

Experiments with the beams - laser sandbox

Art meets Physics: colorful lasers, rotating mirrors, prisms, reflections, fog, electric motors.

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Youtube live demo <https://www.youtube.com/watch?v=uClSWyfejEU>



Press Media



<http://www.baltanakts.lv/2015/lv/program>
http://www.vecumniekumms.lv/?page_id=51



<http://www.1br.lv/kulturas-forumu-balta-nakts-apmeklejusi-apmeram-40-tukstosi-cilveku-fotoreportaza/>

Physics

This interactive artwork was demonstrated to about 2000 visitors during two events.

Art people need to be good in physics to know about different effects that they can use in their designs!

This artwork allows to repeat physics about mirrors that the angle of reflection equals the angle of incidence. Mechanical analogy is a billiard table. Rotating mounts in some way resemble roulette in a casino as one can not predict where exactly they will stop.



Putting on red goggles can see only red beam and not the green and blue because red plastic acts like a filter and allows only red color to pass while absorbing other colors.

Beams become wider as ordinary mirrors are used with metal behind the glass and there are weaker reflections from glass surface too.



Mirrors and prisms

Box 90 x 90 cm was made of 9 mm plywood, height 30 cm. Under the base plate is space for motors and connections.

Rotating mirrors are broken to desired dimension using a diamond scorer. Mirrors are fixed using hot glue. Mirrors are aligned slightly pointing downwards to avoid beam climbing out of the box.

Plane mirrors were cut in a glass shop and glued to the Inner sides of the box. For eye safety a 5 cm wide Black Tesa film stripe is glued around the inside perimeter of the box. This stripe could be twice wider for better eye safety.

Two polished glass prisms were ordered on Ebay. They change the directions of the beams in an interesting way.



Lasers

Red and green lasers are taken from 14 USD laser projector on Ebay. Red laser is 50 mW and green is 20 mW. NOT EYESAFE!!! Laser show comes with a 5 V power supply. It was necessary to alter electrical connections. Projector box was glued below the baseplate. Blue laser pointer was bought on Ebay and supplied from 5V USB phone charger via a 3.3V DC regulator board also bought on Ebay.

Film polarizer put on each laser output to reduce laser intensity for eye safety. For convenient adjustment the polariser is placed in a suitable aluminum electrolytic capacitor can with a drilled hole.



Below is a photo of mains connections. All setup is activated by flipping the red switch. Adjustable power supply is set to 24V for driving the fog generator.



Electro-mechanical

Regular cheap DC 12 V motors are used 24 mm in diameter. Holes in a 9 mm thick plywood plate are drilled 25 mm in diameter. Motors are fixed using hot glue.

Wooden disks are cut out of same kind of 9 mm plywood using a jig saw and sanded using sandpaper. Disks have a centre hole for motor shaft and are also fixed to the shaft using hot glue. Direct connection of the motors shaft to the wooden plate is OK. As the wooden plates are large it takes several seconds to spin the up a time long enough to be controlled by the pushbutton.

Keyboard is made using 16 pushbuttons. You can see wiring in the pictures. 1 A switching power supply is used to drive the motors. Voltage necessary is chosen experimentally. Typically 5-7V.

Many motors can be operated simultaneously, but not for a long time, as mirrors spin too quickly and can break off (actually mirrors had no problems, only the prisms, as they are heavier).

This is like a roulette in casino, but not exactly, as permanent magnets in motors make preferred angles where the rotor will stop.



Smoke or fog

Beams need to be visualized in a smoke or fog. Without smoke one can just see spots where the beams hit surfaces. Best results were obtained with a fog from dry ice (solid CO_2) in water.

Electrical smoke machine produced smoke that raised up and polluted air. Probably one can make own small smoke machine using hot iron and glycerine dropping on it (search Youtube).

We devised a simple water fog machine using ultrasonic piezo moisturiser from Ebay, a fan and a flexible pipe. Disadvantage is that the wooden box got wet as we ran demonstration for 6 hours continuously. Piezo element is driven from 24V and the fan from 9V. Fan pushes air into the jar. A piece of paper can block the air intake and allow to dose the smoke.

