Mysteries of Matter

Equipment	Description & How to Use
Computer with presentation on stand	Runs the presentation slides and show timing. A stands helps keeping the computer out of reach of the liquid nitrogen.
Black table cloth	Covers the equipment before and after the show.
Cheat sheet	Quick reference guide for the presenter.
Clock	Keeps the 45-minute show on schedule.
Liquid Nitrogen 11L Dewar	Main cryogenic storage vessel supplying all liquid nitrogen demonstrations. Stored under the table when not in use.
Small Dewar (2L)	Used to transfer liquid nitrogen from the main dewar to the demonstrations.
Double glass cylinder	Allows the audience to observe liquid nitrogen boiling while minimizing heat transfer.
Small or large glass beakers	Used for the fog and water-freezing demonstrations.

Small and large glass beaker



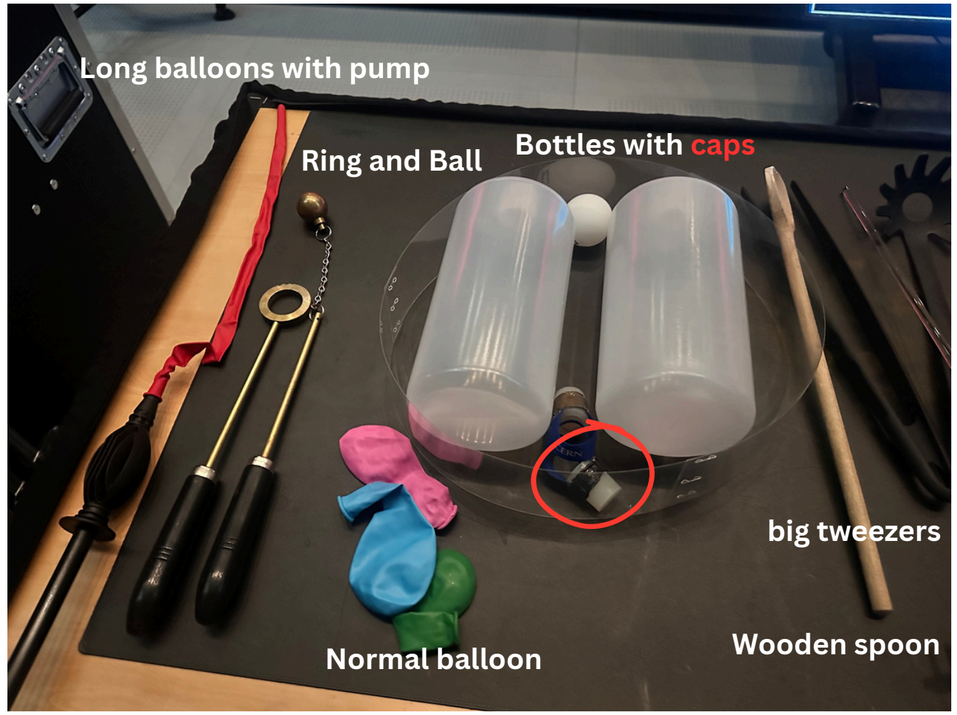
Small Dewar

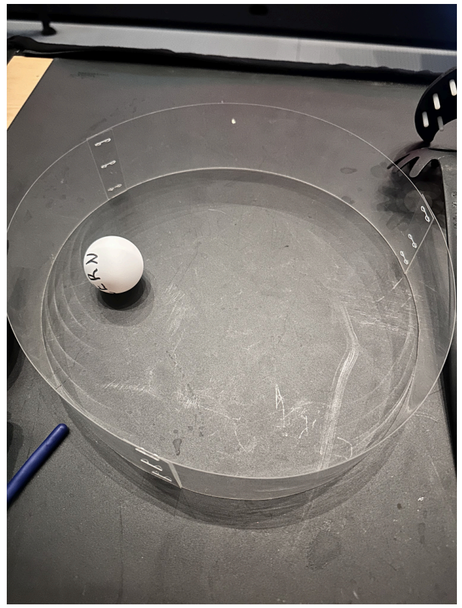




Double glass cylinder

Plastic bottles	Used to demonstrate pressure build-up from liquid nitrogen expanding into gas.
Bottle caps	Loosely fitted to the plastic bottles to demonstrate pressure safely by popping off (rubber or 3D printed).
Long balloon	Already inflated. Demonstrates contraction and expansion of gases when cooled and warmed.
Long spare balloon + pump	Replacement for repeat demonstrations. Or if the presenter would like to show the inflation process.
Normal balloon	Fits onto plastic bottle to demonstrate gas expansion.
Wooden spoon and big tweezers	Safely pushes balloons into liquid nitrogen and removes ice from beakers.
Ping pong ball (with small hole)	Cooled in liquid nitrogen and spun inside a plastic ring to demonstrate gas pressure.
Plastic circle	Holds the ping pong ball while it spins.
Watering can (filled with water)	Supplies water for freezing and condensation experiments.
Ring and Ball apparatus	Demonstrates thermal contraction by cooling the ring until the ball no longer fits through it.





Ping pong ball (with small hole) + Plastic circle

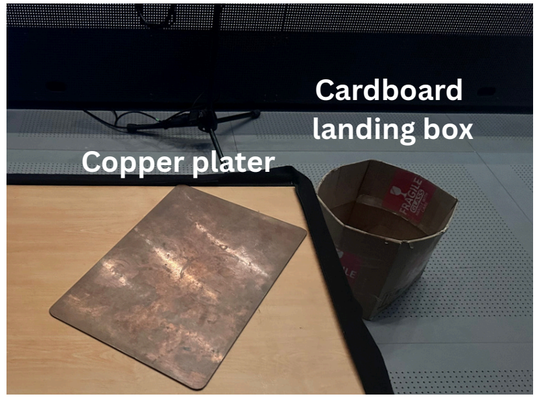


Watering can (filled with water)

Rubber tube (with knot at one end)	Frozen in liquid nitrogen until brittle, then broken with a hammer. The knot prevents fountain effect.
Hammer	Breaks the frozen rubber tube.
Chopping board	Safe surface for striking frozen rubber.
Fluorescent tube	Lights wirelessly near the plasma ball. Both ends should be insulated with insulating tape.
Plexiglass tube	For the Eddy current demonstration (no effect).
Copper tube	For the Eddy current demonstration (effect with magnetic balls).
Copper plate	For the Eddy current demonstration (effect with magnetic balls).
Set of steel (non-magnetic) balls	Shows the difference for Eddy current demonstrations.
Cardboard box	Collects balls safely after they exit the tubes.
Superconductor (YBCO) disc	Cooled with liquid nitrogen to demonstrate flux pinning and magnetic levitation. Must be handled with gloves or plastic tweezers.
Plastic divider	Separates the magnet from the superconductor while cooling. Removed with the loop tool once superconducting state is reached.
polystyrene contenant	Contains liquid nitrogen and the YBCO disc for the levitation demonstration.

Rubber tube + hammer + Chopping board





Superconductor (YBCO) disc, plastic divider + polystyrene contenant



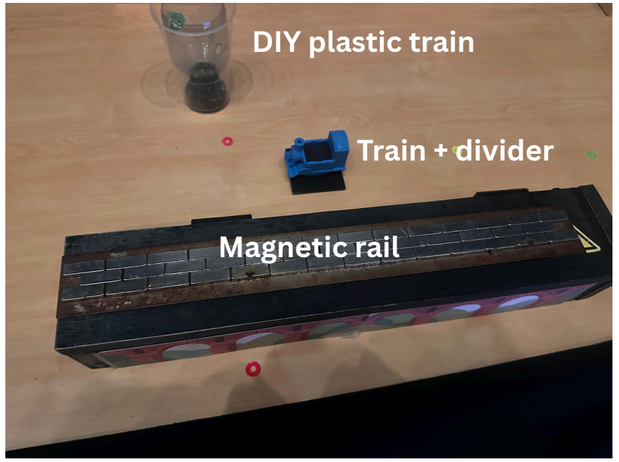


Steel (non-magnetic) balls

Copper + plexiglass + fluorescent tube



Nitrile gloves	Alternative method for handling the superconductor safely.
LHC superconducting cable prop	NbTi - Niobium Titanium prop showing the type of superconducting cable used at CERN.
levitating train	Demonstrates superconducting levitation over a magnetic track. 3D printed train containing YBCO superconductor.
train plastic divider	Separates the rail from the train while cooling. Removed once superconducting state is reached.
DIY plastic train	Alternative homemade train using plastic bottle and a YBCO superconductor at the bottom.
Magnetic rail	Track made of magnets for the levitating train. When not in used, stored in a wooden box for safety.
Small tweezers and loop tool	Handle the cold YBCO disc, magnets and spacer without touching them directly.
Magnets box	Magnets for the levitating experiment (disc, square and genie) and a magnetic ball for the Eddy current experiment. When not in use, stored in the box for safety.
Plasma ball	Produces plasma using high voltage for the plasma demonstration.
Safety goggles	Required whenever liquid nitrogen is handled.
Cryogenic safety gloves	Required when transferring or handling large amount of liquid nitrogen.



Small plasma ball



Levitating demo magnet box + Magnetic ball



LHC superconducting cable prop

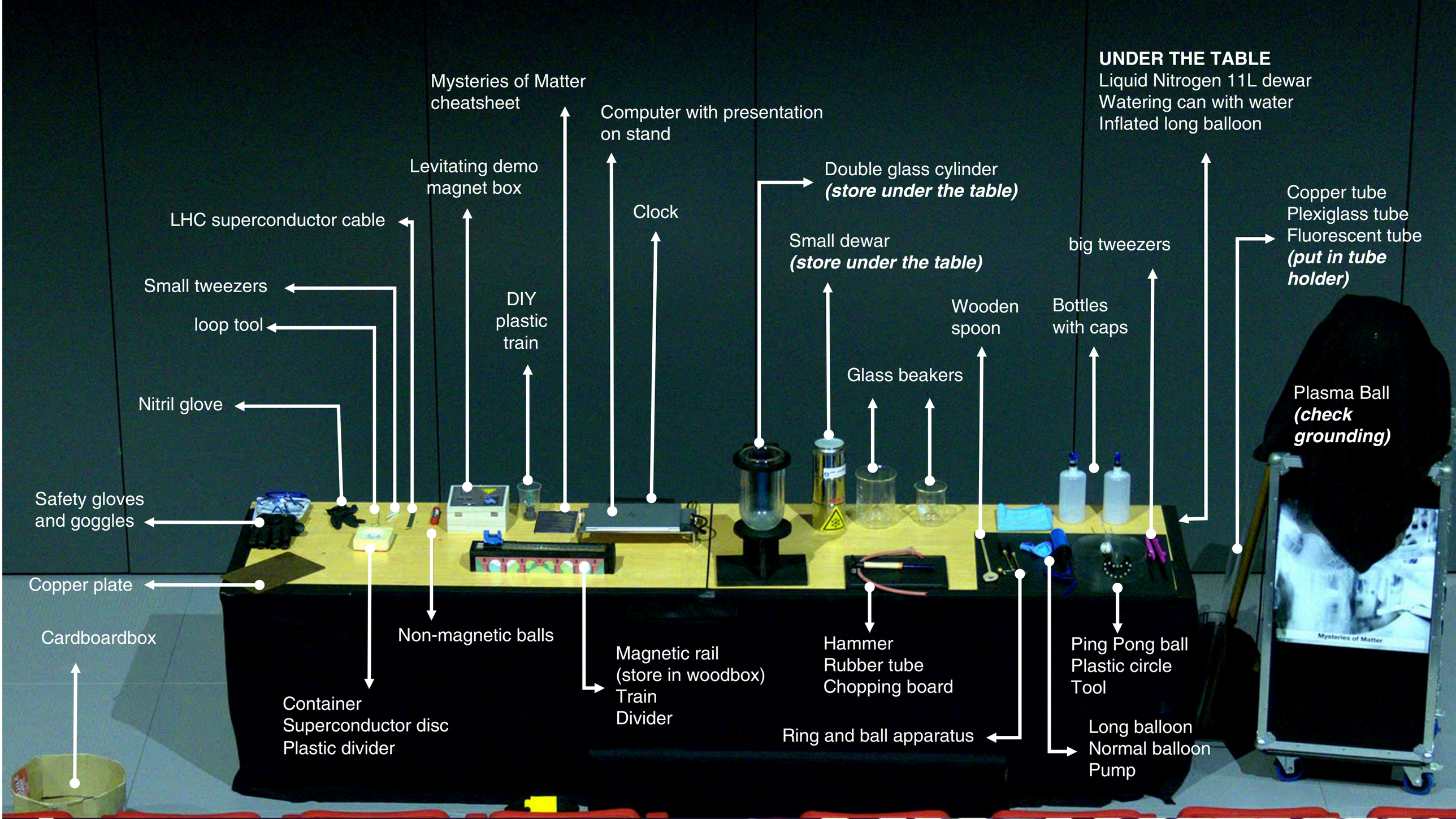


Plastic tweezers

loop tool

Cryogenic safety gloves




Mysteries of Matter cheatsheet
Computer with presentation on stand
Levitating demo magnet box
Clock
LHC superconductor cable
Double glass cylinder
(store under the table)
Small dewar
(store under the table)
Small tweezers
DIY plastic train
loop tool
Wooden spoon
Bottles with caps
Glass beakers
Nitril glove
Safety gloves and goggles
Copper plate
Cardboardbox
Non-magnetic balls
Container
Superconductor disc
Plastic divider
Magnetic rail
(store in woodbox)
Train
Divider
Hammer
Rubber tube
Chopping board
Ring and ball apparatus
Ping Pong ball
Plastic circle
Tool
Long balloon
Normal balloon
Pump
UNDER THE TABLE
Liquid Nitrogen 11L dewar
Watering can with water
Inflated long balloon
big tweezers
Copper tube
Plexiglass tube
Fluorescent tube
(put in tube holder)
Plasma Ball
(check grounding)
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