, but not locking these (Fire service would need to break them open)
  - warning others and helping them to exit,
  - not using lifts,
  - exit building by following the indicated escape routes to the meeting area (In front of building C).
- At the meeting point count and check if all persons belonging to working group (including students) are present.

9.2 Fire protection equipment

- The building is equipped with an automatic fire alarm system for the early detection of fires and the rapid alerting of affected persons.
- If the bell / horn / siren sounds, the building must be left immediately via the signposted escape routes to the meeting point.
- Fire extinguishers are in the corridors.

9.3 Fire protection measures

- All persons in the laboratory must be familiar with the locations of emergency stop facilities (electricity / gas), escape routes, first aid facilities (first aid kit, emergency shower, eye shower) and fire extinguishing equipment.
- Always keep escape routes clear to full extent (doors + windows!)
- Easily combustible materials (paper, wood, etc.) must not be placed in escape routes.
- Storage rooms for wood, paper, flammable liquids or gases or other easily flammable substances must not be entered with an open flame. Smoking bans must be followed.
- Flammable liquids may only be kept in the workplace up to the amount of daily requirement. The provision of combustible packaging material should not exceed the need for one working day.
- Remove waste and shavings regularly.
- Used, oily cleaning cloths must be collected in the designated, closed refractory containers due to their risk of auto-ignition.
- At the end of working time make sure that lights and all electrical appliances are switched off. Excluded are devices that are in continuous operation.
  Safety, telecommunication and fire alarm systems remain permanently operational and must not be switched off. Close all the windows and doors.
- Burning candles (for example on Advent wreaths or arrangements) are prohibited in all offices and service areas.
- Welding, cutting, soldering and cutting work requires special safety measures and (except in the designated workshops) written permission (welding permit). The permit must be obtained from the responsible site supervisor or the responsible departmental head of the building department.
- The installation and use of other than official electrical equipment is prohibited without special permission.
- Defects in fire protection equipment and damage to electrical installations as well as signs (flickering light, stench, etc.) must be reported immediately to the fire prevention officer or supervisor.
- Blown fuses, defective sockets and cables must only be repaired by authorized specialists (Department 5.2).

- In the event of fires on electrical systems, the power must be switched off immediately by means of an emergency stop switch, provided that emergency stop switches are available in the premises.
- Smoke and fire doors are always kept closed unless they are equipped with self-closing devices. Laboratory doors should always be kept closed to prevent the dangerous spread of smoke in case of fire.
  The use of wooden wedges or other objects to keep doors open is prohibited.

10 General security regulations

10.1 Clothing/protective gear

- When working in laboratories, always wear the following work clothing / protective equipment:
  - Chemical safety goggles
  - Lab coat with long sleeves
  - Long pants or long skirt, if possible made of cotton
  - Firm, closed footwear (no sandals, slippers, etc.).

  The clothing must cover all skin areas below the neck (except hands)!
- Do not use jewellery (rings, necklaces) and cosmetics for hygienic reasons.
- The required protective equipment is available at: Assegid Flatae
- As a general rule: Protective equipment must be visually inspected before use. Damaged protective equipment may not be used further!
- When transferring hazardous substances, suitable protective gloves must be worn.
  Caution: Hazardous protective gloves only provide protection against individual substance classes, so the appropriate gloves (see Hazardous Material Operating Instructions) must be selected according to the activity.
- Disposable gloves made of for instance nitrile, vinyl, latex or similar do not provide effective protection against hazardous substances, especially not for prolonged contact. For reasons of hygiene, however, they can be worn under suitable protective gloves.
- Ear protection must be worn in the event of increased noise exposure.

10.2 Eating, drinking, smoking

- Food may not be eaten or stored in the laboratory rooms.
- Glasses, cups, etc. are forbidden in the laboratory because there is a risk of hazardous substances accumulating on these and absorption into the body when drinking.
- Smoking is - as in all rooms of the university - prohibited.
- Food may not be stored in the same refrigerators where hazardous substances are stored.

10.3 Youths, pregnancy

- Special restrictions apply to women, pregnant women and adolescents in accordance with the Maternity Protection Act, the Hazardous Substance Ordinance and the Youth Employment Protection Act.
- A pregnancy should be reported to the supervisor as early as possible so that appropriate protective measures can be taken.

10.4 Working alone

- Working alone in the laboratories is prohibited. There must be at least one other person available, who can provide help in case of danger.

10.5 Experimental Setups

10.5.1 General

- Experimental Setups must be sufficiently steadfast, stable and suitable for the applied temperatures, chemicals and mechanical movements.
- In case of unattended endurance tests, protective measures for incidents (power failure, cooling failure, unexpected reactions) should be provided.
- After the end of the experiment, make sure that all gas and water connections are closed and the power supply is switched off.
- All experimental setups are to be designed in such a way that they can be easily put into a safe state in the event of danger by emergency stop switches (or similar devices
- Test setups may only be put into operation for the first time if they have been checked by a responsible person (see above).

10.5.2 Protection against electrical hazards

- In setups containing electrical equipment, it must be ensured that they are undamaged and suitable for the purpose of the experiment.
- In areas where there is a possibility of liquid splash, only splash proof (water protected) equipment may be used (for example, next to sinks).
- Experimental setups must never be put into operation in which contact parts with dangerous voltages (such as main voltage) are freely accessible.
- Repairs and maintenance work on electrical equipment may only be carried out by suitably qualified persons (electricians).
  For further information, please see the Annex.

10.5.3 Protection against mechanical hazards

- If there is a risk of parts that could spin out of the experimental setup, solid protective covers must be installed.
- With motions that occur at a speed of more than 10 mm / s, protective measures must be taken to prevent persons from reaching into the crushing zone or shear point. This can be prevented by means of fixed covers directly at the danger spots or an effective shut-off of the entire danger area.
- Take special care in the area of rotating rollers, shafts or gear parts. Due to entanglement hazard, these are to be secured in any case.
- Before carrying out any work on the set-ups, the relevant driver must be stopped and secured against being switched on again.
- Work on hydraulically or pneumatically operated parts of set-ups may only be carried out if they have been depressurized and secured against renewed pressure build-up. If movements are triggered by the pressure drop, these must be prevented by suitable measures, e.g. by fixing parts or approaching a previous secure position.
- Collect spilled hydraulic oil with a suitable binder (location: mechanical workshop) or cloth and dispose of it for disposal. Hot hydraulic oil can cause burns.
- When working in the vicinity of free-swinging parts such as pendulums or the like, secure them beforehand against movement or take them down.

10.5.4 Protection against thermal hazards

- When working with stoves, hot work pieces or open flames, make sure that there are no flammable materials (especially paper and hazardous substances) in the immediate vicinity. The surfaces of the work tables should not be flammable or covered with tiles etc.
- The work clothes should have the highest possible cotton content (artificial fibers ignite easily and stick to the skin).
- When handling hot parts, use tools (pliers, etc.) and wear heat-resistant protective gloves.

10.5.5 Protection against laser and other light beams

- When handling laser and other light sources, the relevant safety regulations and operating instructions must be followed.

10.6 Handling of machines / devices

10.6.1 Instruction

- Machines and devices may only be put into operation by persons who have been instructed by one of the above responsible persons in the correct and safe handling.
- Instruction must be repeated annually. The instruction has to be documented by signature.
- Handling of machines and devices are to be carried out as work-related and due to their necessity.

10.6.2 Operational instructions for machines

For the handling of dangerous machines and equipment rules of conduct have been prepared by the responsible persons. These operating instructions list the most important protective measures and rules of conduct. These operating instructions must be observed!

10.6.3 Protective devices

- Machines may only be put into operation if the protective devices provided are in place and effective.
- The manipulation of protective devices is prohibited and may result in criminal prosecution!

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10.6.4 Cooling water

- Cooling water pipes for non-fixed equipment may only be laid as pressure-hose. The hose connections must be secured with clamps.
- With unsupervised experiments measures must be taken to establish a safe condition in the event of failure of the cooling water supply.

10.6.5 Working with vacuum equipment

- Larger glass vacuum equipment must be fitted with a closed trigger or with a splinter guard (for example, a tight-meshed wire net cover, protective screen in front of the equipment). For all work with glass vacuum equipment, at least safety goggles with side protection must be worn.

10.7 Dealing with hazardous substances

10.7.1 General

- Prior to handling hazardous substances and before carrying out procedures in which hazardous substances may be released, the hazard potential must be determined and the necessary protective measures must be taken. In particular, the information from the following sources should be taken into account:
    - Safety Data Sheets
    - Manufacturer or dealer catalogs
    - Literature or work instructions
    - Annexes to the Hazardous Substances Ordinance
- The identified special hazards (H statements) and safety advice (P statements) are binding parts of these laboratory regulations.
- Handling of hazardous substances must be kept to a minimum.
- Hazardous material containers must be clearly labelled with their content and any hazard symbols. They should be resealed immediately after use.
- For containers above 1 liter, the containers must also be completely labelled with the H and P sets.
- Containers intended for food (beverage bottles, jam jars etc.) must not be used for hazardous substances.
- Only containers resistant to the substance may be used.
- At the workplace (for example, at lab table), only the maximum daily requirement amount can be kept.
- (Very) toxic substances should be stored under lock and key so that only qualified persons have access.
  Never carry (glass) bottles by the neck or lid. When transporting outside the laboratory, these must always be transported in plastic boxes that can catch the hazardous substance in case of leaks.
- Food cannot be stored together with hazardous substances (e.g. in the fridge).
- In the case of open handling of gaseous, dusty or hazardous substances that have a high vapor pressure, always work in the fume hood.

10.7.2 Hazardous material operating instructions

For the handling of "more dangerous" substances, the above-mentioned persons responsible will prepare hazardous substance operating instructions that list the most important protective measures and rules of conduct. These operating instructions must be observed!

10.7.3 Handling gas cylinders

- The use of gas cylinders in the laboratory may only be carried out for a short time, insofar as these are not installed in suitable safety cabinets.
  For permanent use (as well as when using toxic gases), fixed gas lines must be laid.
- The number of gas cylinders in a room should be kept as low as possible. Unnecessary bottles must be returned to the outdoor gas storage facility.
- Gas cylinders must always be secured against falling over with a gas cylinder holder, a steel bracket or a chain.
- Gas cylinders must be protected from heat.

- Rooms in which gas cylinders are installed outside safety cabinets are to be marked on the door with a warning sign "Gas cylinder warning", which also indicates the type and quantity of substances.
- Gas cylinders containing toxic, corrosive or highly flammable gases should be chosen as small as possible.
- Rooms containing gas cylinders with flammable gases outside safety cabinets must be well ventilated and equipped with a gas detector.
- Gas cylinders for toxic gases may only be installed or connected in extracted cabinets or fume hoods.
- Gas cylinders may only be moved using special transport trolleys and only with the valve cap screwed on. The carrying of the bottles is strictly prohibited.
- Only gas fittings and hoses that are permissible for the respective type of gas and the pressure occurring may be used to remove gas from compressed gas cylinders. Particular care must be taken to ensure that oxygen does not come into contact with fats or oils, and acetylene does not come into contact with heavy metals such as copper or lead.
- Compressed gas cylinders which extraction valves cannot be opened by hand must be marked and taken out of service.
- Gas cylinder valves should only be opened (carefully) shortly before the start of the test and closed again immediately after the end of the test.
- Gas cylinder valves should only be opened carefully before the start of the test and immediately after the end of the test.
- Keep valves free of grease and oil, especially with oxidizing gases.
- Gas hoses must always be visually inspected before use. Porous, severely kinked or damaged hoses should not be used.
- When connecting gas hoses, always ensure that they are tight.
- When transporting gas areas in elevators, make sure that no persons are traveling in the elevator. For this purpose, barriers and warnings are to be used.

10.7.4 Liquid gases

- Liquefied gases may only be transported in the vessels provided for this purpose (steel insulated tanks, drinking cans).
- They must not be used or stored in small, unventilated rooms.
- When transferring cryogenic gases, cold protective gloves must be worn.

10.7.5 Binder for spilled liquids

Spilled liquids / oils should be sprinkled with sand or binder (location:mechanical workshop) and then taken up with a hand brush / dustpan.

10.8 Dangerous activities

Activities with an increased risk of fire or injury (e.g., working with circular saws, corrosive hazardous substances, dangerous electrical voltages, lasers of classes 3B and 4) may only be carried out if at least one other person is present, even if the specially required protective measures are taken who is not allowed to do the same job. This person must be able to provide first aid or get help in case of danger.

10.9 Unsupervised experimental setups

Unsupervised experiments are only permitted, if it is guaranteed that

- other people cannot intervene in the experiment or be endangered by it,
- dangerous conditions cannot occur, even in the event of power failure, cooling water etc.,
- there is no increased risk of fire due to overheating, for example.

11 Waste

- Expendable waste must be placed in the designated waste containers.
- Electronic waste, toner and used batteries should be taken to the collecting boxes.
- The amount of hazardous waste can be reduced by using only small quantities of substances in reactions. Preference should be given to further use and reprocessing, e.g. of solvents, before their disposal. Reactive residues, e.g. Alkali metals, peroxides, hydrides, Raney nickel, are to be properly converted to less hazardous substances.
- Solvent mixtures should be neutral and peroxide-free. For filling, the solvent tons must be put in the fume cupboard.

- Residues that are not reusable and classified as special waste due to their properties must be packed, labelled, declared and reported to the central hazardous waste disposal (Mr. Sakalli, tel. -2222) in accordance with the separately issued guideline for the collection and disposal of hazardous waste at the university and be handed over for disposal. The same applies to waste chemicals and compressed gas bottles to be disposed of. The applicable transport regulations must be observed.

Mario Agio
14.04.2025
13:03:38
GMT+02:00

Siegen, date 03.04.2025

Prof Mario Agio
Supervisor of Laboratory of Nano-Optics

Annex

Testing of portable electrical equipment

This explanation refers to the obligation to organize a test of the portable electrical equipment in the workshop of the Laboratory of Nano-optics at the University of Siegen.

Definition
Portable electrical equipment is all electrical devices and aids that are connected to a socket (electrical power supply) via a plug connection and can be moved at least partially when connected.
These include, for example: machines, water heater, angle / cut-off grinder, electric hand driller, electric jigsaws, hand-held circular saws, electric soldering iron, welding machines, mobile chip extractors, electric fan heater, power supply units, personal protection adapter, measuring devices, oscilloscopes, computers, monitors, heating plates, extension cables, cable drums, multiple sockets, refrigerators, desk lamps, radiators, 3D printer, printer, timers, projector, overhead projectors, fans and so on.

It is pointed out in this context that all devices used in the area of responsibility must be checked. This also includes private devices (e.g. coffee machines) for whose operation an exemption from the property management exists in accordance with the MSWKS circular of 19.09.2003.

Note: according to point 4.5 of the above-mentioned circular, the operation of private electrical devices is otherwise not permitted.

Hazards
Handling these devices can damage connection cables and electrical components.
This can lead to life-threatening electric shocks for the user. There is also the risk of short circuits, which often cause fires.
In both cases, there is a mortal danger!

Common mistakes
• The insulation of the connection lines are damaged
• The strain relief (often at the same time the kink protection) on the plugs and housing are no longer effective
• Casings are damaged
• The protective conductor ("earth") is no longer effective
• Corrosion inside the housing

Scope of testing
Some of the above errors are easily recognizable from the outside (damage to the outer insulation, missing kink protection, damaged housing).
Defects in protective conductors or inadequacies in the insulation in the device (e.g. due to corrosion) can only be determined by measurements with special measuring devices. These may only be carried out by a suitable

qualified electrician or a person trained in electrical engineering (terms: see DGUV regulation 4 and various DIN VDE)!
In the event of a test by a person who has been trained in electrical engineering, it is necessary to be commissioned and to have regular instruction and control by a qualified electrician. The scope and procedure of the test are specified in VDE 0701-0702 (06-2008).

Legal bases
In the **Accident prevention regulation DGUV regulation 4 "Electrical systems and equipment"** Regular testing of these devices is required in Section 5.
In addition, the **Industrial Safety Ordinance** from 03.02.2015 in §14 a regular check of all work equipment for its operationally safe condition.
In the case of portable electrical equipment, there are hazards for the user mainly due to the electrical hazard, so that the requirements of the Industrial Safety Ordinance should largely be met by testing it in accordance with DGUV regulation 4. For some more complex devices, however, an extended test, e.g. regarding the stability of moving parts, safety switches, light curtains, contact strips, emergency stop devices, may be necessary. For this purpose, appropriate tests, test periods and requirements for the testers must be specified in the risk assessment.

Also in the **Fire protection regulations Part B of the University of Siegen,** which was issued as a mandatory service instruction in 2004 and has since been updated several times, it is required that only tested devices are used.
If fires or other damage are caused by devices that have not been tested (e.g. private coffee machines), the university has the option of claiming recourse for the damage.

Inspection deadlines
According to the accident prevention regulation DGUV regulation 4, the following test periods are to be used as guide values (insofar as "normal" conditions exist in the areas):
• Equipment in workshops, laboratories and classrooms: 1 year
• Devices in offices: 2 years
Further guide values can be found in DGUV regulation 4.
It is possible to deviate from these guide values if the boundary conditions (operating and ambient conditions) deviate from the "usual" level. For this purpose, the qualified electrician must prepare a corresponding risk assessment and give a good reason for the deviation.

New devices
Newly purchased devices do not have to be tested until the test period has expired, as the manufacturer must carry out a corresponding test.
It is advisable to label these devices with the date of purchase so that the expiry of the inspection period can be recognized.

Responsibility for testing
The following people at the University of Siegen are responsible for organizing the exam in their area of responsibility:
• Head of organizational units, specialist groups or institutes,
• Heads of the central facilities or operating units
These persons can delegate the responsibility for the organization and implementation of the test to appropriately qualified persons assigned to them (in writing with the consent of the staff council, with the transfer of appropriate powers).

Framework agreement for review
The university concluded a framework agreement with an external service provider to test the portable electrical equipment.
This can be followed by the individual organizational units (the costs are billed to the organizational unit accordingly), or the test can be organized and carried out by their own (appropriately qualified) employees. If you have any questions about the framework agreement, please contact Department 3.3 "Procurement" (procurement@zv.uni-siegen.de)

Certification mark
The test carried out must be proven by means of a test sticker on the devices, from which the date of the next test can be found.
The test results (measurement results) must be documented and kept until the next test.

Repairs
Repairs to defective electrical devices may only be carried out by qualified electricians!