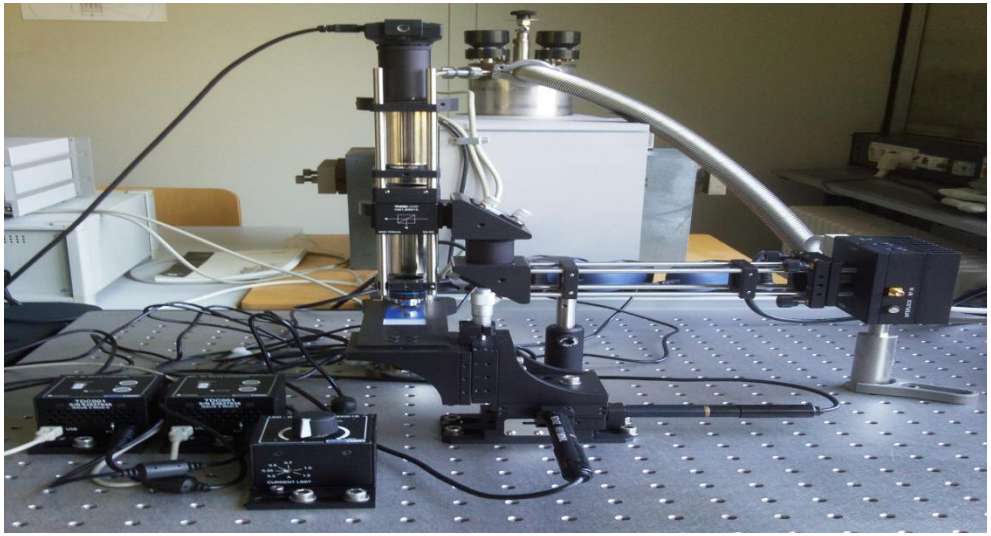
Karlsruher Institut für Technologie

KSOP
Karlsruhe School of Optics & Photonics

Safety Briefing KSOP Optics & Photonics Lab

Karlsruhe, 11 October 2023

PD Dr. Michael Hetterich, Light Technology Institute (LTI) / Institute of Applied Physics (APH)



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  - Fire
  - Electrical
  - Chemical
  - Use of cold and compressed gases
  - Use of lasers
- Conclusion

Avoidance of risks

Avoid every type of risk for yourself and other persons.
Obey the information signs and instructions given to you:

Always follow:

- **the instructions of your supervisors**
- written instructions of the lab !
- guidelines given in this talk / by e-mail
- information signs etc.

in order to:

- prevent unneccesary risks for an accident
- to be insured if an accident happens

Important note:

You are not admitted to the KSOP Optics & Photonics Lab without previous safety briefing !

Precautions related to COVID-19

No longer any restrictions but precautions still make sense

- Masks are not compulsory, but **still recommended**
- **Don’t do labs when you have symptoms of infection**

Preventive occupational medical care

Preventive medical examination (if required)

will be done by the company medical officers.

Consultations by the company medical officers will be made after making an appointment bei phone (Tel. 44313) at BAD Zentrum, Building 20.54 (Neuer Zirkel 1) .

They will be available for all questions about health protection and questions about safety and health in the working place.

Company medical officers are not available in case of emergency (emergency doctor)!

Accident insurance

During work as well as during direct transit to and from work, you are insured by the Accident Prevention Insurance Institution (BG/UK) of KIT

You are not insured during private activities (not even on the toilet !)

Responsible Accident Insurance Institution (BG/UK) of KIT:
Unfallkasse Baden-Württemberg

In case of an accident, tell the medical staff at the hospital

- that it happened at KIT
- that your are insured by the Unfallkasse Baden-Württemberg
- Do not use your private insurance!

General safety instructions

- Familiarize yourself with the set-up and its potential risks before starting work.
- The specific risks of a lab are explained to you by your supervisor. Always follow their instructions!
- Ask your supervisor, if you are unsure about anything!
- Never work alone! (Somebody else must be in shouting distance.)
- Defective equipment (i.e., damaged electrical insulation, loose parts) must not be used. Report problem to your supervisor!
- Instructions of your supervisor against safety regulations must not be followed.
- Use necessary protective equipment (gloves, laser goggles, etc.) for your safety. If you fail to do so, you are not insured!

What do you do when you discover a safety-related defect?

- Report the defect without delay to your supervisor.
- The same applies for accidents, near-accidents, damages or risks.
- Do not continue work before the defect has been fixed!

Emergency measures in case of accident

- Remove the victim from the hazardous area
  (if possible, own safety first!)
- Secure the accident site
- Make an emergency call or shout for somebody to do that if you cannot leave an injured person (first aid). Required information:
  - **Where** did it happen?
  - **What** happened?
  - **How** many victims?
  - **Which** injuries are present?
  - **Wait** for questions!
- Report every accident without delay to your supervisor !
  An official report („Unfallanzeige“) is required!

Important:

- Always dial the **emergency number 3333** at each KIT phone !!!
- Do NOT use your mobile phone, dial 112 etc., since the regular ambulance is not familiar with the KIT campus !!!
- If you have to use a mobile phone: **+49 721 / 608 3333**

Safety Facilities

Laboratory Equipment:

- Eye shower
- Safety shower
- Fire extinguishing media
  - Fire extinguisher
  - Fire blanket
  - Sand/ Extinguisher for flammabale metals, where necessary
- Emergency shut-down
  - for electrical devices
  - for gas supply

If necessary, instructions will be given to you by your supervisor.

Instructions for behavior during accident

NOTFALL

Universität Karlsruhe (TH)

Institut:	.....	Notruf	**3333**
Geb. Nr.:	.....	Durchgangsarzt:	.....
Stockwerk:	.....	Augenarzt:	.....
Raum Nr.:	.....	Nächster Feuermelder:	.....

Im NOTFALL
RUHE bewahren

UNFALL:

Alarmieren:	NOTRUF 3333
	Unfallort und Namen angeben Bestätigung abwarten
Retten:	ERSTE HILFE
Sichern:	Verletzte in Sicherheit bringen Gefahrenquelle beseitigen oder abschirmen

FEUER:

Alarmieren:	NOTRUF 3333 und nächster Feuermelder
	Brandort und Namen angeben, Bestätigung abwarten
Retten:	Personen außer Gefahr bringen ERSTE HILFE
Sichern:	Brand mit Handfeuerlöscher bekämpfen Türen schließen Fenster schließen Technische Anlagen und Maschinen abstellen Abzüge nicht benutzen

Sicherheitsbeauftragter: ..... Raum Nr.: ..... Tel.: .....

Ersthelfer ..... Raum Nr.: ..... Tel.: .....

Verhalten bei Feueralarm

Die Alarmierung wird durch automatische Brandmelder oder durch die Einsatzleitung ausgelöst.
Die Alarmierung erfolgt stockwerkweise.
Nur die durch den Brand unmittelbar gefährdeten Beschäftigten sollen unter den nachstehenden Richtlinien das Gebäude räumen und den Sammelplatz aufsuchen.

Bei Ertönen der Alarmsirene (Dauerton) und/oder Blinklicht

Laufende Geräte abschalten, Beleuchtung einschalten
Fenster und Türen schließen,
persönliche Dinge wie Kleidung, Papiere, Geldbeutel, Schlüssel usw. nach Möglichkeit mitnehmen.

Stockwerk über die Fluchttreppe verlassen
Aufzüge nicht benutzen

Auf vollständige Räumung achten,
dem Einsatzleiter Meldung machen, falls sich noch Personen im Gebäude befinden.

Ruhe bewahren

Am Sammelplatz einfinden
Sammelplatz: .....

Zu beachtende Grundregeln:
Der Vorrang bei der Räumung ist in folgender Reihenfolge zu gewähren:
- Fliehende aus dem Brandherd und unmittelbarer Umgebung,
- von oben kommende Bedienstete,
- von rechts kommende Bedienstete.

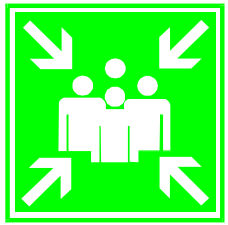
Den Anweisungen der Einsatzleitung ist unbedingt Folge zu leisten.

In every lab, but in German … (→ supervisor)

Behavior during accident

Alarm signals

- Sirens
  - 1 x continuous tone = find the gathering place
- Gathering place:
  - See „Verhalten bei Feueralarm“ and plan of escape and rescue routes
  - It is labelled with this symbol

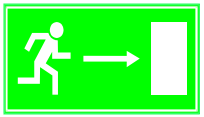


Potential hazards in the lab

- Fire
- Electrical
- Chemical
- Use of cold and compressed gases
- Use of lasers

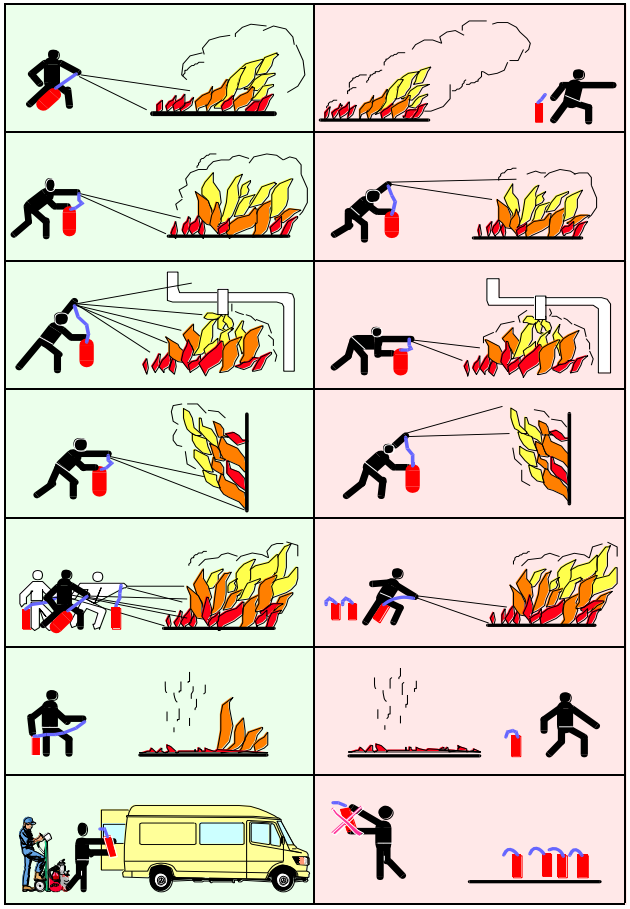
Fire

- When the fire alarm goes off, leave the building immediately, but do not panic! There should be an evacuation assistant for every floor.
- Gather at the indicated places.
- Do not waste time taking any personal belongings with you!
- Emergency exit signs show you the shortest way out!
- *If you notice a fire:*
  - If possible and safe, activate the manual fire alarm, call 3333 and warn others. (Usually there are smoke detectors everywhere.)
  - Only fight the fire yourself if this is possible without own risk, otherwise leave the building as fast as possible. (Often there are sprinklers.)
  - Never open a door when there is a fire behind!



Fire protection

Usage of fire-extinguishing devices



- Fight fire in the direction of the wind.
- Extinguish surface area fires from front to back.
- Extinguish dripping and flowing flames from top to bottom.
- Extinguish wall fires from bottom to top.
- Use an appropriate number of extinguishers simultaneously.
- Continue to monitor fire source.
- After usage, refill the fire extinguisher.

Electrical safety

All equipment in the lab should be safe to use if properly operated and not broken.

General rules:

- You are not allowed to open / modify electrical devices / equipment,
  no matter what your qualification is (electrical engineer …) !
- If a problem occurs, inform your supervisor and do not continue the experiment !

Current through your body (heart !) matters, not voltage !

But: Human body is highly conductive internally &
only shielded by the upper parts of the skin (if there is no sweat).

⇒ Even relatively low voltages (more than a few tens of V)
may lead to substantial currents through your body.

⇒ *Additional problem:*
Current leads to muscle cramp, i.e., you are **not able to release!**

Electrical safety

Particularly dangerous: AC (e.g., mains power supply):

⇒ May lead to **ventricular fibrillation !**
⇒ Drop of blood pressure and death within minutes
⇒ **Immediate first aid required**
(cardiac massage, defibrillator, **call for somebody to dial 3333**),
but **own safety comes first:**
Switch off emergency switch etc. before trying to help!

Further risk after electric shock:

Internal burns (may lead to **kidney failure and death *even days later!*** **)**

⇒ **Report any incident immediately and**
see a KIT-certified (insurance!) doctor!

Chemical safety

If required, detailed instructions will be given to you by your supervisor !

General rules for handling chemicals

- Always work in a fume hood (closed as far as possible)!
- Only keep required chemicals there.
- Always wear protective goggles!
- Wear suitable (!) safety gloves, but only when necessary:
  - Conventional gloves often protect you only for seconds/minutes!
  - Your may contaminate your working place otherwise
  - Risk of allergies
- Use protective clothing when required.
- When dangerous substances are handled, work in a collection basin
- Waste: Use provided and properly labelled collection vessels
- Special instructions for use of hydrofluoric acid required (should be avoided)

Cold gases (Liquid helium and nitrogen)

Risks

- Heavier than air
  ⇒ Risk of suffocation!
- Contact can burn your skin

Measures

- Always use appropriate vessels (dewars) provided.
- Wear protective gloves and goggles when handling liquid gases
- Make sure there is sufficient ventilation.
- Do not fill dewars, when nobody else is there.
- Transport in lift only unaccompanied!
- Follow the intructions given. Do not „play“ with cold gases!

Compressed gases

Risks

- Mostly heavier than air
  - Concentration at lower areas
- Displaces oxygen
- Fire, explosion
- Flammable gases: Flammability at hot surfaces
- Leakage of hose, hose burst
- Hazardous substances
- Dropping gas bottle – Armature or valve are vulnerable/exposed

Handling of gas bottles

Measures

- Do not throw or roll horizontally
- Use gas bottle carriage, only unaccompanied transport in lift (fixed!)
- Prevent shock
- Do not dash against hard objects (may create kerf in gas cylinder)
- After emptying gas bottle screw protection cap on
- Transport and storage with screwed protection cap only
- Don´t fix gas bottle at any source of heat (radiator)
- Toxic and flammable gases have to be positioned in a permanent exhaustor.

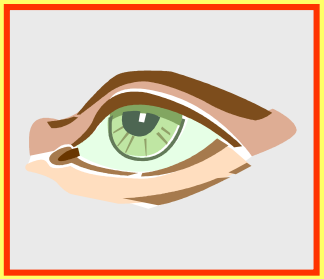
Positioning of gas bottles

- Lock gas bottles against topple down by chains, glamps or rack – don´t use cord (packing thread)
- Use adequate hose support
- Liquid gas: Also empty gas bottles have to be stored upright

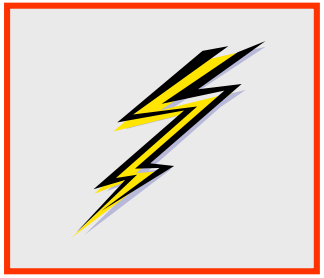
Laser safety

Possible risks when using lasers:

skin damage (burns)



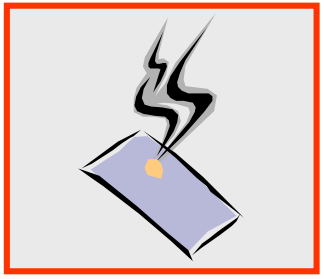
eye damage



electrical current, high voltages

Eye damage is the highest risk!

ignition of flammable or explosive materials



toxic vapors and gases due to irradiation of surfaces

toxic laser media
⇨ excimer gases
⇨ dyes

Classification of lasers

Only **Class 1** lasers are safe under reasonably foreseeable conditions without further measures:

- **Maximum accessible emission is wavelength-depending, max. 0.39 mW @ 532 nm.**
- **No compulsory labeling at the device.**
- **„ ... glare, disturbance of color perception and nuisance cannot be excluded.“**

e.g., laser printers, CD players, LEDs

For all other classes (which nearly all lasers belong to), protective measures are required!

Class 2: Limited safety due to blink response (visible, max. 1 mW cw)

Lasers with class >=2 have to be labeled according to their classification.

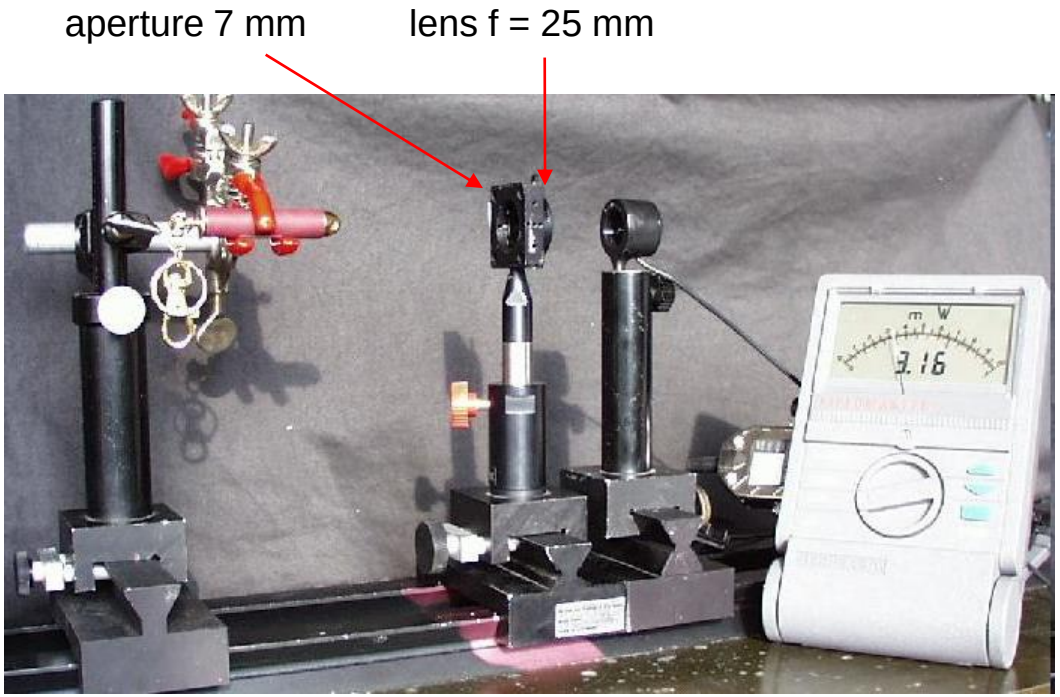
Labeling in laser labs

- Danger sign for laser classes 2–4.
- Warning light and danger signs at the entrances to laser areas classes **3B and 4**.

DIN

ISO

Are laser pointers dangerous to the eye?



P. Hering, Institute of Laser Medicine, University of Düsseldorf (1998)

23 laser pointers classified as class 2 or 3a

15 were class 3b !!!

Safety measures

- Minimize laser area and number of persons. No “friends” etc. in the lab allowed!
- Warn others before a laser is switched on!
- When the warning light is on, knock at the door and wait for an answer!
- Shield beams and block reflections!
- Beams must not leave the table!
- Tighten all beam-related parts and optics (move only one component at a time)!
- No reflective parts (tools, watches, jewellery, ...)!
- **Protective goggles MUST be used at any time (classes 3R, 3B and 4)!**
  They are specific for individual lasers (wavelength, power, cw/pulsed etc.)

  - **Laser Protective Goggles (DIN 58215)**

    Attenuation to class 1

  - **Laser Adjustment Goggles (DIN 58219)**

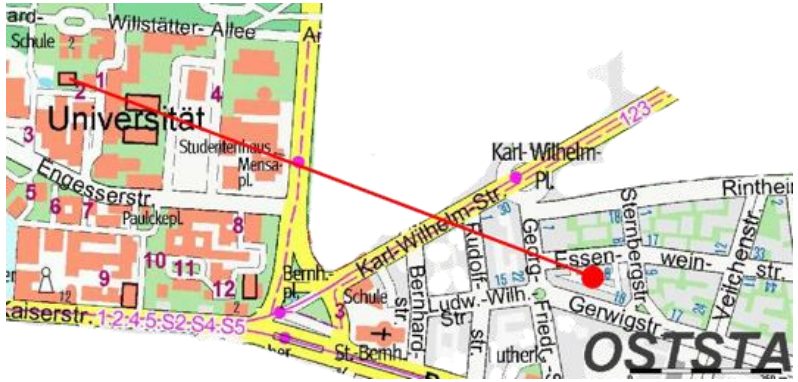
    Attenuation to class 2,
    do not offer full protection!

If required, suitable goggles and instructions should be given to you by your supervisor! If this does not happen, ask explicitly!

If something happened …

If you suspect any harm done to your eye,
***immediately* go to an ophthalmologist !!!**

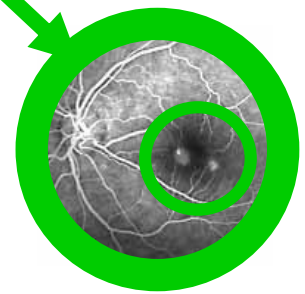
Dres. E. & M. Hyppa
Essenweinstraße 6
76131 Karlsruhe



- Ask someone to accompany you as a precaution!
- Insist on a fluoresceine angiography!
- Fill out an accident report!

Fluoresceine injection

Retinal photograph without fluoresceine



Retinal photograph with UV illumination

St. Luke's Cataract & Laser Institute, Tarpon Springs, FL

Conclusion

Follow the advice
given in this safety briefing
and the instructions
of your supervisor !

An electronic copy of this document will be provided to you on ILIAS !

Important note:
You are not admitted to the KSOP Optics & Photonics Lab without previous safety briefing !

KSOP Optics & Photonics Lab Safety Briefing Acknowledgement

Herewith I acknowledge my instruction within the KSOP Optics & Photonics Lab Safety Briefing concerning the following topics:

- Avoidance of risks, preventive occupational medical care
- Accident insurance
- General safety instructions
- Behavior when safety-relevant problems are detected
- Emergency measures
- Safety facilities
- Potential hazards in the lab:
  - Fire
  - Electrical
  - Chemical
  - Use of cold and compressed gases
  - Use of lasers

I am aware of the fact, that the lab equipment and measurement set-ups must not be used before an individual briefing by the responsible lab supervisor. I am also aware of the fact, that I can contact the lab supervisor and the head of the KSOP Optics & Photonics Lab at any time should problems arise or further clarification be required.

Acknowledge your attendance by writing a personal e-mail to michael.hetterich@kit.edu