

# *Basic Principles of Holography*

**Optical Engineering**

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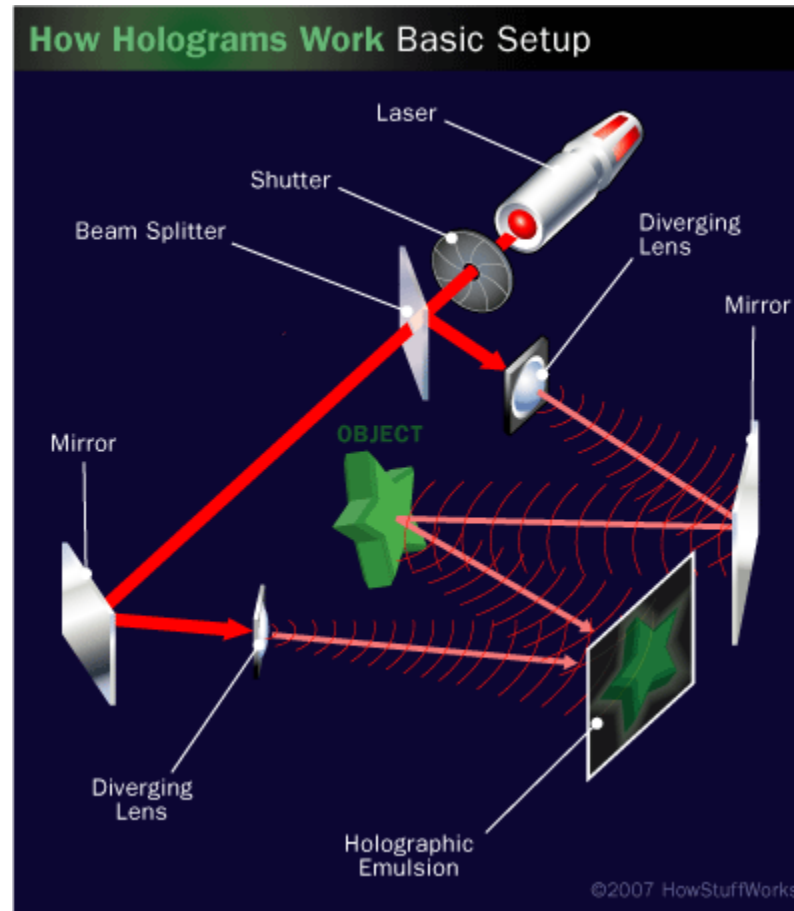
# Holography

**Holography** - is the process of capturing three-dimensional images by recording patterns of light waves. These recorded holograms are viewed by re-exposing the developed film to light in order to recreate the pattern of light recorded. When viewing a hologram, the original object appears to be floating in space, and it retains its properties of perspective. That is to say, the observer is able to see the object from different angles as his frame of reference changes, just as would be seen with a "real" object. This attribute can likely be associated with holograms essentially consisting of light.



Holography was first developed by **Dennis Gabor**, a British scientist native to Hungary, in **1947**. Gabor later received the **Nobel Prize** for his work in **1971**.

# Basic Hologram Recording Setup

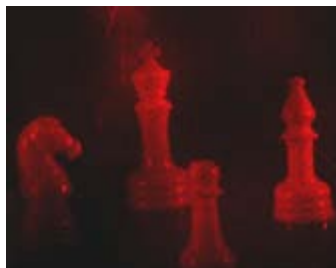
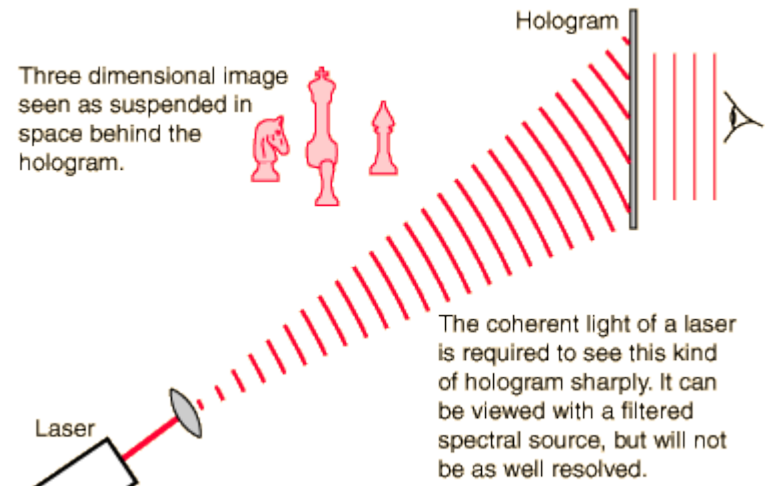
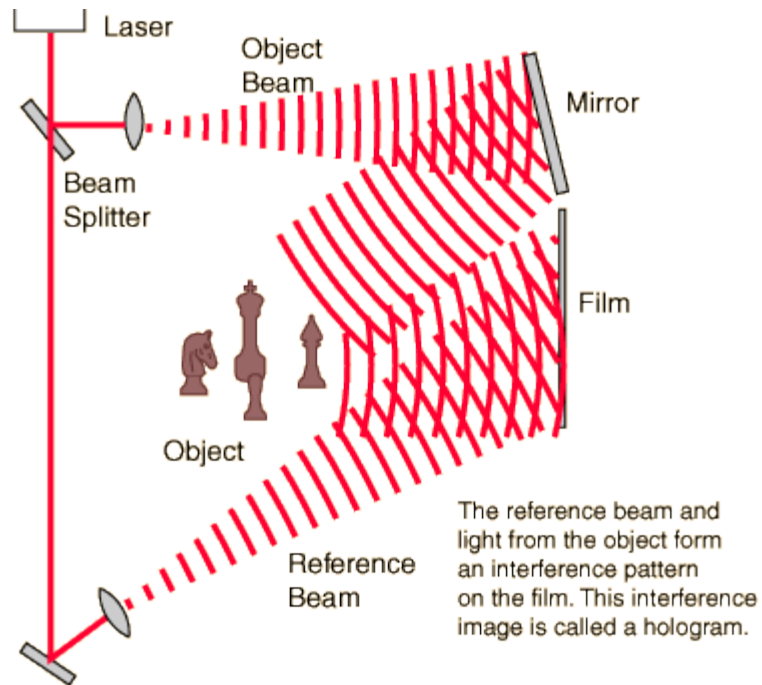


<https://science.howstuffworks.com/hologram1.htm>

# Holograms Types

- **Transmission holograms**, use lasers and the light source is shined *through* the hologram towards the observer.
- **Reflection holograms**, use a light source (typically white light) from the same side as the viewer.
- **Embossed holograms**, are the ones you typically see on credit cards. The interference pattern is recorded onto a metal stamp and then imprinted on cheap foil.
- **Computer holograms**. Using mathematical models, the interference pattern on the hologram is calculated by a computer.
- **Rainbow holograms**, the same image appears in different colors when viewed at different angles

# Transmission Hologram



# Transmission Hologram

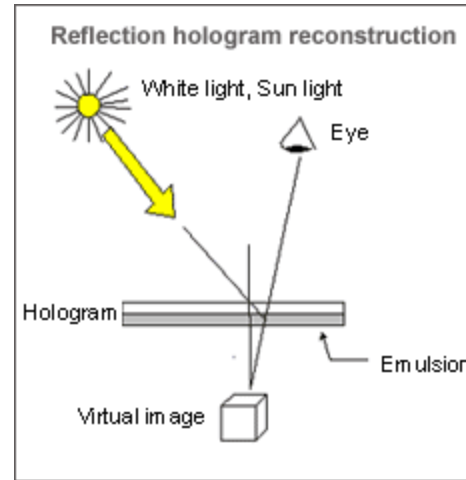
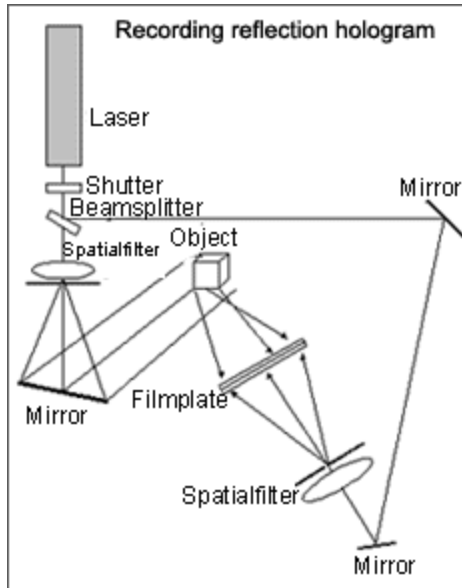


A huge Sea turtle in 2 different views surrounded by fishes  
Format: 40" x 32" (102 x 81cm), 2 color, 2 channel transmission  
hologram  
Mastering: Dr. John Perry, thanks to friendly support of Holographics  
North Inc.

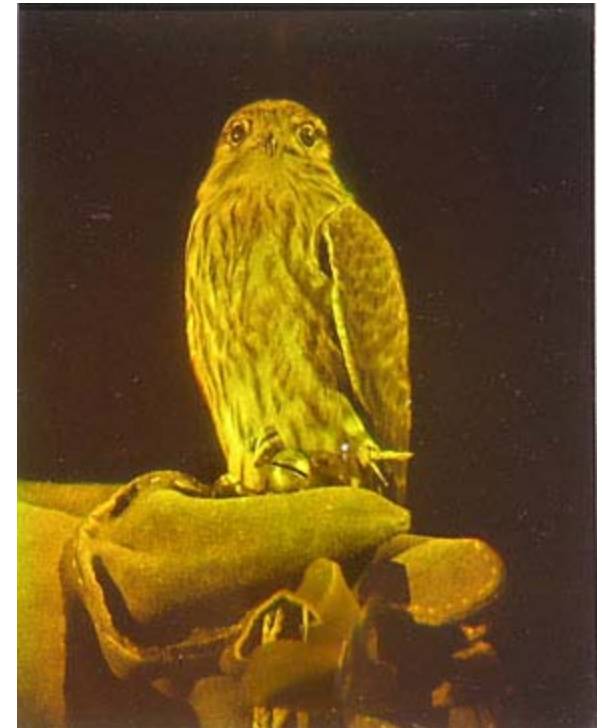


Pegasus, Transmission Hologram

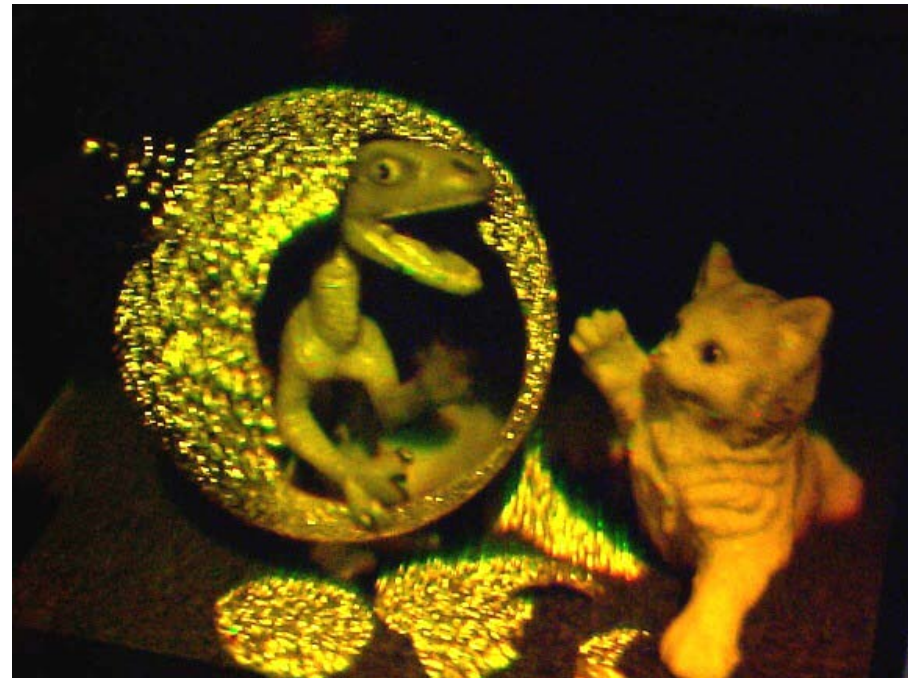
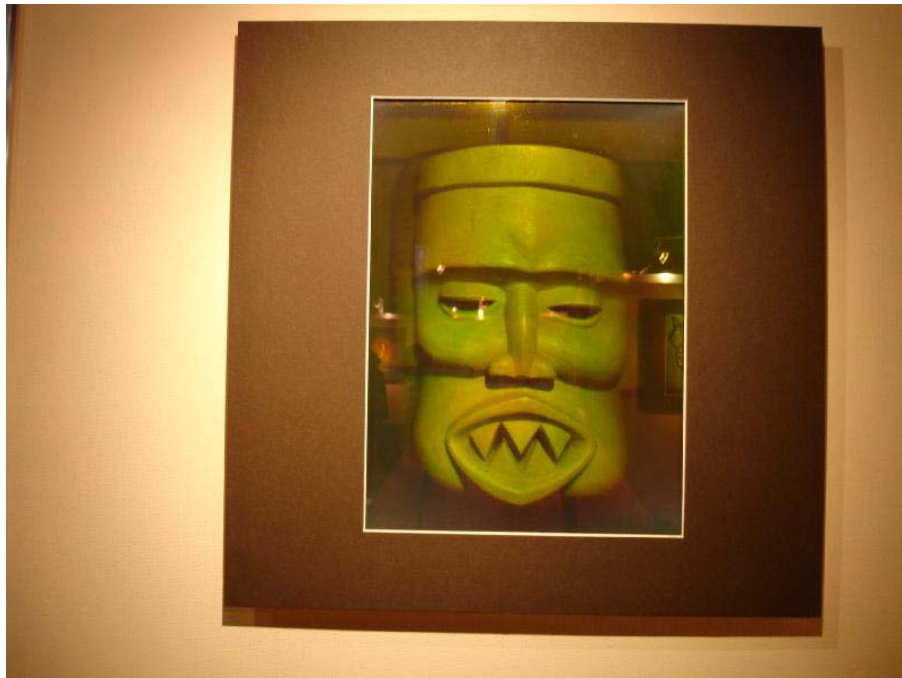
# Reflection Hologram



**HAWK** Reflection hologram on film (10" x 8")

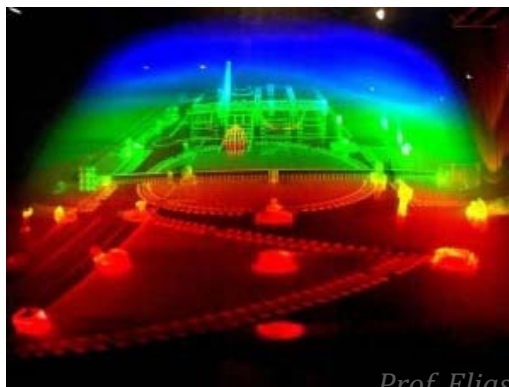
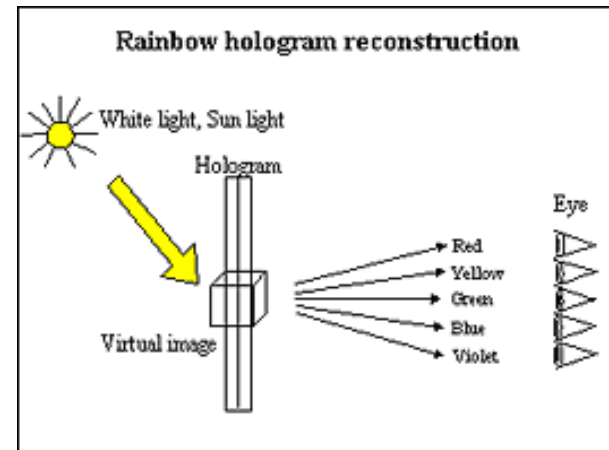
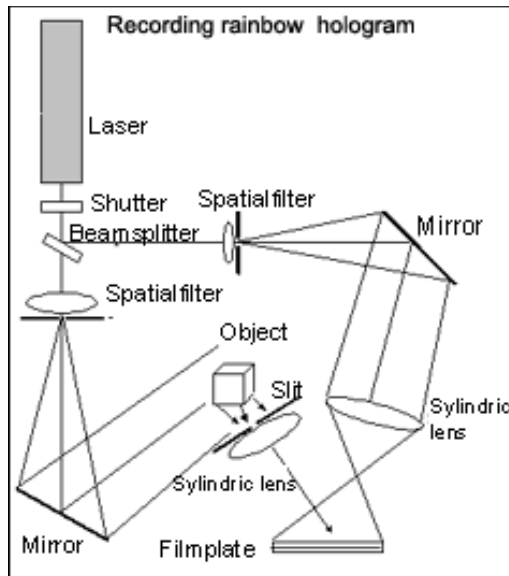


# Reflection Holograms





# Rainbow Hologram



# Rainbow Holograms

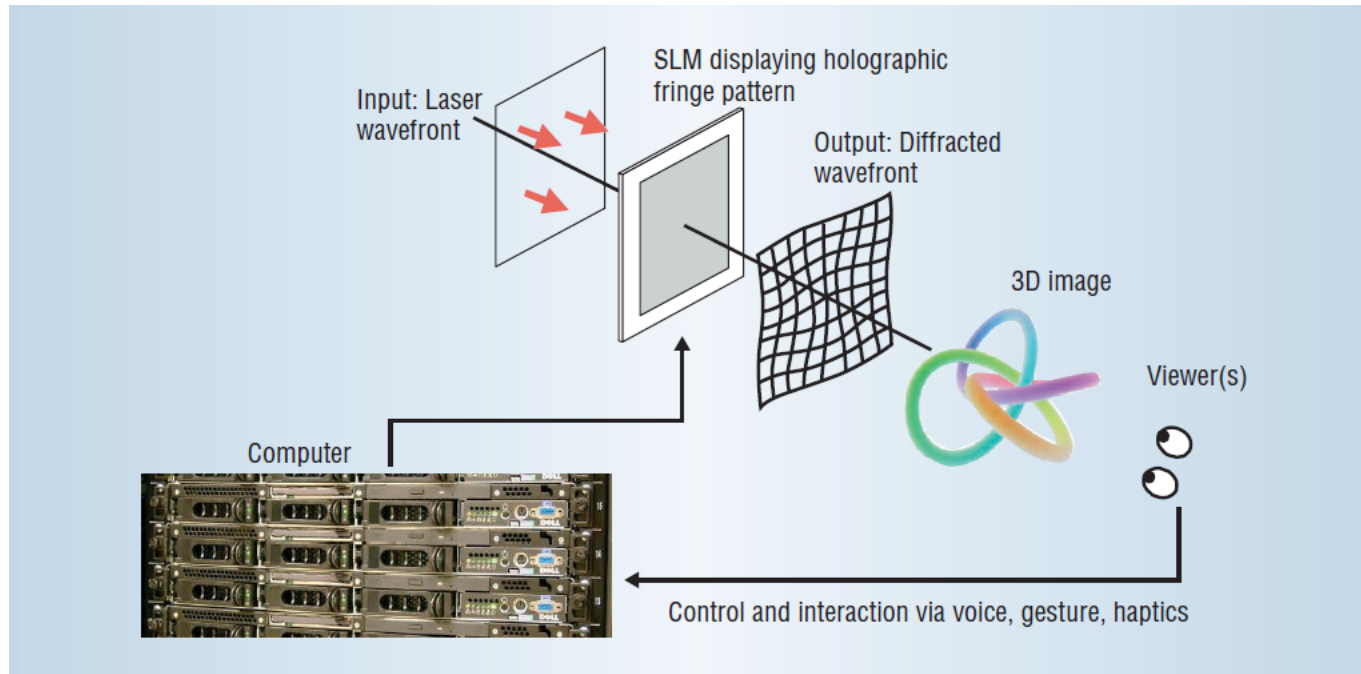


Bread basket  
50x35 cm, Rainbow Type



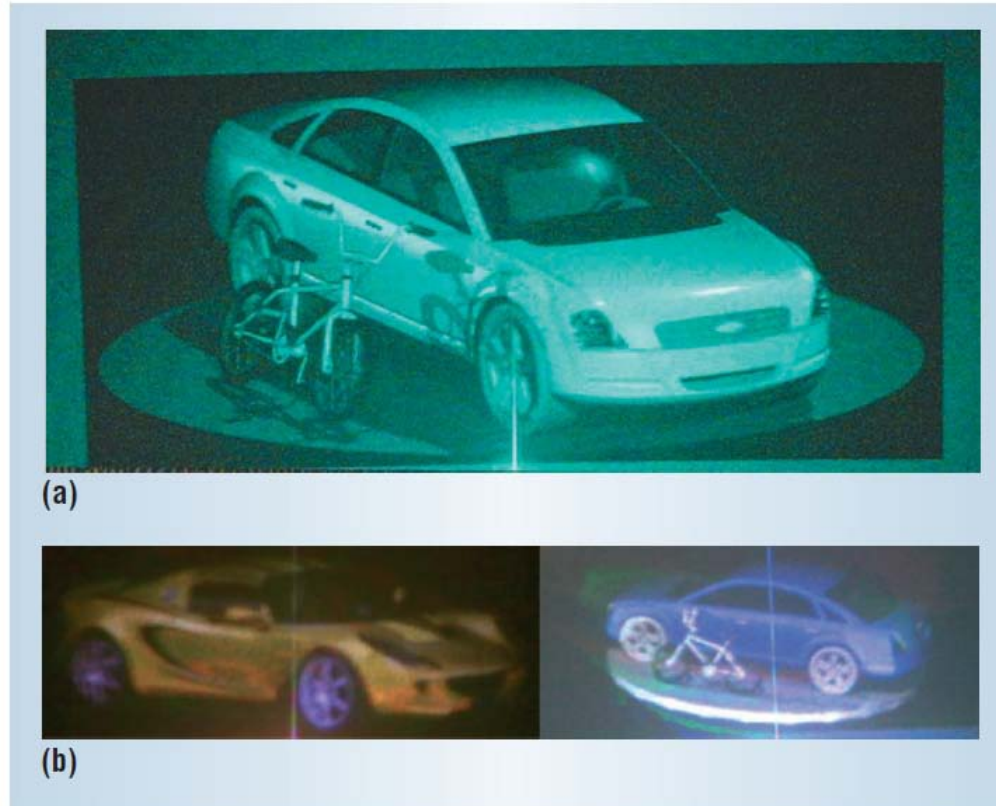
Ship Rainbow Hologram .. First hologram made at JonBrodels holography studio .. Model constructed by 19th century Napolianic prisoners of war ~ Courtesy of Royal Greenwich Maritime Museum 1981 ~ Kodak Ship Hologram Commissioned by Kodak for 1st Prize in their international photography competition. ~ An early example of the reflection type rainbow hologram. ~ 10"x 8" mirror-backed white light transmission hologram. ~ Card holograms are a later

# Computer Generated Hologram



A computer calculates a holographic fringe pattern for display by the spatial light modulator (SLM), which diffracts laser light to yield an interactive, true 3D image.

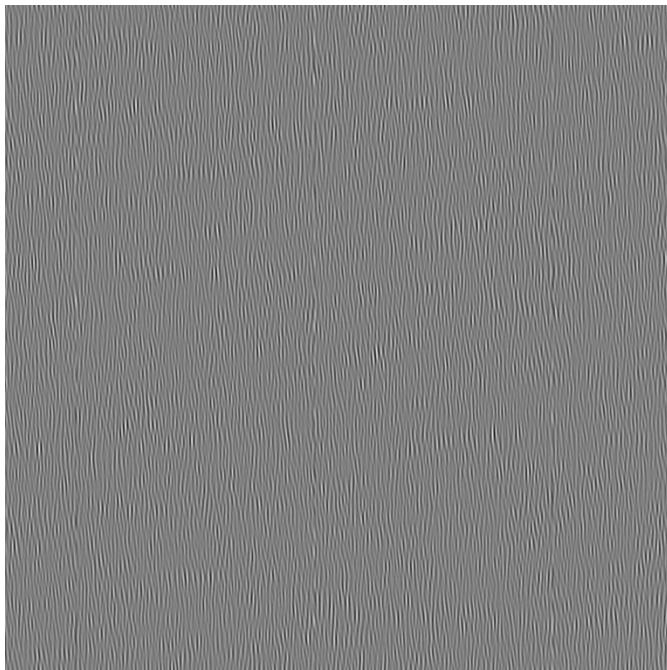
# Computer Generated Hologram



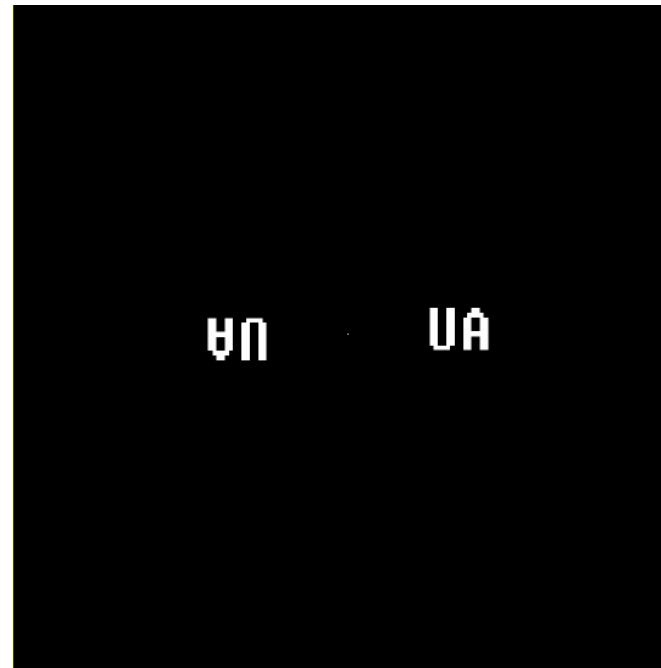
**Computer-generated holograms. (a) Monochromatic and (b) color, full parallax, 3D image produced by the 10 8 pixel Active Tiling system.**

# Computer Generated Hologram

Computer Generated Hologram

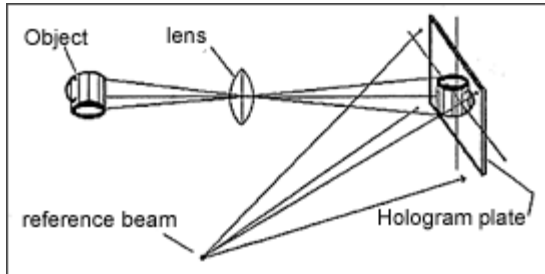


Reconstruction

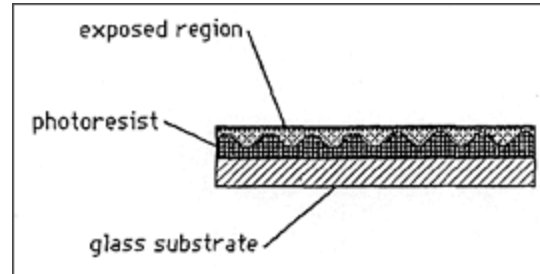


# Embossed Holograms

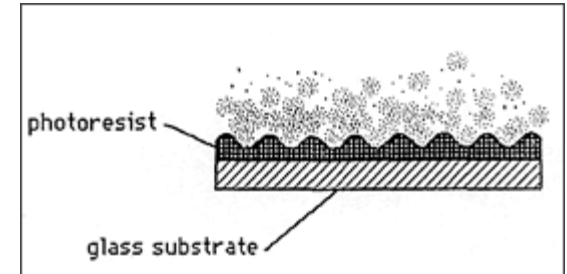
## Forming a Hologram



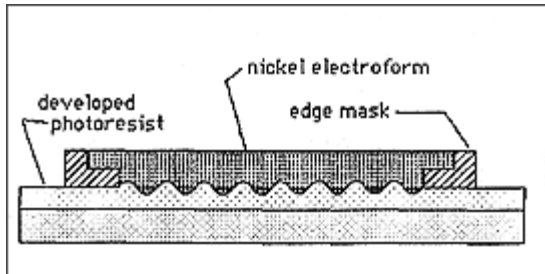
## Exposed Photoresist Plate



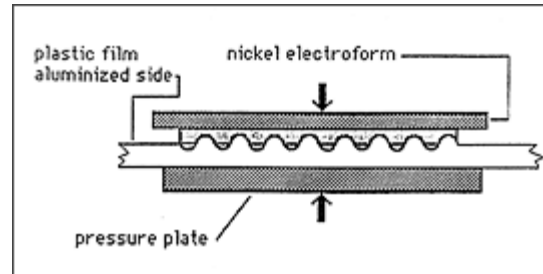
## Development of Photoresist



## Nickel Electroforming



## Embossing a Hologram



# Embossed Holograms

