HOLOGRAPHY

What is a Hologram?

It is an advanced form of photography that allows an image to be recorded in three dimensions.

-While standard photography records colour and intensity information, a hologram encodes phase and intensity.

-A Holographic Image is created using a coherent light source to create an interference pattern on a film or plate.

-When reconstructed, an observer can view a virtual image beyond the film that contains all possible perspectives of the object that available according to the placement of the film.

Holography: Means

- **It is an advanced form of photography that allows an image to be recorded in three dimensions.**
- **The technique of holography can also be used to optically store, retrieve, and process information.**

History of Holography

- **Invented in 1948 by Dennis Gabor for use in electron microscopy, before the invention of the laser**
- **Leith and Upatnieks (1962) applied laser light to holography.**

Conventional vs. Holographic photography

- **Conventional:**
  - **2-d version of a 3-d scene**
  - **Photograph lacks depth perception**
  - **Film sensitive only to radiant energy**
  - **Phase relation (i.e. interference) are lost**

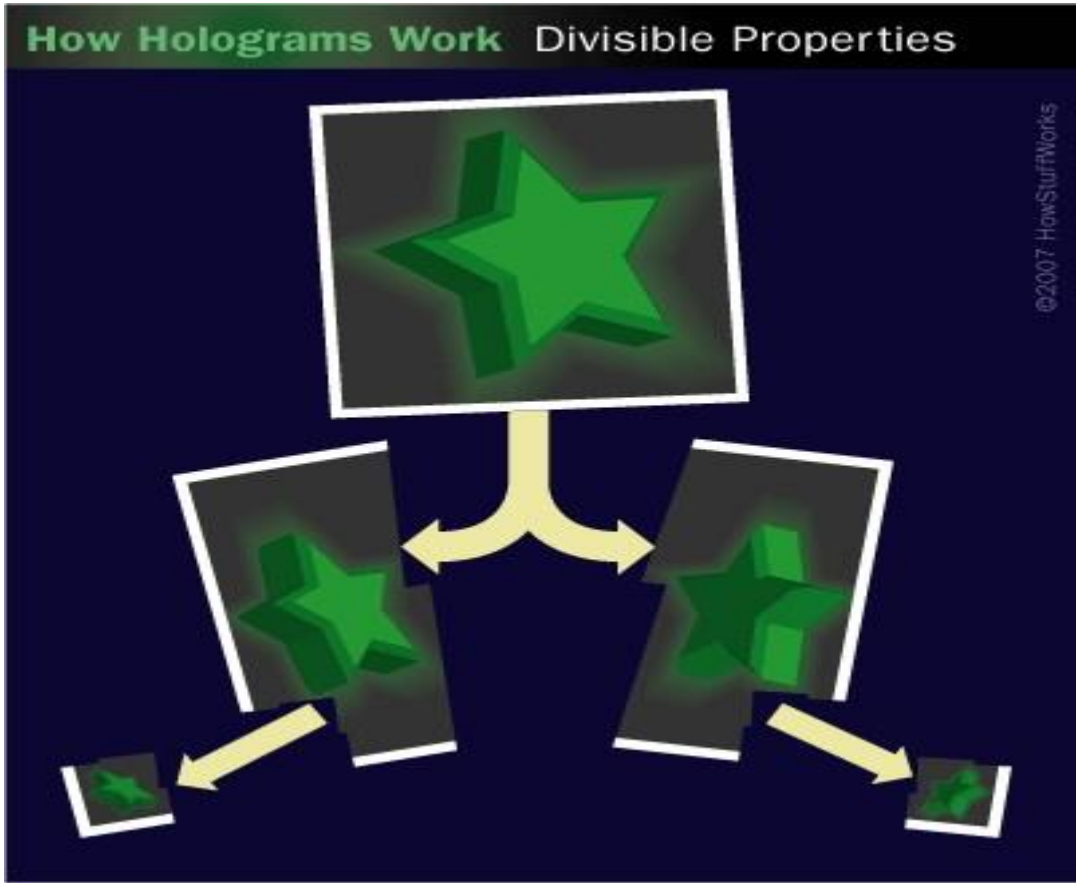
Conventional vs. Holographic photography

- Hologram:
- **Freezes the intricate wavefront of light that carries all the visual information of the scene**
- **To view a hologram, the wavefront is reconstructed**
- **View what we would have seen if present at the original scene through the window defined by the hologram**
- **Provides depth perception**

Hologram properties

- **If you look at these holograms from different angles, you see objects from different perspectives, just like you would if you were looking at a real object**
- **They usually just look like sparkly pictures or smears of color**
- **If you cut one in half, each half contains whole views of the entire holographic image.**

Hologram properties



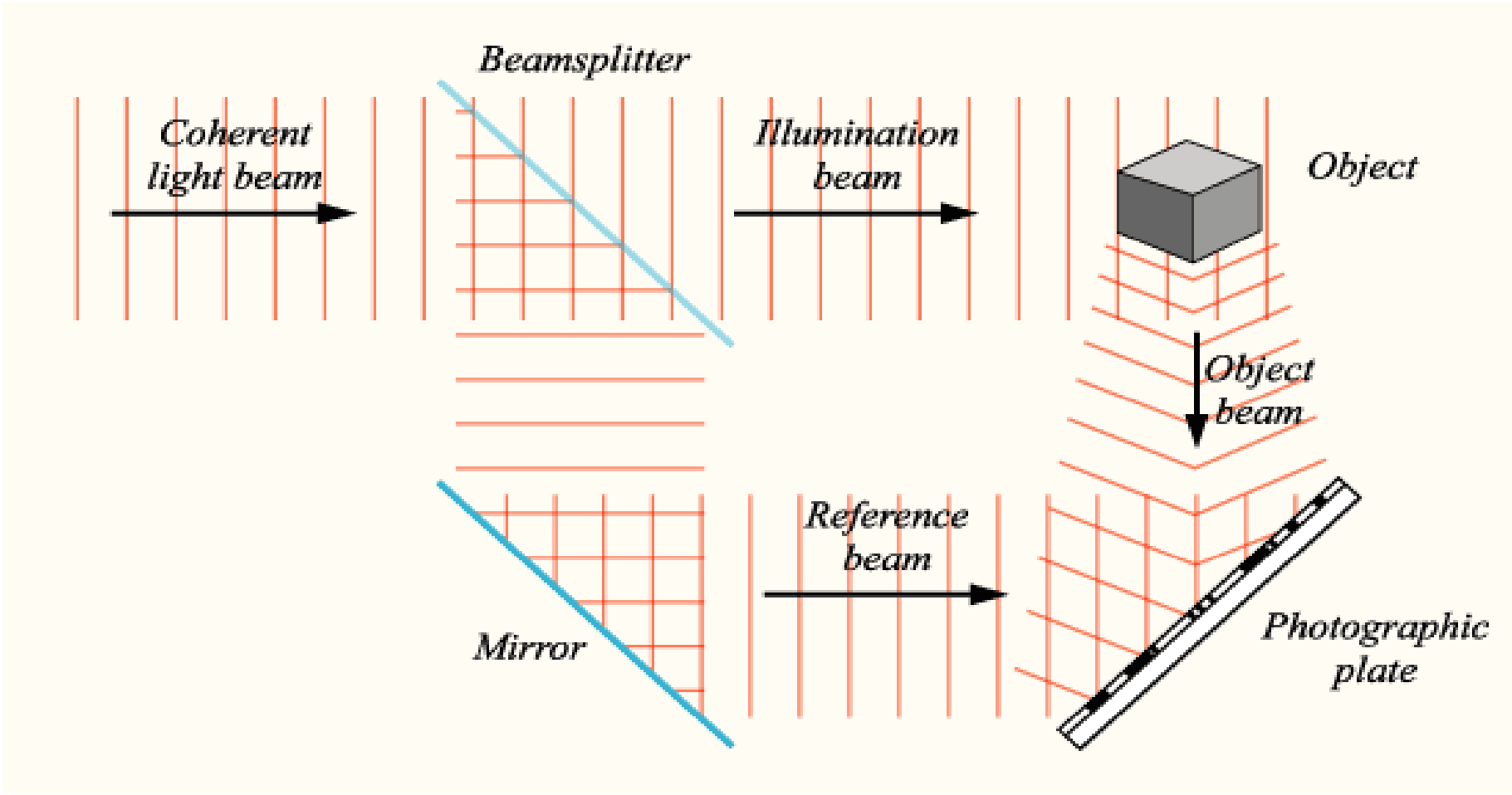
Hologram construction

- **Laser : Red lasers, usually helium-neon (HeNe) lasers, are common in holography**
- **Beam splitter: This is a device that uses mirrors and prisms to split one beam of light into two beams.**
- **Mirrors: These direct the beams of light to the correct locations.**

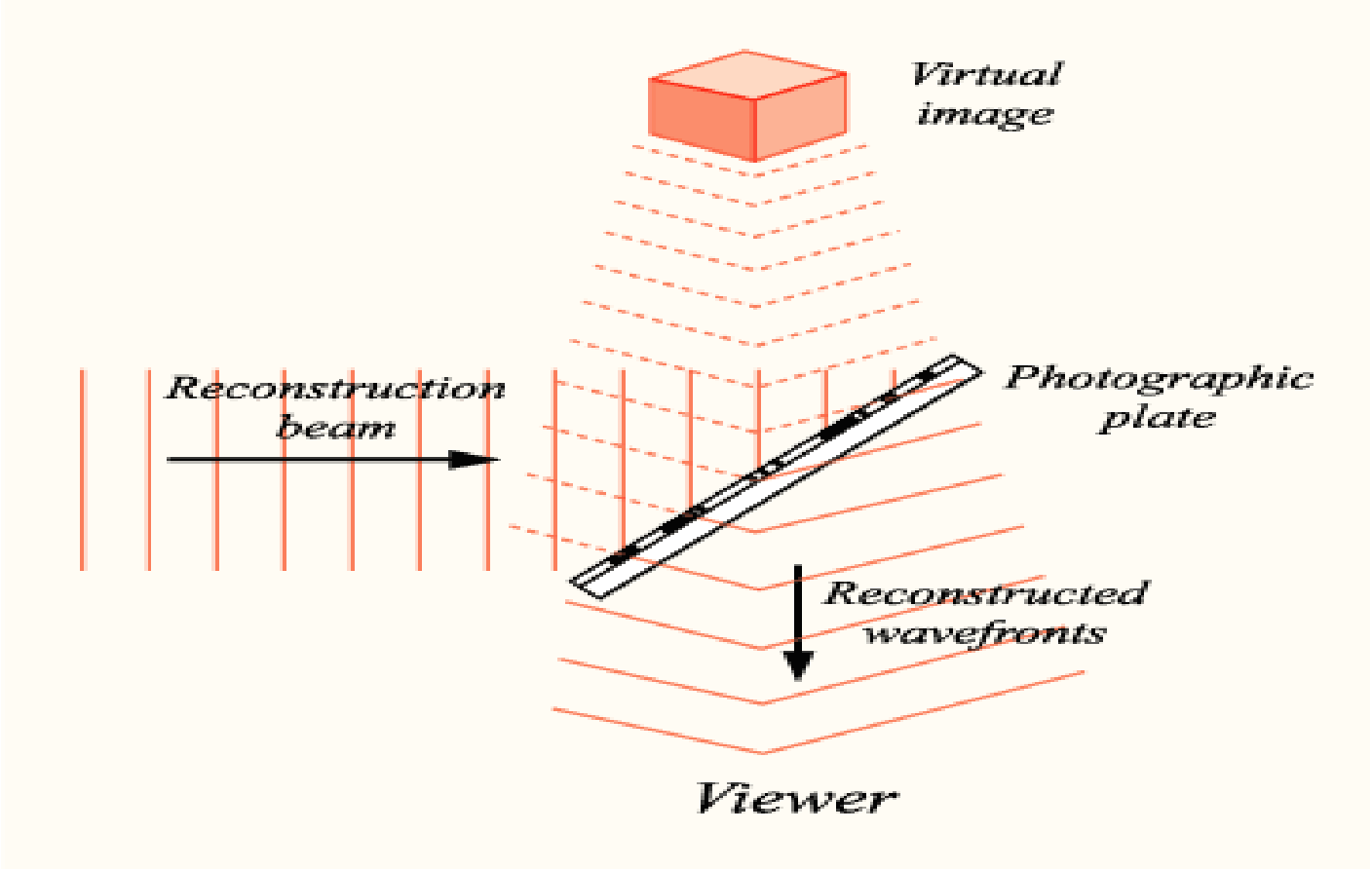
Hologram construction

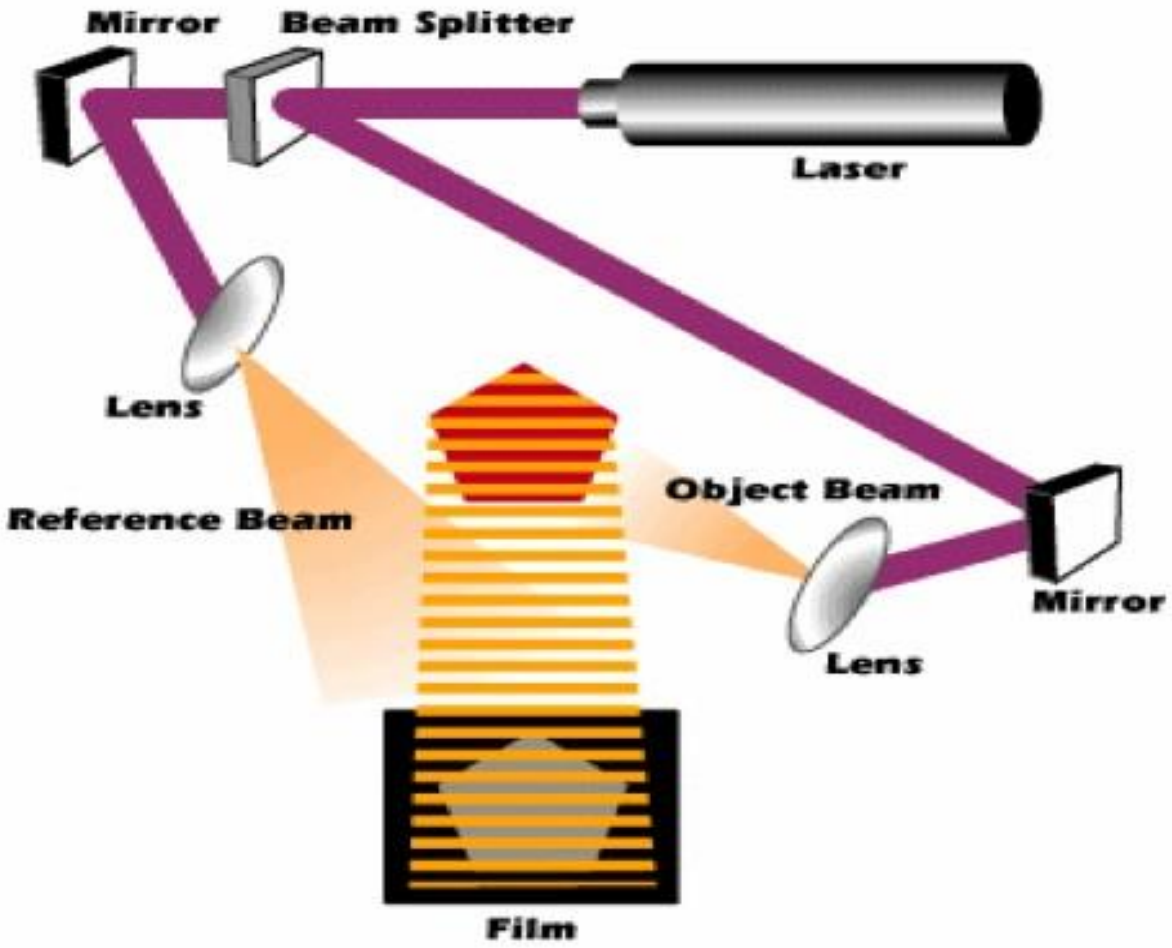
- **Holographic film: Holographic film can record light at a very high resolution, which is necessary for creating a hologram. It's a layer of light-sensitive compounds on a transparent surface, like photographic film.**

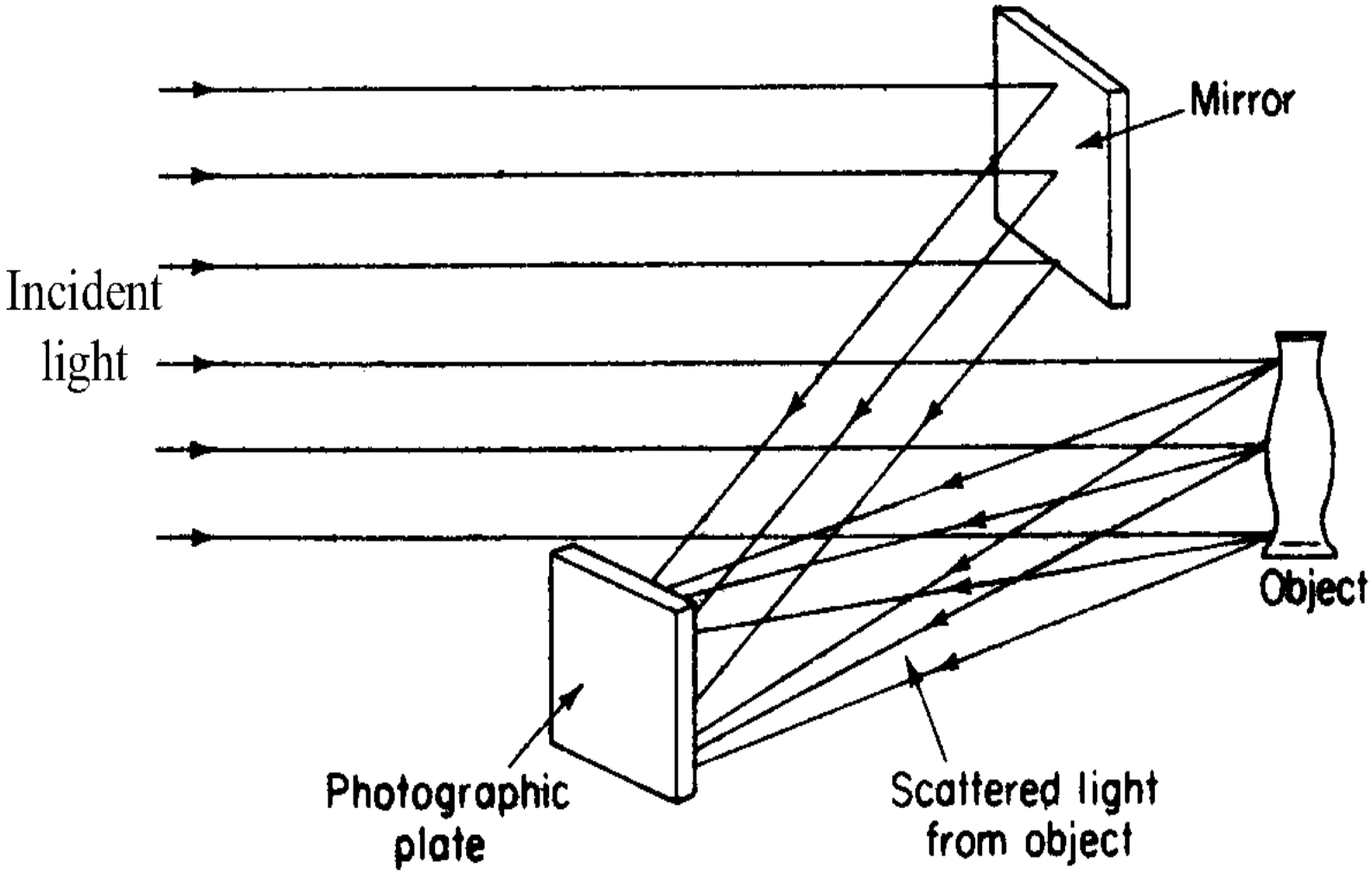
Hologram working



Hologram reconstruction




Mirror
Beam Splitter
Laser
Lens
Reference Beam
Object Beam
Mirror
Lens
Film


Mirror
Incident
light
Object
Photographic
plate
Scattered light
from object

Types of Holograms

-Transmission Holograms: **Use two beams to create the interference pattern recorded on the film.**

- **A beam splitter divides the laser beam into two parts. One becomes the reference beam and the other, the object beam.**
- **The reference beam needs only go to the film.**
- **The object beam passes reflects off of the object before hitting the film.**

-Reflection Holograms: **Place the film between the light source and the object, thus effectively creating two light sources, and an interference pattern.**

Advantages/Disadvantages

-Transmission Holograms: **They take up more space, require more equipment, and require more adjustments and fine tuning to acquire a good hologram. However, the freedom to adjust many more parameters in a transmission hologram makes them a more powerful tool.**

-Reflection Holograms: **These are much simpler to create, and require little setup and equipment. They are limited in their ability to change relative intensities, and require transparent film. Plates will not work for reflection holograms.**

Hologram: Some Applications

- **Authentication.**

- **Virtual Display.**

HOLOGRAM: AUTHENTICATION

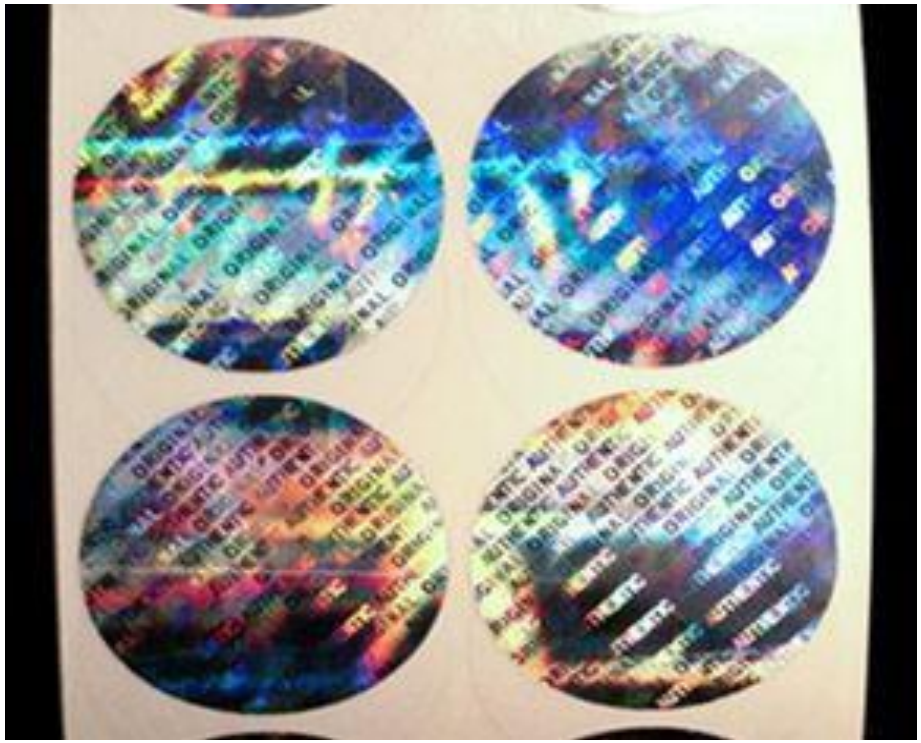
- Identitycard.
- Passport.
- Sticker or Tag.

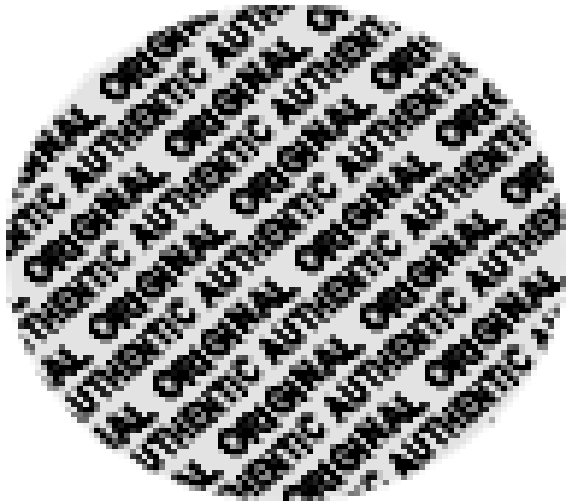
IDENTICARD:

PASSPORT:


1
2
3
4
5
6
7
P
D
1220000016
MUSTERMANN
ERIKA
DEUTSCH
12.08.1964
F
MÜNCHEN
08.10.2001
07.10.2011
P<D<<MUSTERMANN<<ERIKA<<<<<<<<<<<<<<<<<<<<<<<<
1220000016D<<6408125F1110078<<<<<<<<<<<<<<4

STICKERS:





WHY HOLOGRAM FOR AUTHENTICATION:

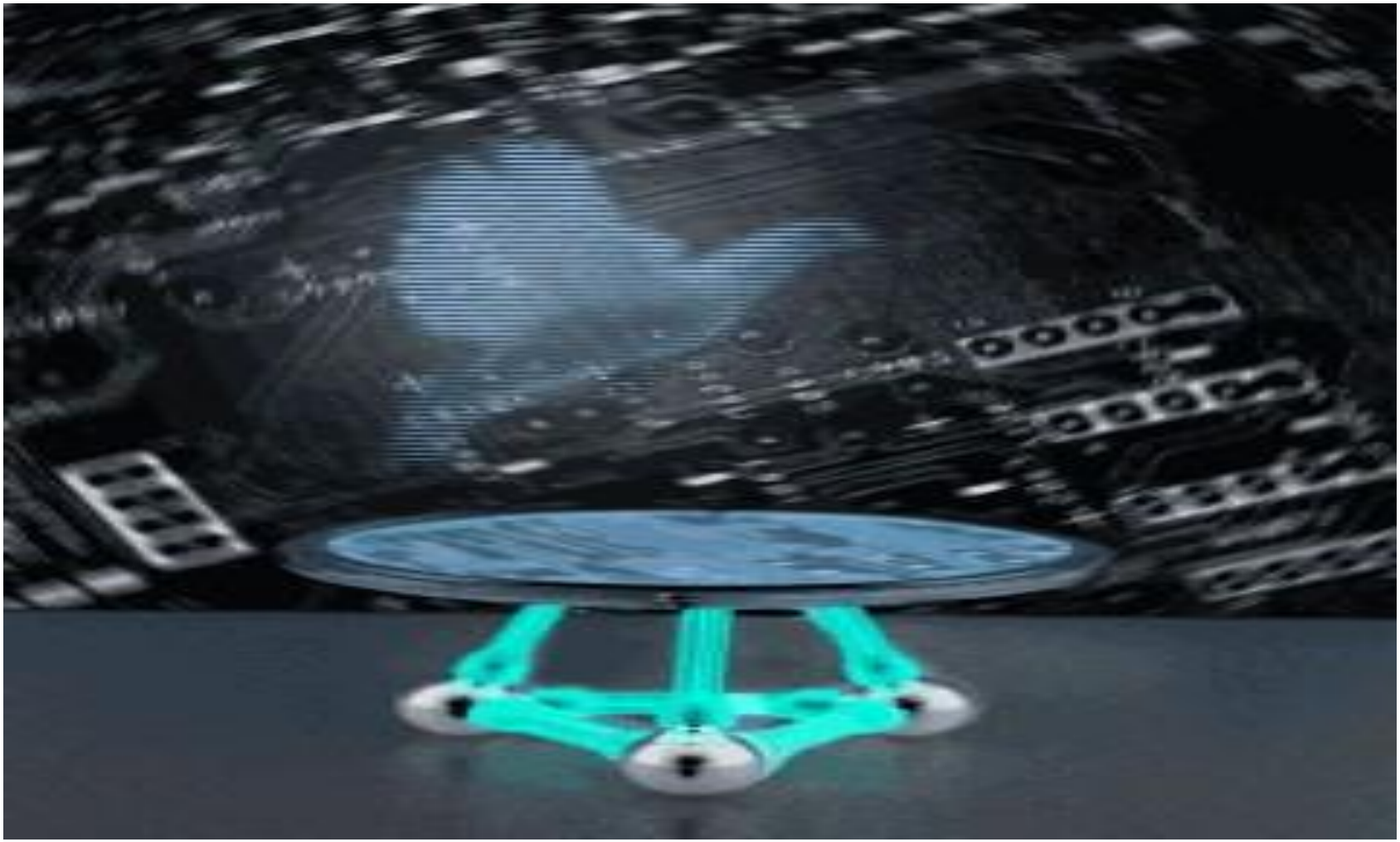
- **Hologram stickers cannot be scanned or photocopied .**

- **Hologram stickers can also create a unique and attractive complement to your existing packaging and product.**

Virtual Display:

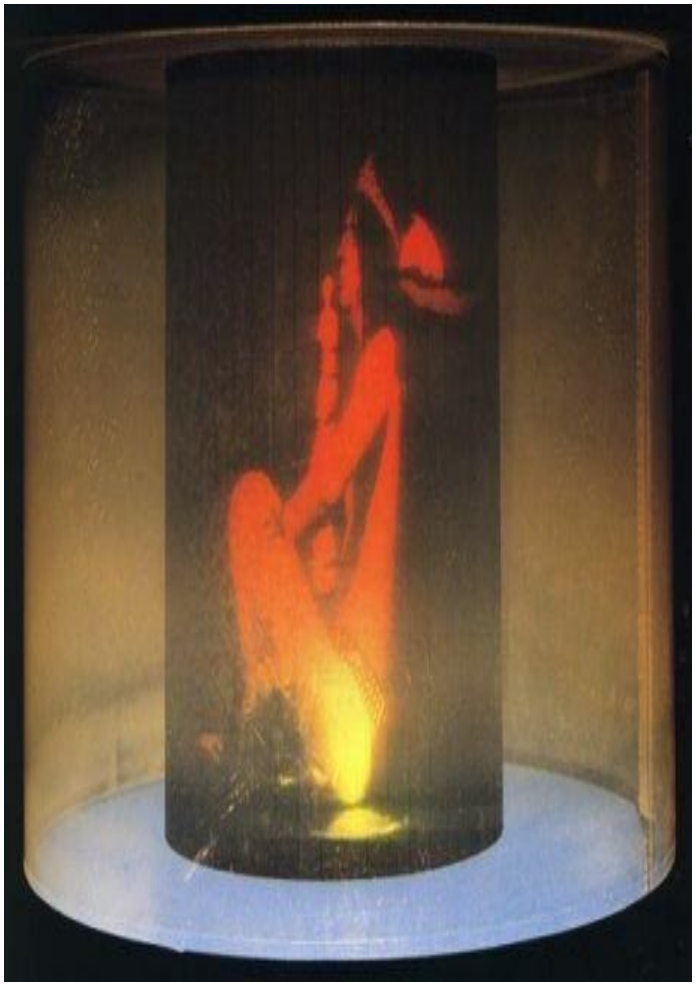
- Sci-fic movies.
- For trade-show booths.
- Museums display .

SCI-FIC MOVIES:



For trade-show booths:

MUSEUM DISPLAY:



Applications of Holography

- Design of containers to hold nuclear materials
- Credit cards carry monetary value
- Supermarket scanners
- Optical Computers
- Improve design of aircraft wings and turbine blades
- Used in aircraft "heads-up display"
- Art
- Archival Recording of fragile museum artifacts