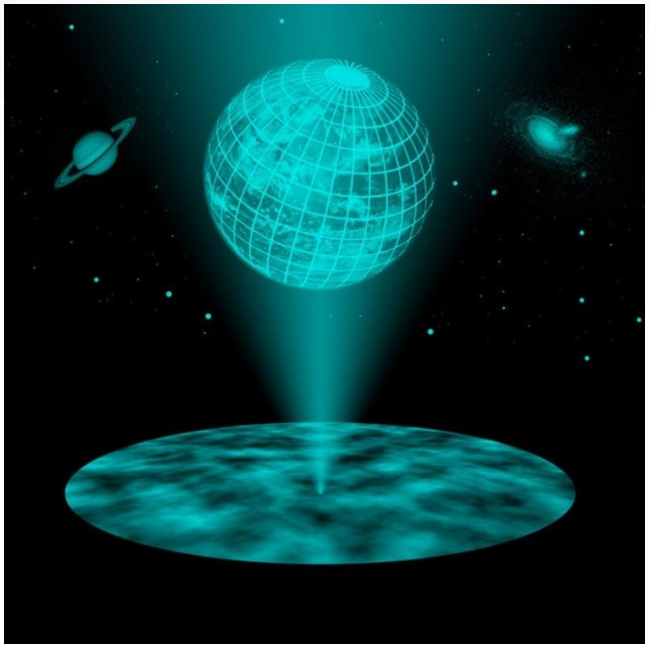


HOLOGRAPHY

سالي خالد عباس

المرحلة الثالثة

قسم الفيزياء/كلية العلوم/جامعة بغداد

Outlines

- What is holography?
- History of holography
- Components required
- Principles of holography
- Construction of holography
- Reconstruction of an image from Hologram
- Hololography vs. Photography
- Applications of holography

What is holography?

- Word Origin : Hologram is from the Greek word holos, meaning whole and gramma means writing .
- **Holography** is the process or technique of making three-dimensional image of the object. A hologram is produced by the interaction of two beams of laser light , one is the object beam coming through the object and another is the reference beam coming directly from the source.

History of holography

- Holography was invented in 1947 by Hungarian physicist Dennis Gabor (1900–1979), work for which he received the Nobel Prize in Physics in 1971
- Gabor's research focused on electron optics, which led him to the invention of holography. The basic idea was that for perfect optical imaging, the total of all the information has to be used; not only the amplitude, as in usual optical imaging, but also the phase. In this manner a complete holo-spatial picture can be obtained.

Components required

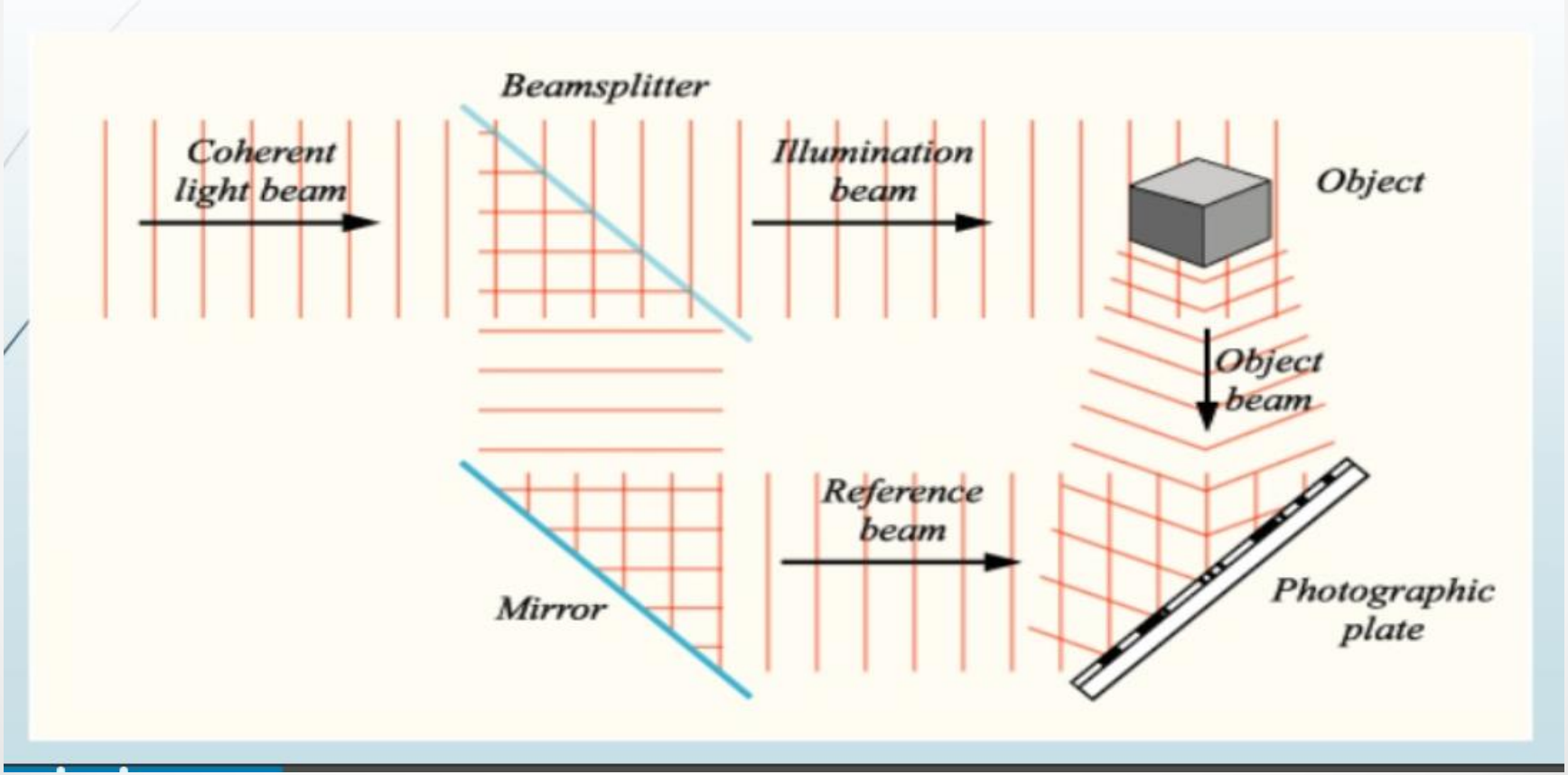
- Laser: Usually Helium neon laser (HeNe) is used
- Beam splitter : A device that uses mirrors and prisms to split laser beam into two beams: 1-reference beam

  2-object beam.
- Mirrors: to direct the light to the right locations
- Holographic film: Layer of light sensitive compound on a transparent surface.

Construction of a hologram

1. The laser points at the beam splitter, which divides the beam of light into two parts.
2. Mirrors direct the paths of these two beams so that they hit their intended targets.
3. Each of the two beams passes through a diverging lens and becomes a wide swath of light rather than a narrow beam.
4. One beam, the **object** beam, reflects off of the object and onto the photographic emulsion.
5. The other beam, the **reference** beam, hits the emulsion without reflecting off of anything other than a mirror.

Construction of a hologram



Principle of Holography

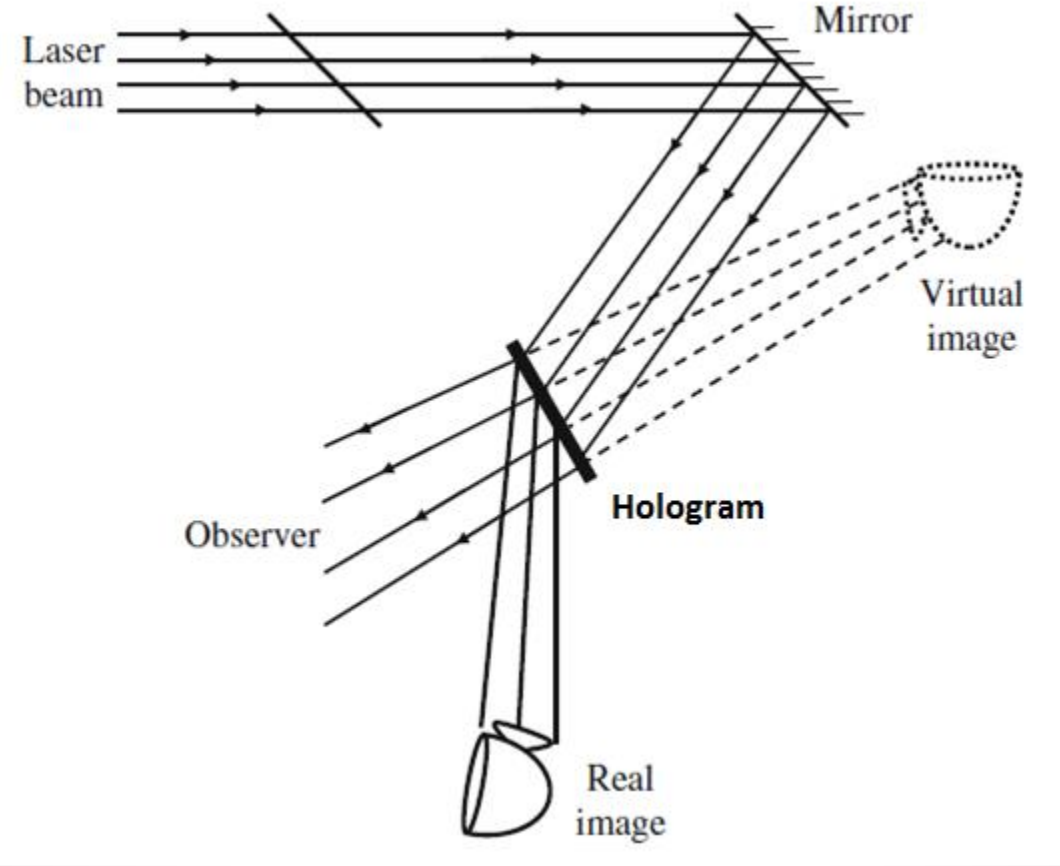
- During the recording process, object wave and the reference wave (coming directly from source) interfere in the plane of the recording medium and produce interference fringes. This photographic plate carrying the interference pattern is called Hologram.

- The interference fringes contain all the information about the intensity and the phase of the scattered beam from object.

Reconstruction of an image from Hologram

- To view the image, the hologram is again illuminated with another laser beam called the reconstruction beam which is at same angle as reference beam.
- Hologram acts as a diffraction grating.
- This forms a real image in front of the hologram and a virtual image behind the hologram.
- The virtual image has all the characteristic of the object. The real image can be photographed directly without using a lens.

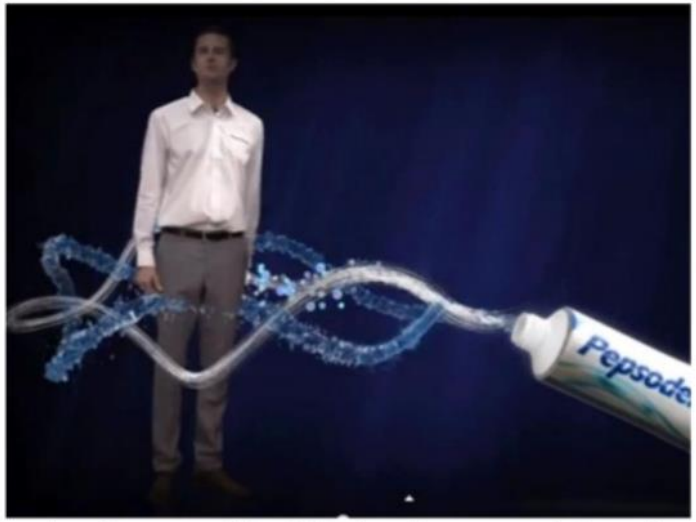
Reconstruction of an image from Hologram



Hololography vs. Photography

- Photography is 2D record of a 3D object whereas holography gives a three dimensional form of original object. If any object is hidden just behind another object then the observer can see the hidden object in viewing the hologram.
- Hologram is the positive pattern whereas in conventional photography negative pattern is produced.

Applications of Holography



Marketing with 3D holographic display

3D Holography in education

Applications of Holography

In Medical Diagnostics

In Entertainment Industry

Applications of holography

Virtual Reality, Augmented reality and Telepresence

Homework

- 1- What phenomenon is used in a hologram?
- 2- which mirror is used in holography?
- 3- what is the type of laser used? And can we use a different type of laser?
- 4- what are the beams produced by the beam splitter?

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Thank you for listening….