Safety Form
Mysteries of Matter Science Show

PERFORMING EXPERIMENTS IN EDUCATION CONTEXTS

INFORMATION ABOUT THE SCIENCE SHOW

What is happening, what are the different steps?

- **Introduction:** the guide welcomes the audience, informs them of the format of the show (duration – 45 min, language, emergency exits and safety measures) and introduces the concept of matter and states of matter.
- **Presentation of Liquid Nitrogen:** pouring liquid nitrogen from the big dewar in the small dewar.
- **'Liquid' demonstrations**: pour liquid nitrogen into the double-glass cylinder to show boiling, pour liquid nitrogen into water and show fog and water ice forming.
- **'Gas' demonstrations**: push a long balloon into liquid nitrogen and observe its size, pour liquid nitrogen into a bottle and close it with a cap that will pop once enough pressure has built up, attach balloon on top of bottle that will inflate due to nitrogen gas. (Optional) Ping pong ball with a hole dipped in liquid nitrogen then put in a closed round to circle due to momentum of nitrogen gas leaving the ball.
- **'Solid' demonstrations**: hammering a frozen rubber tube, metal ring and ball apparatus (ball doesn't fit through the ring after cooling the ring).
- **'Magnet' demonstrations**: (optional) Eddy currents in copper tube by letting strong sphere magnet fall through.
- **'Superconductor' demonstrations**: superconducting levitation demo and superconducting levitating train.
- **'Plasma' demonstrations**: plasma ball and fluorescent tube that lights up in close vicinity
- A laptop is used for the presentation

Who is involved in the experiment and what is their status?

Name of person involved	Role
Guide/presenter	Presenting the show and doing the experiments. Guides with medical condition (pregnancy, heart conditions, sensitive medical devices) may not perform the show.
SG Education team on duty (management team)	Presenting the show and doing the experiments - on duty means this person might do the show if there is no guide available. Members of the team with medical condition (pregnancy, heart conditions, sensitive medical devices) may not perform the show.
Translator (optional)	Translating the show but not participating in any experiments.
Audience	General public (visitors) - seated in the auditorium, not participating in any of the experiments. No participants on stage.
Technical team	Responsible for transporting the show equipment between the storage room and the stage, set up the show equipment on the stage table. Trained for Transport and refill of liquid nitrogen dewars.

☒ Minors (<18 years), if yes, specify minimum age: recommended minimum age for audience is 6 years old, no participants on stage. No strict age limitation.

LIST OF POTENTIALLY HAZARDOUS MATERIALS THAT ARE REQUIRED

For details, please refer to corresponding appendices

☒ Hazardous chemicals – If yes, indicate type and quantity used during the experiment and amount in stock: liquid nitrogen (-196°C, 1 dewar with 11 litres) - *Appendix 2*

☐ Gas – If yes, indicate the type and quantity:

☐ Ignitions sources (naked flames, hot surface, sparks, static electricity):

☐ Pressure equipment (> 0.5 bar)

☐ Vacuum equipment

☒ Heavy objects – If yes, specify: liquid nitrogen dewar (11 litres) - *Appendix 2*

☐ Unprotected sharp edges – If yes, specify:

☒ Magnetic fields – If yes, indicate the type, field strength, quantity: **Disc magnet** (NdFeB, Ø 15 mm, height 8 mm, holds approx. 6.2 kg, neodymium, N42, nickel-plated, Remanence Br 12900-13200 G/ 1.29-1.32T), **Cube magnet** (NdFeB, 10 mm, holds approx. 3.8 kg, neodymium, N42, nickel-plated, remanence Br 12900-13200 G/ 1.29-1.32T), **Disc magnet with hole (genie)** (NdFeB, Ø 18 mm, height 4 mm, holds approx. 4 kg, neodymium, N35, nickel-plated, remanence Br 11700-12100 G/ 1.17-1.21T), **Sphere magnets** used for the Eddy Current experiment (optional) (NdBeB, Ø 12.7 mm, holds approx. 2.4 kg, neodymium, N42, chrome-plated, remanence Br 12900-13200 G/ 1.29-1.32T), **Magnetic track** used for the superconducting train (3 lines of 14 magnets, NdFeB, 30x10x5mm, one magnet holds approx. 6.5kg, neodymium, N42, nickel-plated, 12900-13200 G/ 1.29-1.32T - *Appendix 6*

Note limits for medical implants (<0.4 mT) & exposure for general public and pregnant women (<40 mT)

☐ Hot materials (> 50°C) – If yes, specify

☒ Cold or cryogenic materials (< 0°C) – If yes, specify: Liquid nitrogen (-196°C, dewar with 11 litres - *Appendix 2*

☒ Electrical equipment – If yes, specify type, voltage, current, exposed live parts: Plasma ball (output variable from 1 to 14kV, frequency variable from 20 to 50 KHz, current reactance limited, input 115/220 at 50 to 60 Hz) - *Appendix 8*

☐ RF, microwaves

☐ IR light – If yes, specify power:

☐ Laser – If yes, specify class, wavelength and power:

☐ UV light – If yes, specify wavelength and power:

☐ Radioactive sources/objects – If yes, specify isotope, radiation type and activity:

☐ X-ray sources – If yes, specify energy and dose rate:

☒ Lithium batteries – If yes, specify: laptop for presentation - *Appendix 9*

☐ Small items that can be swallowed (only relevant if young children are involved)

☒ Other (e.g. mercury lamps, loud noise, dust of combustible solids, heights, other chemicals, …):
fluorescent tube - *Appendix 8*, **balloons** - *Appendix 4*, **superconductor discs** (YBCO disc used for the levitating demonstration: Ø 45mm, H 8mm, seeded material, composition: Y1.65Ba2Cu3O7-x – bulk, additional performance: Surface stabilization, the magnetic properties of the HTS elements: levitation: 80 - 90 N at 0.5 mm distance, trapped field: 0.9 - 1.2 T (77K, 1.4 T excitation), YBCO disc used in plastic train: Ø 28mm, H 10mm, Melt-textured material, composition: REBa2Cu3O7-x with RE2BaCuO5 excess, levitation: 60 N+, trapped magnetic field up to 2.5T (77K)) - *Appendix 7*

IDENTIFICATION AND HANDLING OF THE RISKS

What are the risks for the people involved in the experiment and how they are handled? (prevention measures, PPE, good practices, emergency and first aid instructions, include storage and transport)

(1) General safety information: at the beginning of the show, the guide provides important information regarding emergency exits in the auditorium and outlines the appropriate actions to take in the event of an alarm. **Nobody from the audience is allowed on stage** at any time during the show.



For the following experiments – see appendices

(2) Liquid Nitrogen, applies to steps (3) to (7)
(3) Liquid experiments
(4) Gaz experiments
(5) Solid experiments
(6) Magnets
(7) Superconductors
(8) Plasma ball and fluorescent tube
(9) Laptop for presentation – Lithium battery

What are the risks for the room/building in which the experiment takes place and how they are handled? (prevention measures, good practices, emergency instructions, include storage and transport)

Fire risks: The experiments take place on two tables in the center of the stage, wrapped on the sides by black cloths. These tables, as well as the black cloths, have passed the fire class M1 test (non-flammable or very low flammability (highly resistant to ignition)).

Fire risks from electrical equipment are minimized by following the guidelines in the appendices. In the event of a small fire, a CO_2 or dry chemical fire extinguisher is available at the side of the stage for immediate use. For larger fires, the audience must be evacuated through the emergency exits, the alarm activated, and emergency services contacted immediately.

Access to the stage is restricted using red/white barrier tape which informs people that they are not allowed to access the stage area. Between the shows, all hazardous materials are hidden from public view: dewars with liquid nitrogen are stored beneath the demonstration table, and the whole table, including all equipment, and the plasma ball, are covered with M1 black cloth.

Emergency instructions and experiment guidelines have been provided to the guides during their training and are shared with the audience at the beginning of the science show.

Transportation: the transport between the storage rooms and the auditorium is done by the technical team. They have followed the Cryogenic safety training. They also take care of refilling liquid nitrogen dewars when needed.

Appendices

(2) Liquid Nitrogen		
Description: Non-flammable, non-toxic, colorless, odorless, LN2 cryogenic liquid (77K = -196°C) Quantity: 11L dewar, guides handle small quantities up to 2 liters from a smaller dewar.		
Only trained guides can handle liquid nitrogen, no public participation. The operator should wear closed shoes and long trousers, and not wear any jewelry or metallic accessories on their hands and forearms, and should wear the appropriate PPE (goggles, gloves when handling larger quantities)		
Hazards	**Protective equipment and precaution**	**Emergency action**
Cryogenic burns and frostbite Direct contact with liquid nitrogen or surfaces cooled by it can cause severe cold burns, as it rapidly freezes living tissue. Eye injuries: Splashing or vapor from liquid nitrogen can cause serious damage to the eyes, leading to frostbite or even blindness if not immediately treated. Cold gas is invisible but produces cold mist in contact with ambient air.	**Personal protective equipment (PPE):** Always wear appropriate PPE -**Cryogenic gloves** (when pouring liquid nitrogen from the 11L dewar to the 2L dewar) -**Safety goggles** (all the time) -**Closed-toe shoes and long trousers**. In case the presenter exceptionally forgets long trousers, the cryo-apron can be used to provide protection. This does not cover the feet, so closed shoes are still required. All **jewelry and metallic accessories** on hands and forearms (rings, watches…) must be removed. Lanyards / long chains should also be removed prior to using liquid nitrogen. Never allow liquid nitrogen or cold gas to come into contact with skin and eyes. **Be cautious of condensation** on containers, which may appear harmless but could cause burns. **Avoid inhalation** of vapor or mist.	In case of spillage of larger quantities (> 5L): evacuate all persons from the immediate danger area and call the fire brigade if necessary. Ventilate the area. In case of cold burns (skin or eyes): immediately seek a tap with tepid water. Keep rinsing the affected part with tepid water for minimum 15 minutes and call emergency services.
Asphyxiation In an enclosed space, liquid nitrogen can displace oxygen as it evaporates into nitrogen gas, leading to an oxygen-deficient atmosphere and the risk of asphyxiation.	Science show area and gas storage room are well-ventilated areas to avoid the build-up of nitrogen gas. The gas storage room is clearly labeled with Oxygen deficiency signs and cryogenic product signs. Excess liquid nitrogen is disposed of by allowing it to evaporate in a well-ventilated area. Liquid nitrogen dewars can be transported in goods elevators BUT no person is allowed to use the elevator at the same time.	If exposed to low oxygen concentration: move the affected person into fresh air; if not breathing, give artificial respiration. Call the emergency services.
Explosions from trapped liquid If liquid nitrogen is trapped in a sealed or poorly vented container, it can rapidly expand as it vaporizes, potentially causing the container to explode.	Liquid nitrogen is stored in clearly labeled containers designed for cryogenic liquids (dewar flasks), that can handle extreme cold and that allow for the safe release of pressure.	If you suspect a container may be over-pressurized (e.g., swelling or making an unusual noise), evacuate the area immediately and avoid approaching the container until it has been safely vented or handled by professionals.
Heavy weight A full Nitrogen dewar is heavy, leading to a risk of back strain or injury if not lifted properly.	Transportation is only done by the trained technical team. When liquid nitrogen is transported, approved containers are used, which include safety vents, and they are secured properly to prevent tipping or spilling. When pouring liquid nitrogen from the 11L dewar to the 2L dewar, handle the dewar carefully, don't allow it / cause it to fall.	In case of serious injury, contact the emergency services

(3) Liquid Experiments		
In addition to liquid nitrogen hazard specified in (2)		
Description: pour liquid nitrogen into a double-glass cylinder to show boiling, pour liquid nitrogen into water and show the ice and fog that forms		
Only trained guides can handle liquid nitrogen, no public participation. The operator should wear closed shoes and long trousers, should not wear any jewelry or metallic accessories on their hands and forearms, and should wear the appropriate PPE.		
Hazards	**Protective equipment and precaution**	**Emergency action**
Cryogenic burns Pouring liquid nitrogen into water will create cold fog and ice	When adding liquid nitrogen to water, do so **slowly** to prevent violent boiling and splashing. **Keep a safe distance** from the fog. **Do not touch** the ice with bare hands, use the wooden spatula provided.	In case of cold burns (skin or eyes): immediately seek a tap with tepid water. Keep rinsing the affected part with tepid water for minimum 15 minutes and call emergency services.

(4) Gas Experiments		
In addition to liquid nitrogen hazard specified in (2)		
Description: push a long balloon into liquid nitrogen, pour liquid nitrogen in a bottle with cap and then a balloon, (optional) ping pong ball in liquid nitrogen.		
Only trained guides can handle liquid nitrogen, no public participation. The operator should wear closed shoes and long trousers, should not wear any jewelry or metallic accessories on their hands and forearms, and should wear the appropriate PPE.		
Hazards	**Protective equipment and precaution**	**Emergency action**
Noise A balloon can burst unexpectedly due to overinflation or weak spots in the material, potentially causing loud noises	The guide should inform the audience that the balloon may burst and kindly suggest that individuals with sensitive hearing, as well as children, can **protect their ears** by covering them with their hands.	In case of signs of distress (children crying), calmly reassure the person and check for serious signs of distress. Provide assistance if necessary and seek medical attention if needed.
Cryogenic burns The pressure builds up quickly in the bottle, and the gas can produce mist in contact with ambient air. When the bottle cap flies off it could knock the bottle and spill the liquid nitrogen contents.	Handle the balloon, and ping pong ball carefully as they could be very cold. Before starting the pressure experiment, **remove all liquid nitrogen containers (beakers, double glass cylinder, small dewar) from the table and place them safely under the table.** Only pour a very small amount of liquid nitrogen into the bottle.	In case of cold burns (skin or eyes): immediately rinse the affected part with tepid water for a minimum of 15 minutes and call emergency services.

(5) Solid Experiments		
In addition to liquid nitrogen hazard specified in (2)		
Description: Hammering a rubber tube that has been dipped into liquid nitrogen (the tube is therefore rigid and brittle, and shatters when hammered)		
Only trained guides can handle liquid nitrogen, no public participation. The operator should wear closed shoes and long trousers, should not wear any jewelry or metallic accessories on their hands and forearms, and should wear the appropriate PPE.		
Hazards	**Protective equipment and precaution**	**Emergency action**
Fountain effect	Make sure there is a **knot** at the end of the rubber tube and dip the other end into the liquid nitrogen.	In case of cold burns (skin or eyes): immediately seek a tap with tepid water. Keep rinsing the affected part with tepid water for minimum 15 minutes and call the emergency services.
Projectiles When shattering the rubber tube, pieces (projectiles) scatter in all directions.	Wear **safety goggles** to protect eyes from potential shards of rubber tube. **Hit the tube gently**, to avoid the shards from flying too far off the table.	In case of serious injury, contact the emergency services

(6) Magnets

Description: different magnets are used to show levitation with superconductors

Neodynium magnets: [1]

- **Disc magnet:** NdFeB, Ø 15 mm, height 8 mm, holds approx. 6.2 kg, neodymium, N42, nickel-plated, Remanence Br 12900-13200 G/ 1.29-1.32T, recommended distance for pacemaker: 85mm, for general public and pregnant women: 38mm
- **Cube magnet**: NdFeB, 10 mm, holds approx. 3.8 kg, neodymium, N42, nickel-plated, remanence Br 12900-13200 G/ 1.29-1.32T, recommended distance for pacemaker: 75mm, for general public and pregnant women: 32mm
- **Disc magnet with hole** (genie): NdFeB, Ø 18 mm, height 4 mm, holds approx. 4 kg, neodymium, N35, nickel-plated, remanence Br 11700-12100 G/ 1.17-1.21T, recommended distance for pacemaker: 75mm, for general public and pregnant women: 33mm
- **Sphere magnets** for the Eddy Current (optional): NdBeB, Ø 12.7 mm, holds approx. 2.4 kg, neodymium, N42, chrome-plated, remanence Br 12900-13200 G/ 1.29-1.32T, recommended distance for pacemaker: 75mm, for general public and pregnant women: 32mm

Magnetic track used for the superconducting train: 3 lines of 14 magnets, NdFeB, 30x10x5mm, one magnet holds approx. 6.5kg, neodymium, N42, nickel-plated, 12900-13200 G/ 1.29-1.32T. For a single magnet: recommended distance for pacemaker: 85mm for general public and pregnant women: 38mm

When not in use, the magnetic train track and neodymium magnets **are stored in labeled wooden boxes** to prevent pinching, unintended metal attraction, and public contact, ensuring a safe distance is maintained.

Only trained guides use the magnets, no public participation.
The operator should not wear metallic accessories, should not have any medical conditions (including pregnancy, heart conditions, sensitive metal devices).

Hazards	Protective equipment and precaution	Emergency action
Pinching/crushing injuries Strong magnets can snap together with significant force, potentially pinching or crushing skin or fingers if they are powerful enough.	**Handle magnets carefully**. Use both hands to handle large magnets and keep fingers clear of the magnetic surfaces to prevent pinching or crushing injuries.	If a magnet causes a crush or pinch injury, carefully separate the magnets, if possible, to release the affected area. Seek medical attention for severe injuries.
Metal object attraction Magnets can attract nearby metal objects (tools, jewelry, etc.), leading to unexpected impacts, injuries, or damage.	**Keep magnets away from ferrous objects** (iron, steel) in the area to prevent accidental attraction and collisions. **The operator should not wear metallic accessories (watch, jewelry).**	If a magnet attracts a nearby metal object and causes an injury, assess the injured area. Seek medical attention for severe injuries.
Damage to electronics Magnets can interfere with or damage electronic devices, including smartphones, computers, medical devices (e.g., pacemakers), and credit cards with magnetic strips.	**Maintain a safe distance (at least 30cm)** between magnets and sensitive electronics, including computers, phones, credit cards, and medical devices like pacemakers. The operator may **not have any sensitive medical device.**	If it is suspected that a magnet has interfered with a medical device, move away from the magnet immediately and see professional medical help. If the person experiences serious symptoms, call emergency services.

[1] Safety distances have been calculated following the protocol established by our provider supermagnete.ch: https://www.supermagnete.ch/eng/faq/How-do-you-calculate-the-magnetic-flux-density

Magnet fragmentation If large magnets collide or are mishandled, they can chip, crack, or shatter, sending sharp fragments flying.	**Handle magnets carefully**. Dispose of old or damaged magnets properly according to local waste disposal guidelines. If magnets are damaged and fragmented, handle the pieces carefully with **protective gloves** to avoid injury from sharp edges.	If a magnet breaks or shatters, evacuate the area to avoid injury from flying shards. Sweep or vacuum the area thoroughly, using caution with magnetic fragments to avoid injury. Use protective gloves when handling fragments.
Magnetic field hazards Strong magnetic fields can interfere with medical equipment. The limits for medical implants (<0.4 mT) & exposure for general public and pregnant women (<40 mT)	As the strength of the magnets are higher than authorized limits for the general public and pregnant women, **no volunteers or other members of the public are allowed to manipulate the magnets.** **Only the guide can use them**, **and only if they have no medical conditions** that prevents them from handling magnets (pregnancy, sensitive medical devices, heart condition).	If it is suspected that a magnet has interfered with a pacemaker, defibrillator, or other medical device, move away from the magnet immediately and seek medical advice. If the person experiences symptoms, call emergency services.

(7) Superconductors

In addition to liquid nitrogen hazard specified in (2)

Description: ceramic superconductor material – YBCO (Yttrium barium copper oxide). This is a high-temperature superconductor, that becomes superconducting below the boiling point of liquid nitrogen (at about 90K; -180°C).
YBCO disc used for the levitating demonstration: Ø 45mm, H 8mm, seeded material, composition: Y1.65Ba2Cu3O7-x – bulk, additional performance: Surface stabilization, the magnetic properties of the HTS elements: levitation: 80 - 90 N at 0.5 mm distance (77K, 0.4 T PM, standard magnet in Germany), trapped field: 0.9 - 1.2 T (77K, 1.4 T excitation)
YBCO disc used in plastic train: Ø 28mm, H 10mm, Melt-textured material, composition: REBa2Cu3O7-x with RE2BaCuO5 excess, levitation: 60 N+, trapped magnetic field up to 2.5T (77K)

Only trained guides can handle liquid nitrogen, no public participation.
The operator should wear closed shoes and long trousers and should not wear any jewelry or metallic accessories on their hands and forearms and should wear the appropriate PPE.

Hazards	Protective equipment and precaution	Emergency action
Material brittleness Superconductors (especially high-temperature superconductors) are often brittle and can crack or shatter when handled improperly. Humidity can increase brittleness of superconductors	**Be careful when handling** the superconducting disc and do not let the train fall as this could break the YBCO ceramic and cause pieces to be exposed. The superconducting train is stored in a dry environment.	If the ceramic falls and breaks, use gloves to pick up the pieces. Ensure that all pieces are removed from the area and wash hands with soap and water. Dispose of YBCO in accordance with local and national regulations. This should be done by a trained professional.
Toxic materials While YBCO in form of a pellet is not considered a hazardous chemical, powders are considered toxic if ingested and might cause skin, eyes or respiratory system irritations.	**Use the plastic tweezers or gloves provided** to handle the YBCO disc for the levitating demonstration. The other YBCO piece is secured within a plastic train structure and should not be touched directly. If the YBCO breaks and powder is released, make sure nobody inhales or touches the powder and ensure safe distance and disposal.	Wash hands thoroughly with soap and water if there is any direct contact with the YBCO material. Call emergency service in addition to the action below if YBCO enters the eyes, is ingested or inhaled: Eyes: rinse several minutes, remove contact lenses if present and easy to do so. Inhalation: remove the affected person to fresh air and keep at rest Ingestion: rinse mouth with water

(8) Plasma ball and fluorescent tube		
Description: Ø35cm Plasma Ball connected to 230V. Variable high voltage high frequency single ended plasma driver: output variable from 1 to 14kV, frequency variable from 20 to 50 KHz, current reactance limited, input 115/220 at 50 to 60 Hz, safety: equipped with a 1 Ampere fuse, overvoltage shutdown with manual reset. Use of standard fluorescent tube to show movement of electrons		
Only trained guides operate the plasma ball, no public participation. The operator should not wear metallic accessories, should not have any medical conditions (including pregnancy, heart conditions, sensitive metal devices/implants).		
Hazards	**Protective equipment and precaution**	**Emergency action**
Electric shocks Plasma balls generate high-voltage discharges. Although the current is low and usually not harmful, prolonged or sensitive exposure can cause discomfort or minor electrical burns. Fluorescent tube can conduct electricity if not properly isolated.	When setting up the show, the technicians ensure that all metal parts of the Plasma Ball are **properly grounded** to prevent electric shocks. Live part of the Plasma Ball transformer has been protected (plastic casing and tubes) to avoid direct contact to skin or nearby conductive objects. **Turn off after demonstration** or if you observe bluish glows, hissing sounds or ozone smell. The Plasma driver is clearly labelled with a **high voltage sign**. Both extremities of the fluorescent tube are protected with **isolating tape**.	Any electric shock produced by the Plasma ball or fluorescent tube should only be uncomfortable to slightly painful. If someone receives an electric shock, unplug the plasma ball, and ensure they are not in contact with the plasma ball before touching them to avoid being shocked yourself. If they lose consciousness or show severe symptoms (chest pain, difficulty breathing), call the emergency services immediately.
Fire risks Sparks produced by the plasma ball can ignite flammable gases or materials in the vicinity.	The Plasma ball is operated in a dry, well-ventilated environment, away from any flammable or combustible materials (e.g., gases, solvents, paper), or water.	In case of fire: turn off the plasma ball immediately, disconnect the equipment from the power source, and use a fire extinguisher (CO_2, dry chemical) to put out the fire, if trained to do so. For larger fires, activate the alarm, evacuate the area and call emergency services.
UV Radiation Plasma balls and fluorescent tubes emit small amounts of ultraviolet radiation, which can be harmful to the eyes with prolonged exposure.	Avoid prolonged exposure by switching off the Plasma Ball after the demonstration.	For any signs of eye irritation or potential UV-related damage (such as redness, sensitivity to light, or blurry vision), call emergency services.
Electromagnetic Interference Plasma balls emit electromagnetic fields that can interfere with sensitive electronic equipment like pacemakers, mobile phones, or computers.	Keep the plasma ball away from sensitive electronic equipment to prevent electromagnetic interference. **Nobody with a sensitive medical device is allowed on the stage**.	If interference with nearby electronic devices occurs, turn off and unplug the plasma ball. If you suspect interference with a pacemaker, defibrillator, or other medical device, move away from the plasma ball immediately and seek medical advice. If the person experiences symptoms, call the emergency services.

Heat Generation Plasma balls can get warm or overheat after extended use, which might lead to burns if touched. Overheating can also lead to damage and other issues (e.g. fires).	Do not touch the plasma ball for extended periods to avoid potential discomfort or burns from the electrical discharge. Switch off the Plasma Ball after the demonstration to avoid overheating. **Turn power down if necessary** as it is possible to overpower. The Plasma Ball unit is equipped with a 1 Ampere fuse to protect from overload.	If anyone sustains a burn, hold the affected area under cool running water for 10-20 minutes, and seek medical attention for severe burns. If the plasma ball overheats and causes a fire, see the advice regarding 'Fire risks', above.
Glass Breakage The glass dome of the plasma ball and the fluorescent tube are fragile and can shatter if dropped or struck, posing a risk of cuts and exposure to electricity.	**Be careful** when handling or transporting the Plasma Ball as well as the fluorescent tube.	If the glass of the plasma ball or fluorescent tube shatters, do not touch the shards or the device. Unplug it immediately. Wear gloves to clean up the broken glass and dispose of it safely. Do not throw mercury-containing product (such as fluorescent tubes) into the normal bin; dispose of them in the recommended/ appropriate way.
Mercury Exposure Fluorescent tubes contain small amounts of mercury, which is toxic. If the tube breaks, mercury vapor or liquid can be released, posing a risk of inhalation or contamination.	Always handle fluorescent tubes gently to prevent breakage. When not in use, the fluorescent tube is securely stored.	In case of breakage, ventilate the area well to disperse any released mercury vapors. Don't inhale mercury vapors, contact the technical team for vacuuming and removing any broken glass. Do not throw mercury-containing product into the normal bin; dispose of them in the recommended/ appropriate way. If anyone inhales mercury vapor or has direct contact with mercury, seek medical attention.

(9) Laptop for presentation		
Description: a laptop with lithium battery is used for the presentation of the show		
Only trained guides operate the computer, no public participation.		
Hazards	**Protective equipment and precaution**	**Emergency action**
Electric shocks A damaged charger or power supply could expose live electrical components.	Regularly inspect the charger and cables for damage. The laptop and all power cords and accessories are secured and kept away from water/liquid nitrogen	If someone receives an electric shock, immediately disconnect the power source if possible. Avoid touching the person, to avoid being shocked yourself. Call emergency services if the person is unconscious, has burns, or experiences severe symptoms such as chest pain or difficulty breathing.
Overheating Prolonged use or exposure to heat may cause the laptop to overheat, potentially leading to battery failure or even fire.	The laptop is kept on a flat, hard surface for proper ventilation. The laptop is not used near hot sources. Avoid leaving the laptop on charge when not used.	If the laptop becomes too hot to touch, turn it off immediately, unplug it, and allow it to cool down. Do not use it until it has been inspected for damage. In case of fire: stop using the laptop immediately and use a fire extinguisher (CO_2, dry chemical) to put out the fire, if trained to do so. For larger fires, activate the alarm, evacuate the area and call emergency services.
Battery leakage or swelling Physical damage or manufacturing defects in lithium-ion batteries can cause swelling, leakage of harmful chemicals, or even explosions in rare cases.	Regularly ensure the laptop is in good working condition, paying close attention to the battery.	In the event of battery leakage, avoid touching the leaking substance. Ventilate the area and use gloves if cleanup is needed. Dispose of the battery following hazardous waste guidelines.