WHAT IS HOLOGRAPHY?

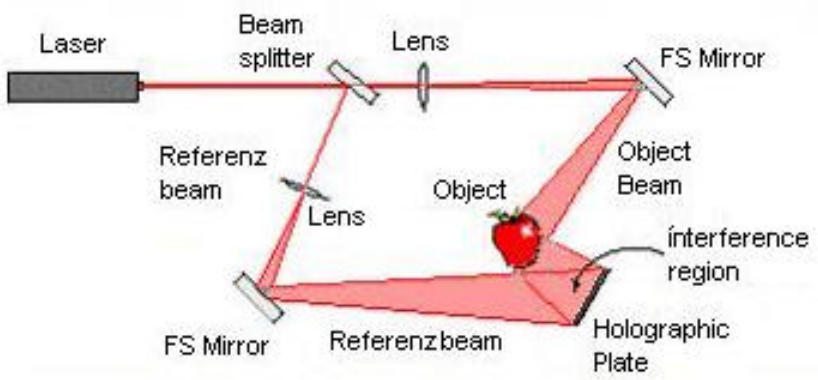

Diagram 1

What is a hologram?

It is a light wave interference pattern recorded on photographic film (or other suitable surface) that can produce a 3-dimensional image when illuminated properly.

How is a hologram made?

A laser beam is **split** into two beams: {see diagram above}
The **reference beam** is spread by a lens or curved mirror and aimed **directly at the film plate**
The **object beam** is spread and aimed at the object. The object reflects some of the light on the holographic film-plate. The two beams interact forming an interference pattern on the film. This is the hologram. Laser light is needed because it is made of coherent waves (of same wavelength and phase). The principle of holography was discovered in Britain by Dennis Gabor in 1948. He was awarded the Nobel price for this discovery in the early 70's.

How is a hologram viewed?

When the hologram is illuminated **from the original direction of the reference beam**, a 3-dimensional image of the object appears where the object was originally. Some holograms must be viewed with laser or monochromatic (single color) light, and others with white light.

What are the main types of holograms?

Transmission Holograms:
Viewable with laser light. They are made with both beams approaching the film from the SAME side.

Reflection (White Light) Holograms:
Viewable with white light from a suitable source such as spotlight, flashlight, the sun, etc. They are made with the two beams approaching the holographic film from OPPOSITE sides.

Multiple channel holograms:
Two or more images are visible from different angles. There are different types of multiple channel holograms:

- Simple ones with 2, 3, or a few images each viewed from a different angle.
- Multiplex: A large number of "flat" pictures of a subject viewed from different angles are combined into a single, 3-dimensional image of the object. A COMPOSED hologram.
- Rainbow holograms: The same image appears in a different color when viewed from different angles.

Real Image Holograms (H-2's)
These are usually reflection holograms made from a transmission original (H-1). The image dramatically projects *IN FRONT OF THE PLATE* toward the viewer. Most holograms in holography museums are of this type. The procedure for making them is quite elaborate and demands precise control of angles.

Mass-Produced Holograms
Embossed--Made by stamping on foiled backed mylar film using a metal master (most common method).

- Polymer--Made from light sensitive plastic. The Polaroid Corporation mass produces holograms by this method.
- Dichromates--Very vivid holograms on jewelry, watches, etc. They are recorded on a light sensitive coating of gel that contains dichromate.

What are some applications of holography?

Holographic Art
Holography museums, advertising, postage stamps, jewelry, etc.

Security from Forgery
Credit cards, tickets, etc.

Optical Devices
Holographic lenses, diffraction gratings, etc.These are holograms in which the "object" is a mirror or a lens.A flat mirror as an object produces a diffraction grating. A lensor a concave mirror as the object produce a hologram that behaves LIKE A LENS! These HOLOGRAPHIC LENSES are lighter than traditional lenses and mirrors and they can be designed to perform more specialized functions such as making the panel instruments of a car visible in the windshield for enhanced safety.

Holographic Interferometry
A very precise technique for measuring changes in the dimensions of an object. Useful in industrial stress analysis, quality controll, etc.

Pattern Recognition
Using electro-optical devices with computers to interpret what is "seen" by a machine. Peace-time and military application of lasers and holographic optical devices.

Medical Applications
Combining CAT scans into a 3-dimensional image, A multiplex. Ultraound holography, etc.

Other
Holographic computer memory storage, holographic microscopy, holographic radar, etc.