STEMBOT

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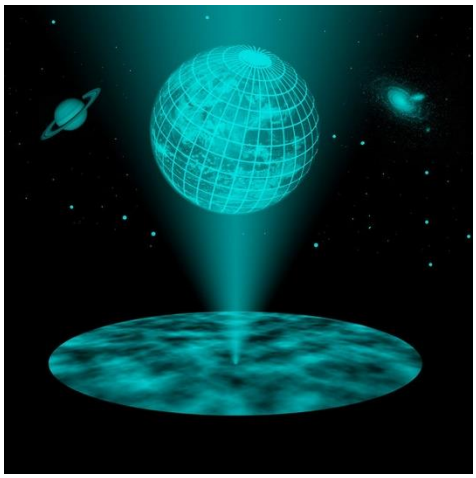
Apparition



Key words

- Physics
- Light
- Reflection
- Hologram

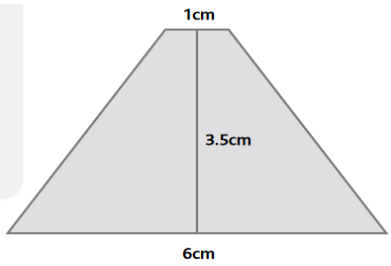
The science behind

Introduction

In the video tutorial, you will learn to create your own hologram using light reflection and your smartphone.

First, you will create a template made of 4 identical trapezes of 6cm by 3.5cm by 1cm each. (See below)

Then, duplicate the template onto clear plastic, and cut each element. Taping them together with clear tape, you will get a 3D shape with a small hole at the bottom and a big opening. Place your creation in the middle of your phone and press Play! The light reflecting from the phone will go through the clear plastic pieces, which act as mirrors and reflect the image on each side, creating a 3D Hologram.



Light reflection

Light reflection is a **physical phenomenon** related to the direction of light propagation. It occurs when light meets a surface (glass, for example) and what is commonly known as the 'bounce' of the light beam occurs.

We are surrounded by infinite rays of light that constantly collide with objects!

To understand the reflection of light, three elements are considered:

1) the **incident ray,** which is the ray that reaches the reflecting surface.

2) the **reflected ray**, which is the ray that 'exits' or bounces off the reflective surface.

3) the **regular line** is an imaginary line perpendicular to the surface drawn from the point where the incident and reflected rays meet.

Thanks to the reflection of light, we perceive the shapes and colours of our environment, as the reflection of light on surfaces allows the illumination of spaces so that we can distinguish our surroundings.

Hologram

The term **hologram** is generally used to identify three-dimensional images, i.e. those that appear with different perspectives depending on the point of observation. Holograms make it possible to reproduce a previously recorded image with considerable precision.

- During the recording process, a beam of laser light is sent either towards the object to be reproduced or towards a sheet of sensitive material (in this case, plastic acrylic).
- Thanks to an interplay of mirrors, the light arriving from the source interferes with the light reflected from the object.
- Lines, called interference fringes, are then formed on the plate. The frames contain information about three-dimensionality.

By illuminating the plate with another laser beam, the information is decoded, and the three-dimensional image of the object is reconstructed, which finally appears to the viewer as if it were physically present.

In other words, in order to produce an accurate visualization of a hologram at a certain point in space, two light waves must be coordinated in motion - a reference wave and an object wave. Both are formed by separating the laser beam.

The reference wave is created directly by the light source, and the object wave is reflected from the recorded object. There is also a photographic plate on which dark stripes are "imprinted" depending on the distribution of electromagnetic energy (interference) in a given place.

To reproduce a "portrait", the photographic plate has to be "illuminated" with another light wave in close proximity to the reference wave, which converts both waves into a new wave of light that runs alongside the object wave. The result is an almost entirely accurate reflection of the object itself.

Everyday life

Light reflection on everyday items

- Looking at the light reflection on a pool, lake or body of water

Reflection off of smooth surfaces, such as a calm body of water, leads to a type of reflection known as **specular reflection**. Specular reflection occurs when light rays come from only one direction, fall on the surface and are reflected in only one outgoing order.

When the sun is high in the sky, during the day, the bodies of water appear bright and evenly lit. You will not usually see patterns of light forming on the water's surface. However, around sunrise and sunset, you will notice that the sun reflects off the water and seems to start a kind of illuminated path on the water's surface. Even if you throw a stone into the water, a quick ripple will create a sparkling effect on the surface. This is known as sun glitter. There are two main reasons behind this: firstly, water behaves like a smooth surface on a macroscopic scale when reflecting sunlight. A rippled - but locally smooth - surface will reflect the sun at different angles, creating other observable images of the sun.

- Disturbance of reflection with waves (rocks in a pool)

Throw a rock into the pool, and the water is perturbed to form waves, which disrupt the reflection by scattering the reflected light rays in all directions.

Holograms

Holograms or **3D holographic** projections are high-definition projections that simulate **3D** making a real object indistinguishable from one in video reproduction, all without glasses. It is possible to represent both people and objects of any type and size through holograms. It is also possible to have an interaction between real people and holograms so that on stage, at the same time, there can be a flesh and blood interlocutor and a **3D holographic projection** of him, two indistinguishable figures capable of shaking the certainties of the people present.

The term **hologram** has been introduced in numerous science fiction films. Star Trek's 'Holodeck' was a pivotal moment in which the idea of the hologram became established in the collective imagination. This cinematic metaphor, followed by countless other similar hologram scenes, depicts the personification of a virtual figure in a real space in a film. Among the most famous holographic locations are the dashboard of Minority Report and the overlays of Iron Man. In particular, the entire special effects department, the **'compositing'** overlays images created with three-dimensional technology on video footage.

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