

Lecture no. 7

Department: Information and Library Science

Subject: Information Storage & Retrieval

Name of the lecture: storage devices-difficulties of HVD

Dr. Arwa Z. Nasser

### **Difficulties:**

**One of the biggest difficulties facing developers of holographic data storage is the consistent alignment of data layers with the reader. Reading one layer of holographic image is relatively easy; reading multiple layers (otherwise known as "multiplexing") is a lot more difficult. The slightest defect in the recording medium or the position of the medium to the optical reader reduces the clarity of output. Furthermore, to overcome the problem of decreasing efficiency of each holographic layer, "the exposure time for each hologram had to be different to compensate for the recording order."**

## **LIMITATIONS AND CHALLENGES**

- It is very difficult to arrange all of those components like CCD camera , SLM arrays and beam steering devices.
- Needs good recordings sensitive material to allow high data transfer rate.
- If too many pages are stored in one crystal, the strength of each hologram gets diminished.

# COMPONENTS

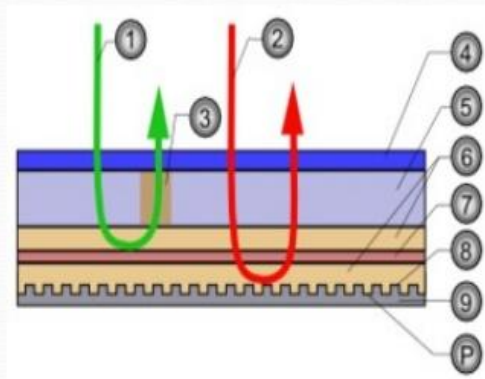
- Most holographic storage systems contain some components basic to the setup.

These are :-

- a) Laser Beam
- b) Beam Splitters to split the Laser Beam
- c) Mirrors to direct the Laser Beam
- d) A liquid crystal Display panel(SLM)
- e) Lenses to focus the Laser Beam
- f) Recording Material
- g) CCD cameras

6

## Holographic Versatile Disc structure



1. Green writing/reading laser (532 nm)
2. Red positioning/addressing laser (650 nm)
3. Hologram (data)
4. Polycarbon layer
5. Photo polymeric layer (data-containing layer)
6. Distance layers
7. Dichroic layer (reflecting green light)
8. Aluminum reflective layer (reflecting red light)
9. Transparent base

7

# How Does Holographic Data Storage Work?



010010010101010  
01010101011010  
01001010101010  
01101010101010  
10101010101010  
10101010100000  
10111101110101  
10101010101010



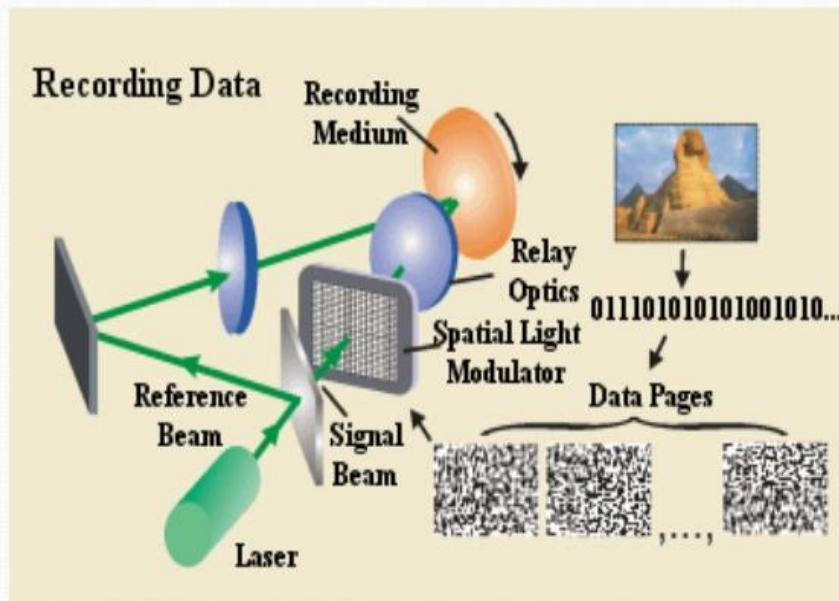
1. The object is converted into binary code of 1's and 0's like we use today.
2. Next, the 1's and 0's are converted into a matrix of light and dark squares.

○

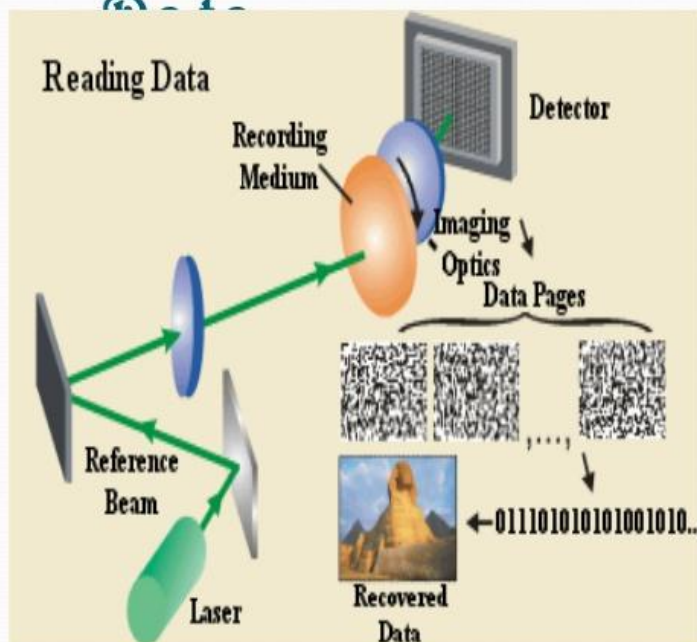
# How Does Holographic Data Storage Work?

3. Those light and dark squares are then electronically sent to a spatial light modulator (SLM).
4. The laser beam then shines through the spatial light modulator (SLM).
5. Pixels of the spatial light modulator filter (block or allow) the light thus encoding the data into the laser beam.





## The HVD System: Reading



In order to retrieve and reconstruct the holographic page of data stored in the crystal, the reference beam is shined into the crystal at exactly the same angle at which it entered to store that page of data.



**HVD**  
Holographic Versatile Disc

**Capacity:** 700 mb      **Capacity:** 4.7Gb      **Capacity:** 30-50Gb      **Capacity:** 1-4TB

13

# HVD Pro Series 1000

## Magnum





# References:

- ❖ The Economist, Holographic data storage, Jul 31, 2003, <http://www.economist.com/node/1956881>
- ❖ General Electric Global Research
- ❖ IBM J.RES. DEVELOP VOL 44 MAY 2000 J.ASHLEY ETAL
- ❖ InPhase Technologies, Longmont, Colorado, <http://www.inphase-technologies.com/>
- ❖ Wikipedia – Holographic Data Storage, [http://en.wikipedia.org/wiki/Holographic\\_data\\_storage](http://en.wikipedia.org/wiki/Holographic_data_storage)
- ❖ Bell Laboratories Physical Sciences Research, <http://www.bell-labs.com/org/physicalsciences/projects/hdhds/1.html>
- ❖ How Holographic Memory Will Work by Kevin Bosner. <http://computer.howstuffworks.com/holographic-memory1.htm>
- ❖ Optware Corporation of America, Longmont, Colorado, <http://www.thic.org/pdf/Jul05/optware.mdeese.050719.pdf>
- ❖ Technology Review, July 2010, <http://www.technologyreview.com/blog/mimssbits/25418/>

## References

- Physics for Scientists and Engineers with Modern Physics – Vol 2, Serway and Jewett
- International Conference on Holography, Optical Recording, and Processing of Information: <http://spiedl.aip.org/dbt/dbt.jsp?KEY=PSISDG&Volume=6252&Issue=1>
  - Thermally sensitized optical recording in azobenzene polymers
    - D.Illieva, M. Ivanov, T. Petrova, V. Dragostinova, G. Minchev, T. Todorov, L. Nikolova
  - Refractive data of optical plastics for laser applications
    - N. Sultanova, S. Kasarova, C. Ivanov, I. Nikolov
  - Pulse Recording Dynamics of Diffraction Gratings in Xanthene Dyes Sensitized Photopolymer Material
    - E. Vasilyev, V. Shelkovnikov, E. Pen, A. Plechanov
  - Holographic recording in nanoparticle-doped photopolymer
    - I. Naydenov, H. Sheriff, S. Mintova, S. Toala
- <http://hyperphysics.phy-astr.gsu.edu/hbase/optmod/holcon.html>
- <http://www.research.ibm.com/journal/rd/443/ashley.html>
- <http://www.howstuffworks.com/holographic-memory.htm>
- <http://en.wikipedia.org/wiki/Holography>
- [http://en.wikipedia.org/wiki/Holographic\\_Versatile\\_Disc](http://en.wikipedia.org/wiki/Holographic_Versatile_Disc)
- <http://www.inphasetechnologies.com/downloads/pdf/products/2007TapestryProductBrochure.pdf>