

Lectures 1234567

Computer Aided Design

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Computer Aided Design

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Interests: Mechanical Design

Finite Element Analysis

Mechanism Simulation

CAD – CAE – CAM

Intro. to Computer Graphic Systems

Textbooks:

- Computer Aided Engineering Design, Anupam Saxena, Birendra Sahay, Springer, 2005
- Engineering Design A Systematic Approach, G. Pahl, W. Beitz, Springer-Verlag, 2007

Lectures 1234567

- Lecture 1 Intro. to Computer Graphic Systems
- Lecture 2 Geometry
- Lecture 3 Vector Algebra
- Lecture 4 Transformations
- Lecture 5 Curves
- Lecture 6 Surface Modeling
- Lecture 7 Solid Modeling

Lecture 1 Intro. to Computer Graphic Systems

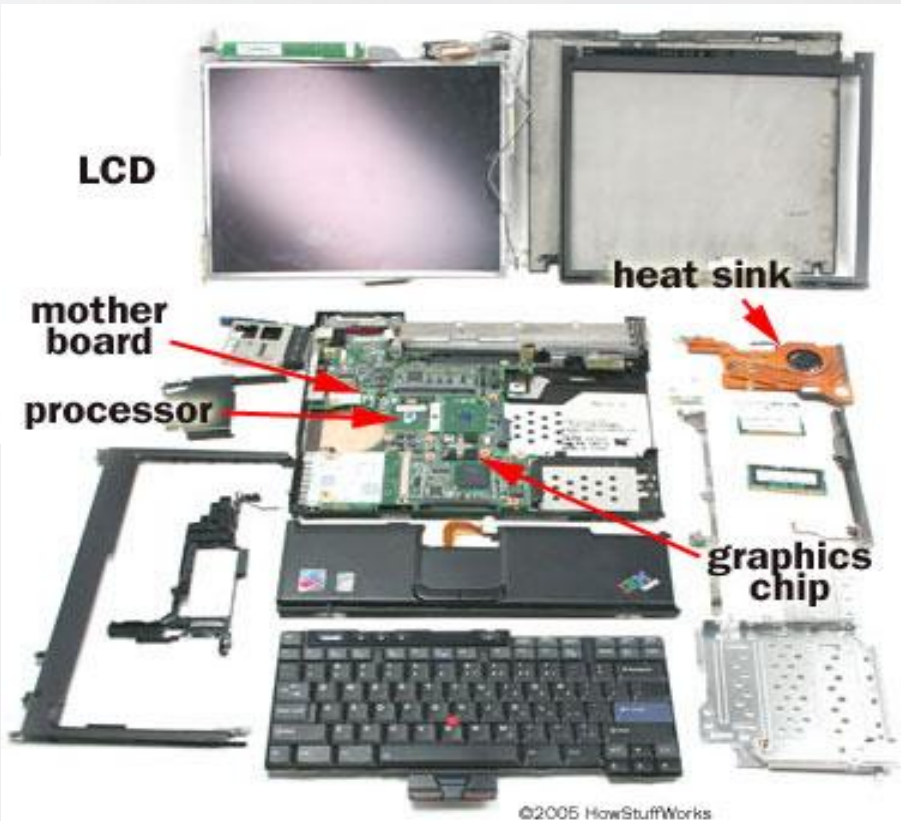
- Introduction to Computer Graphic Systems
- Hardwares and Softwares

Hardware

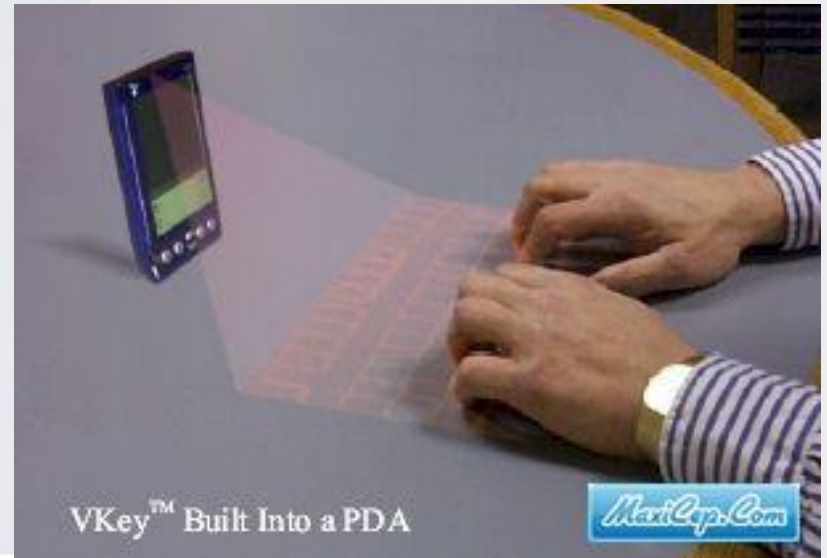
- Input Devices
 - Storage Devices
 - Transmission Devices
 - Output Devices
-
- The graphical information is first transferred to computer system by input devices.
 - It is then stored internally in specific formats that depend on the device type used
 - and is finally transmitted to the appropriate output device for viewing.

Hardwares - Input Devices

- Keyboard
- Mouse
- Joystick
- Lightpen
- Microphone
- Scanner
- Camera
- Glove

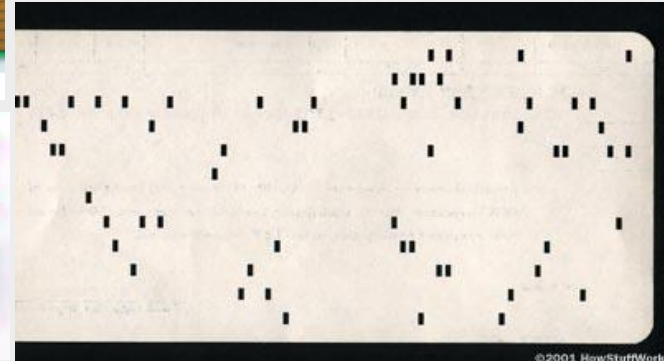
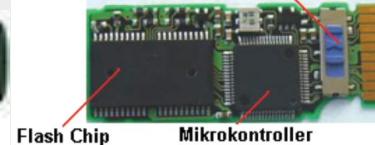
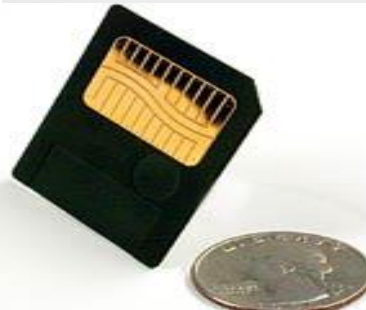


Bluetooth projection keyboard

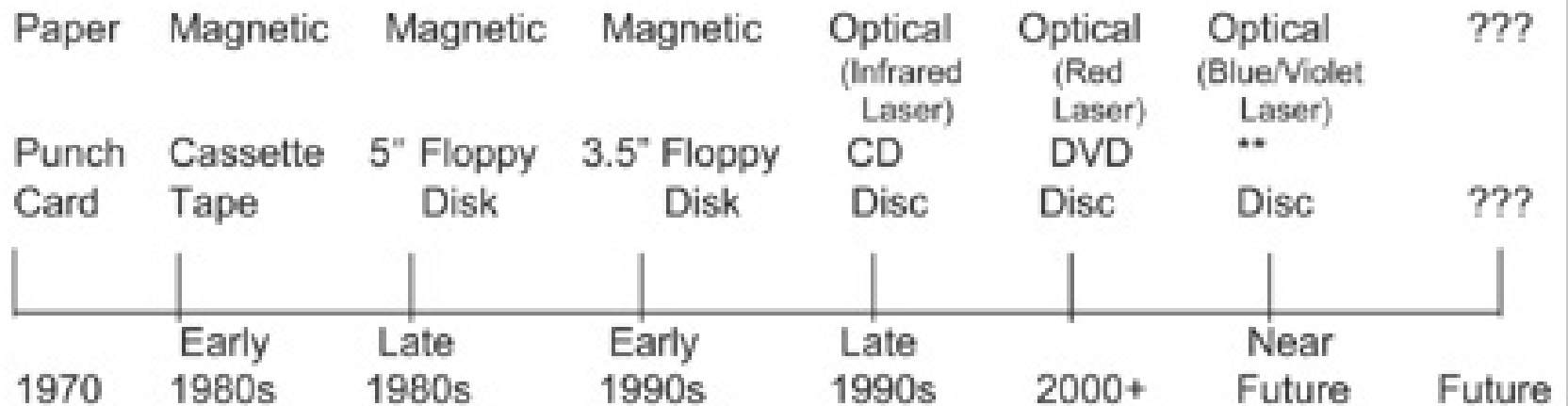


Hardwares - Storage Devices

- Harddisk
- Jazdrive
- Zipdrive
- Magnetic disk
- Optic disk
- Flash disk SD
- Memory
- Paper



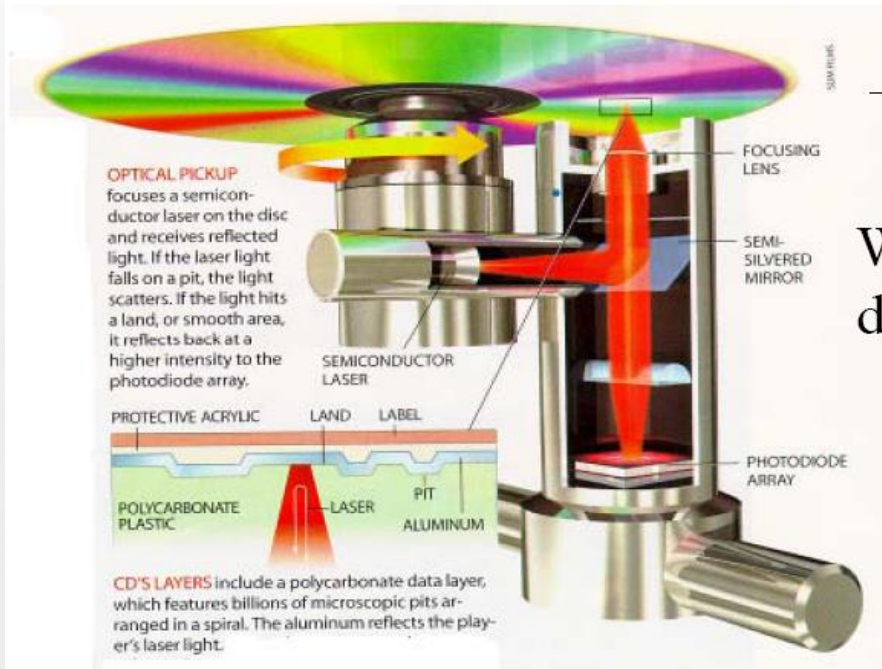
Storage Devices



** Blu-Ray Disc, Advanced Optical Disc, or other.

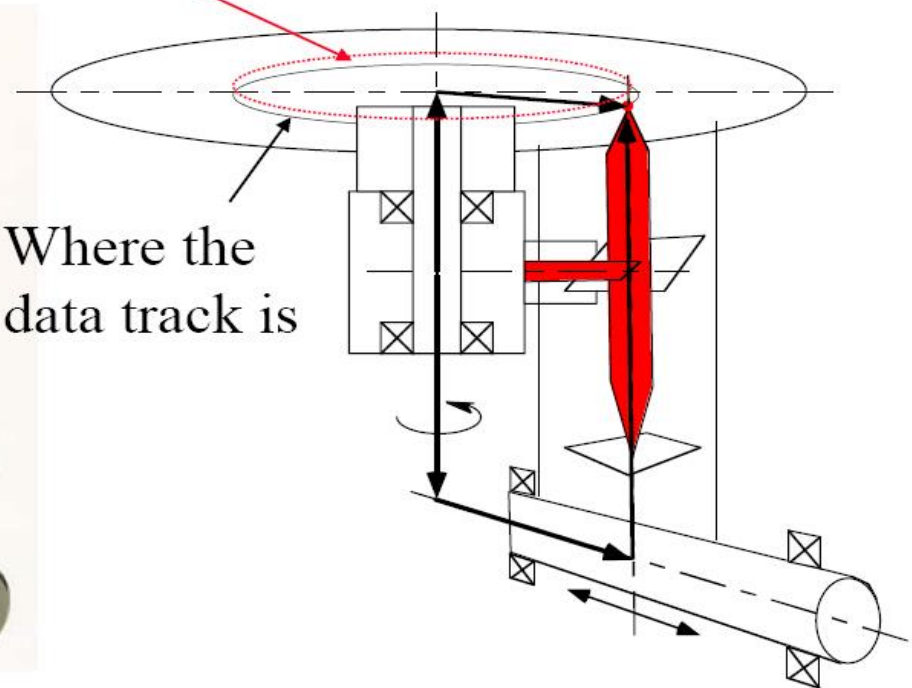
Hardwares - Storage Devices

Optical Disk Drive KCs



Where the laser points

Where the data track is



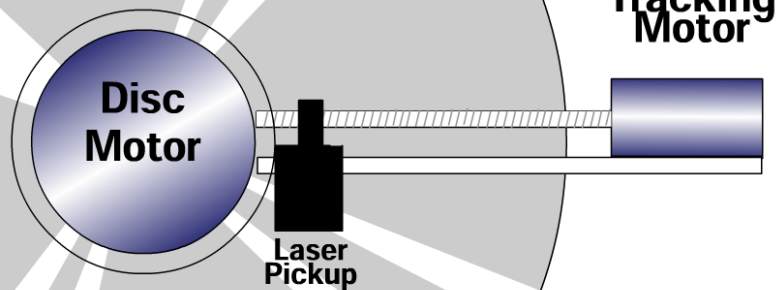
Source: Scientific American
September, 1998 © Slim Films
Used with permission.

KCs: Size, weight, \$/megabyte

Reading the DVD

Reading the DVD Disc

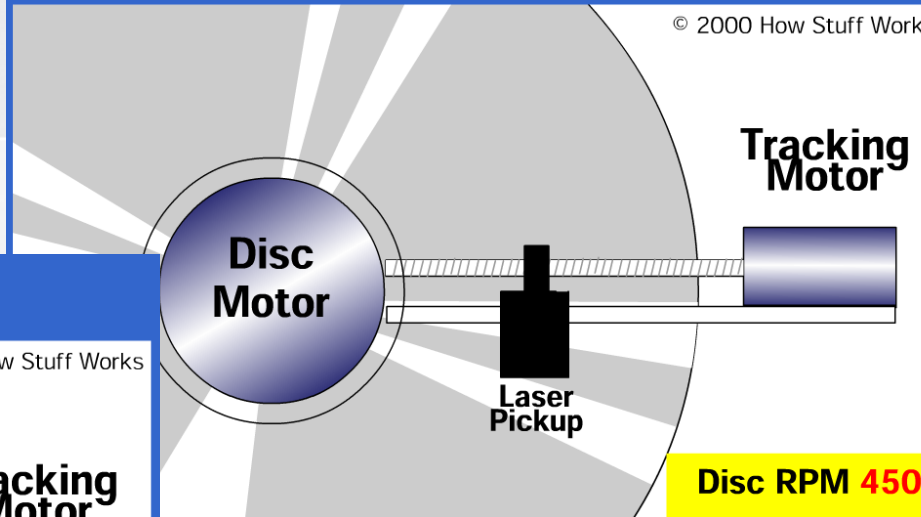
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Disc RPM 500

Reading the DVD Disc

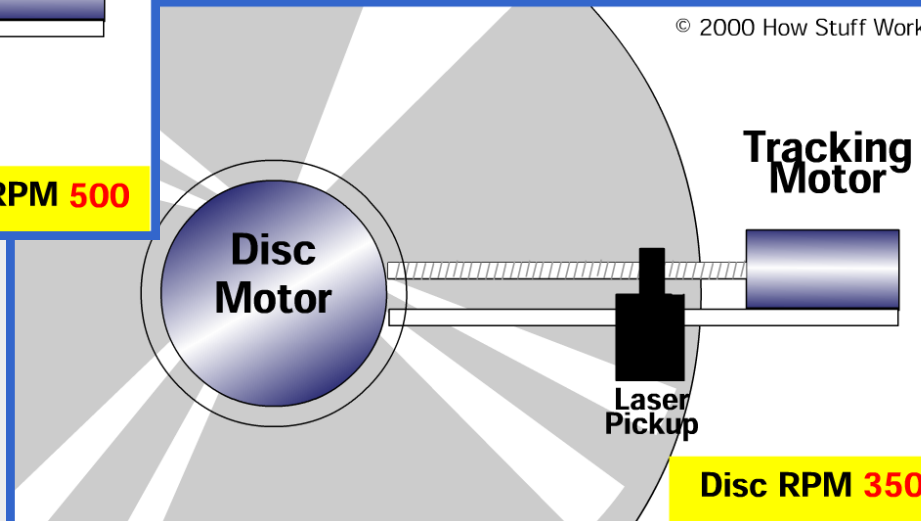
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Disc RPM 450

Reading the DVD Disc

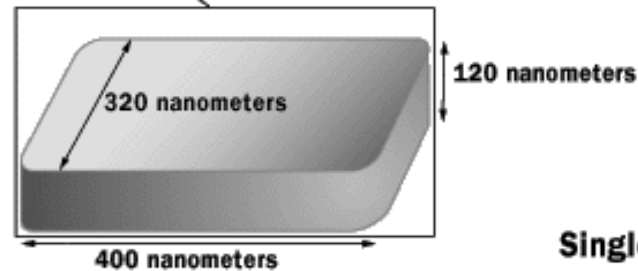
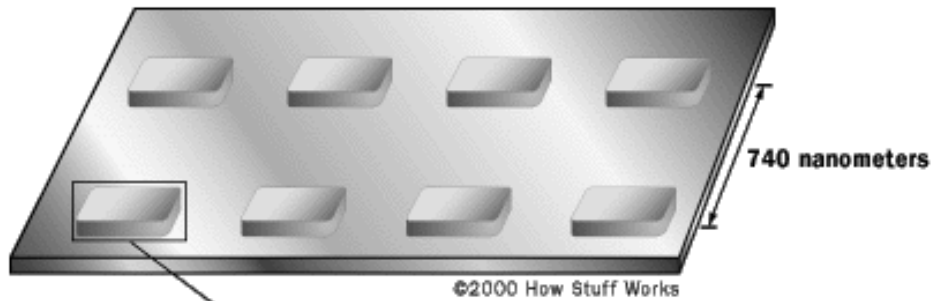
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Disc RPM 350

DVD track

Each writable layer of a DVD has 7.5 miles long spiral track of data.

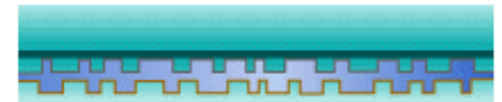


DVD pit layout

Single-sided, single layer (4.7GB)



Single-sided, double layer (8.5GB)

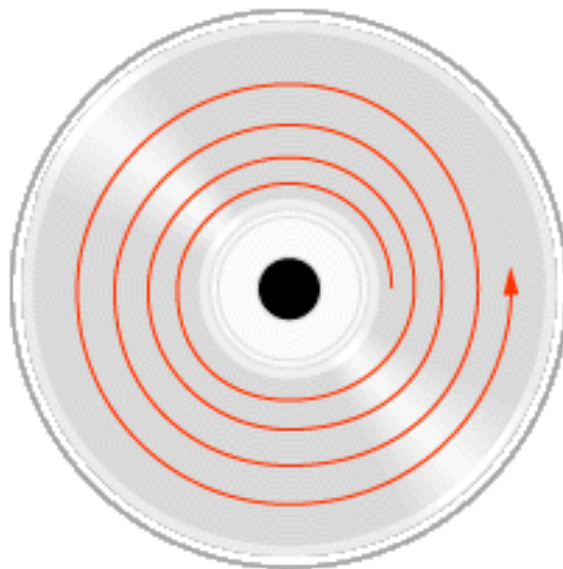


Double-sided, double layer (17GB)

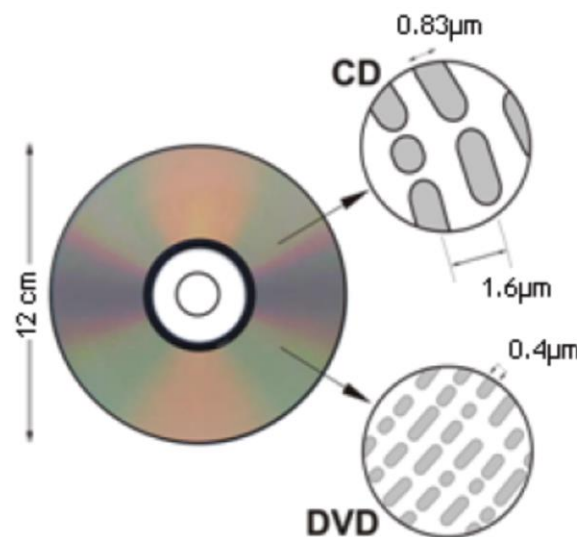


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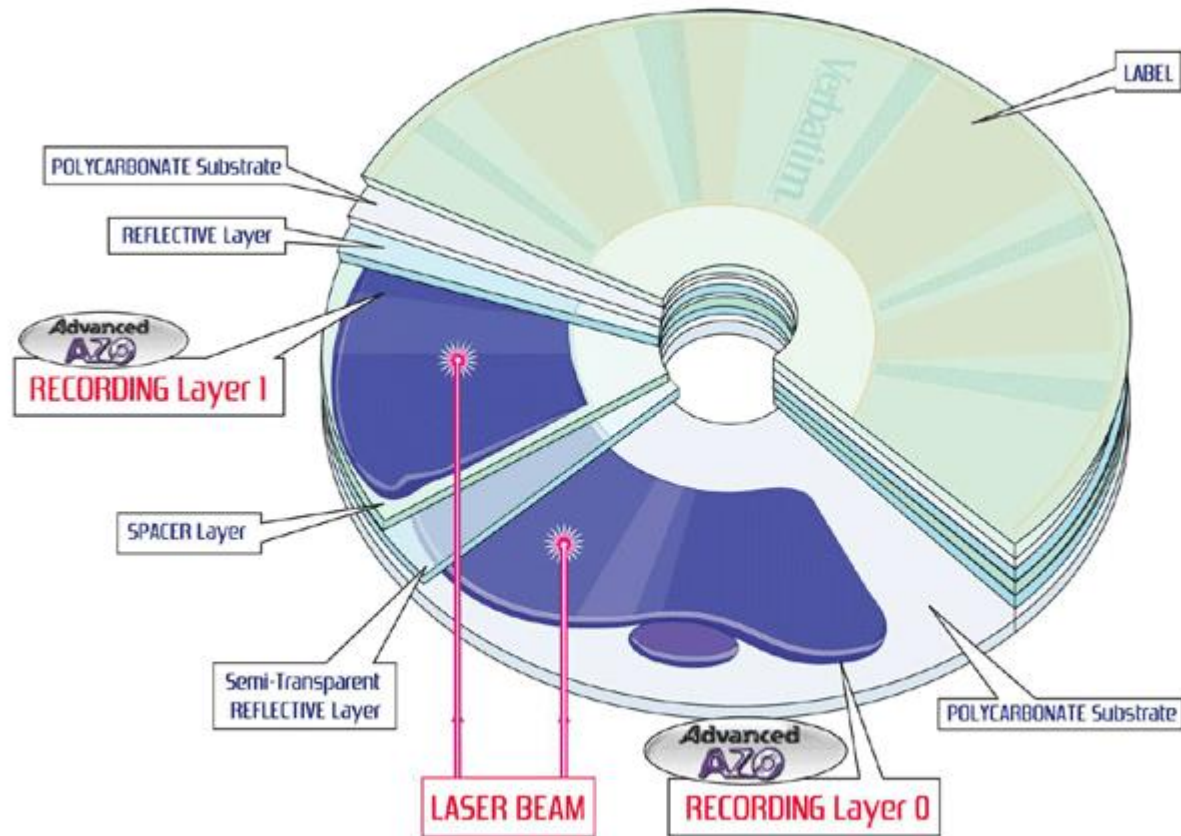
DVD formats



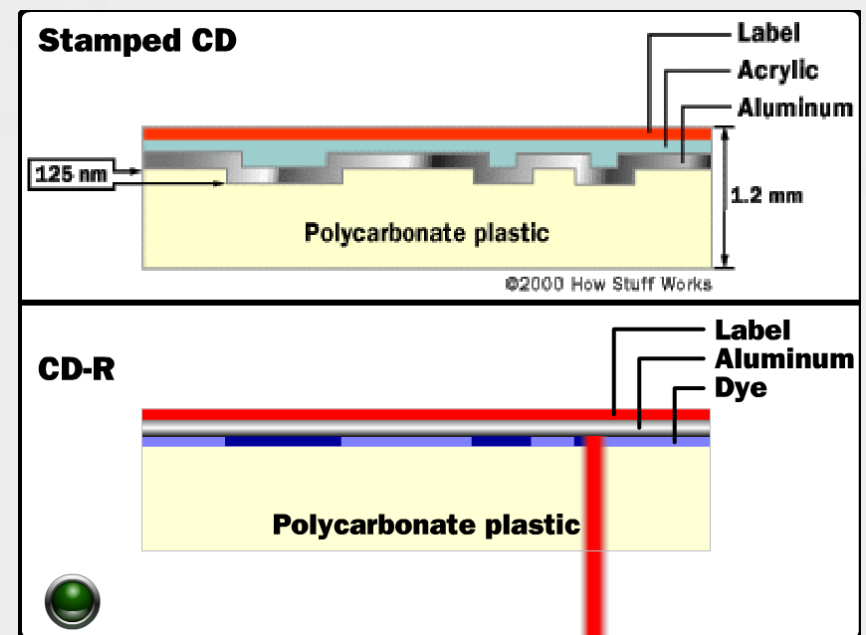
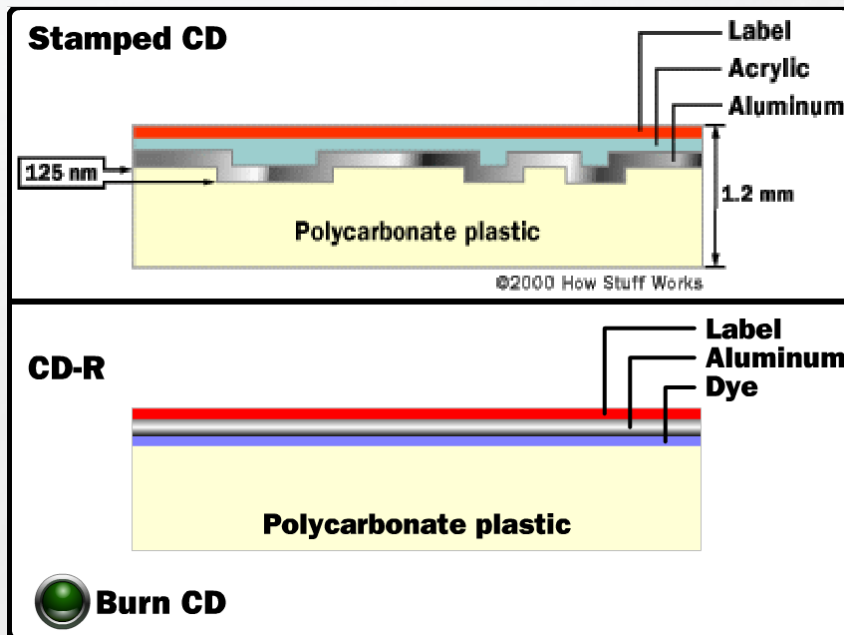
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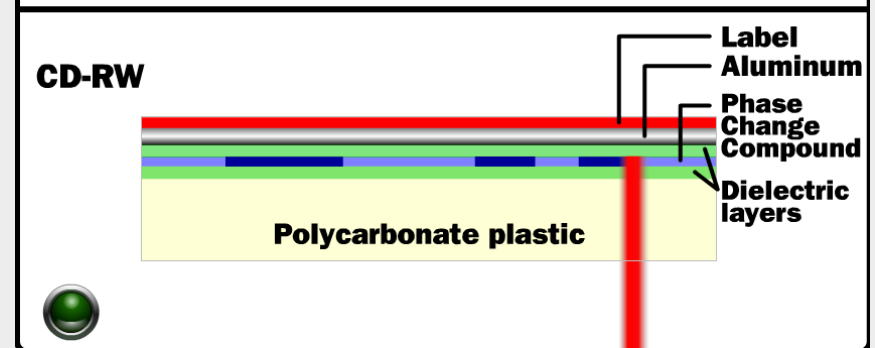
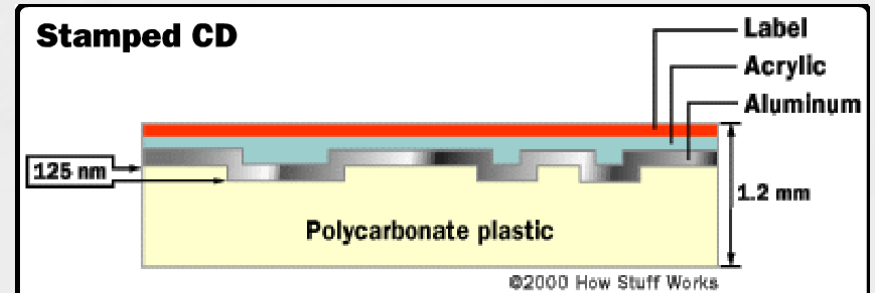
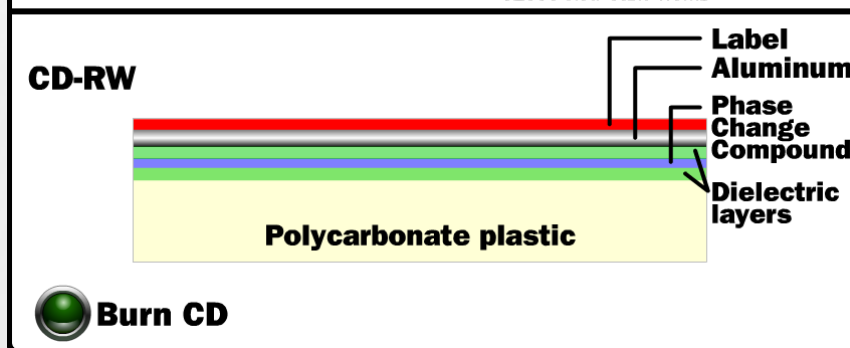
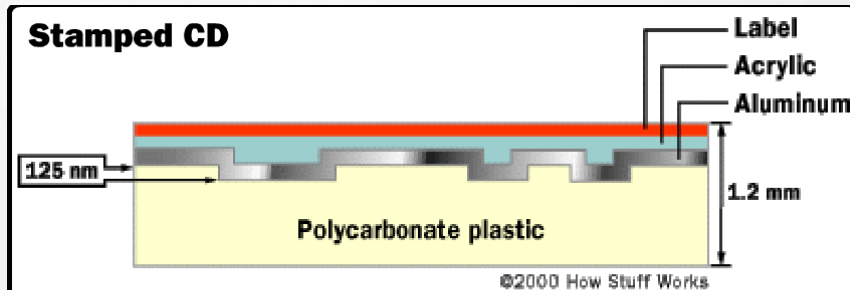
Storage Devices



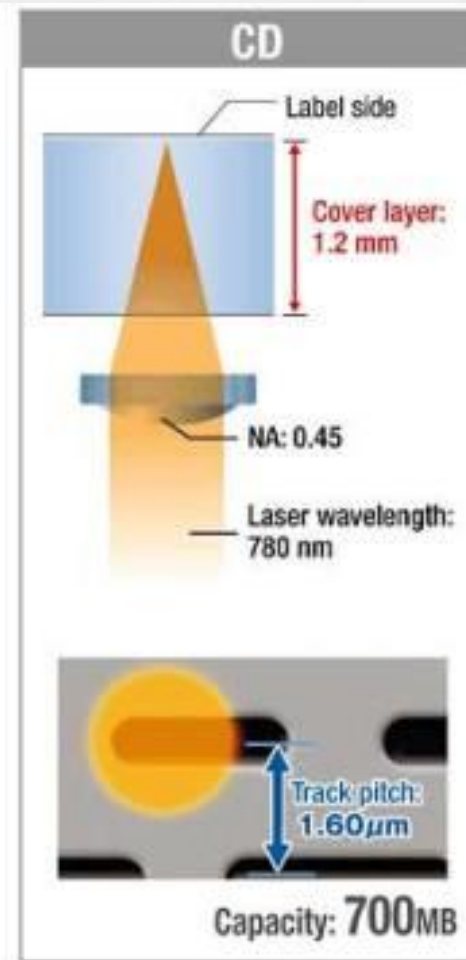
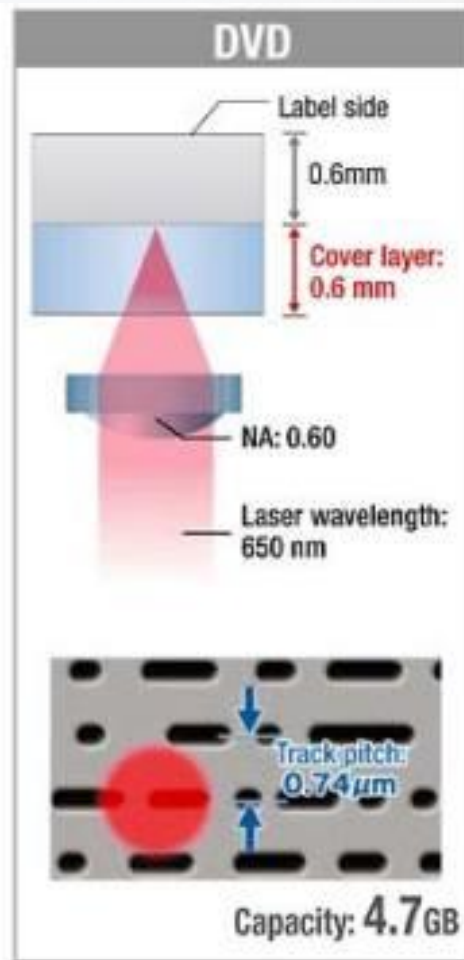
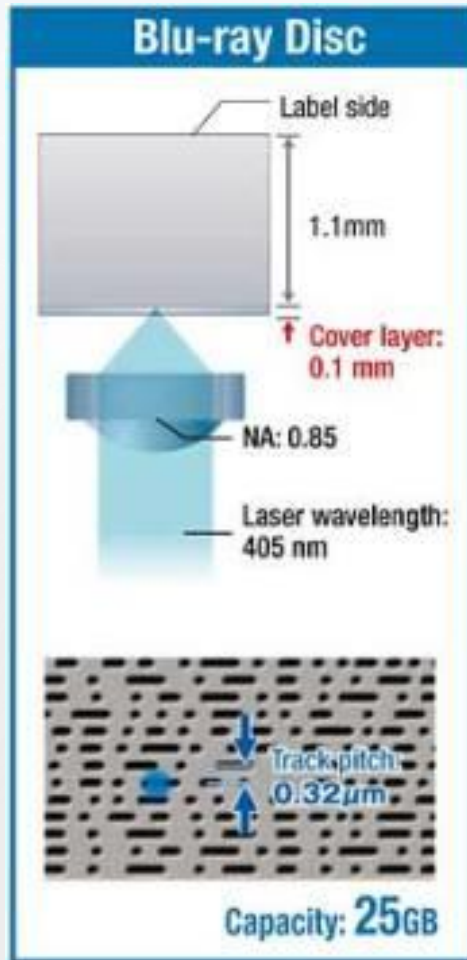
Burning the CD-R



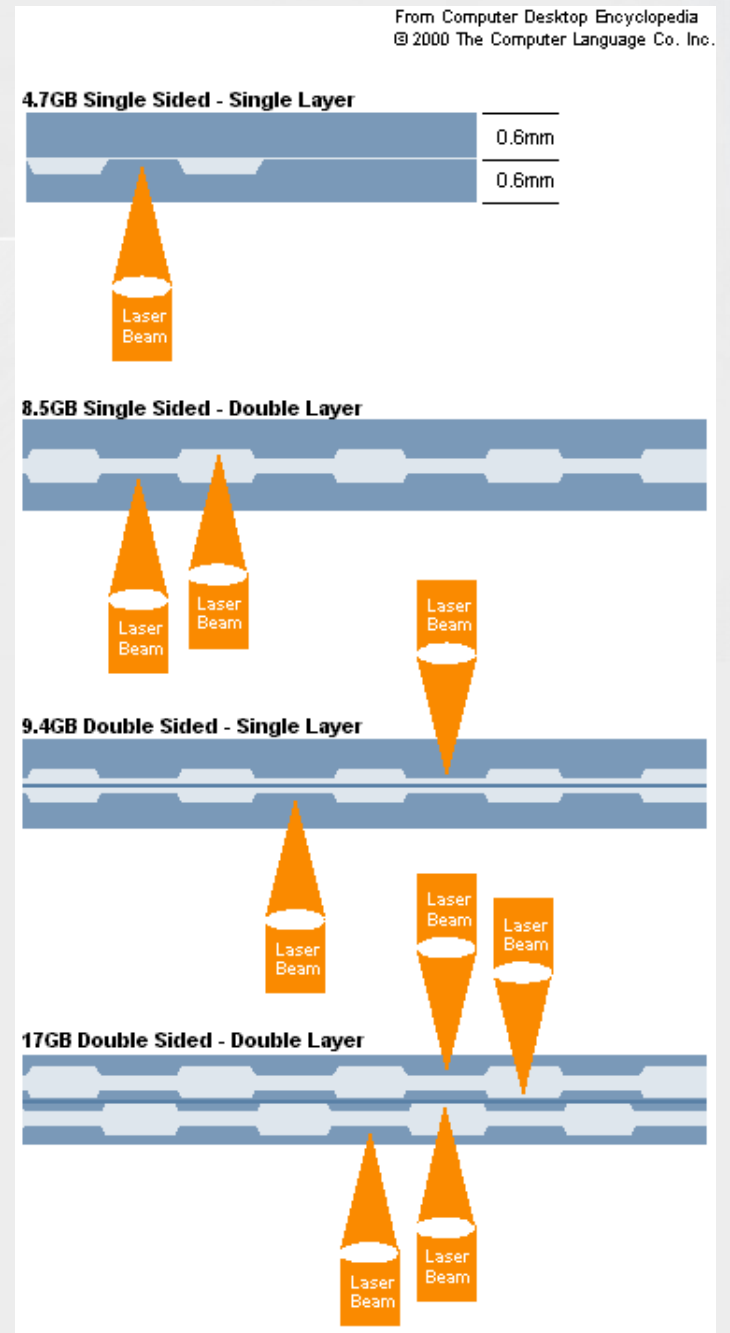
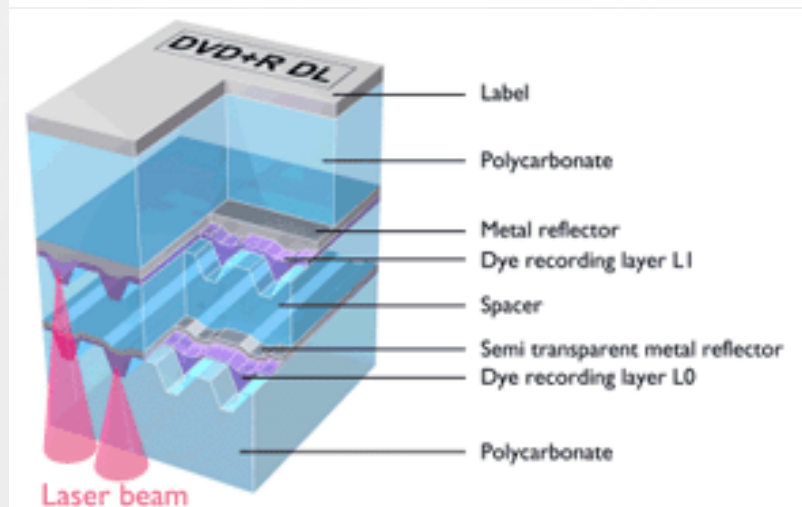
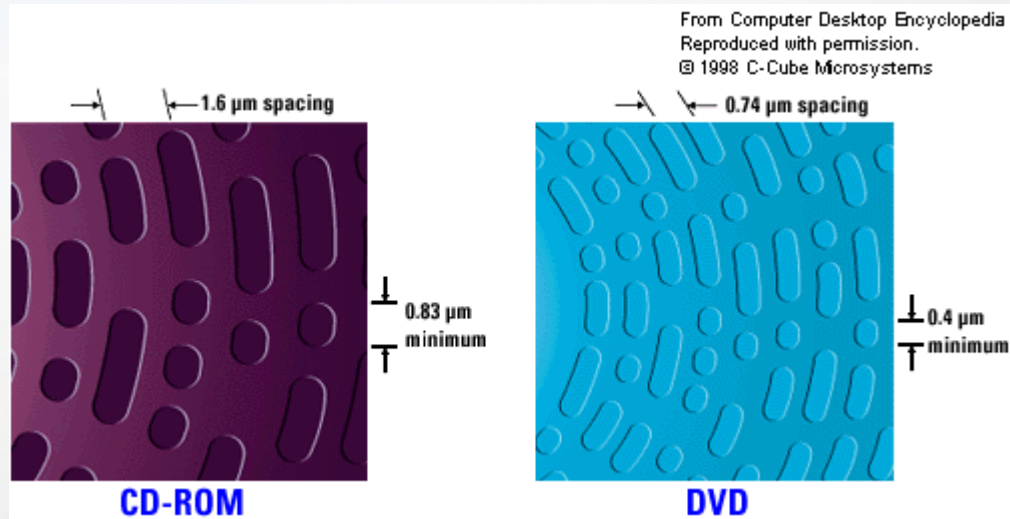
Burning the CD-RW



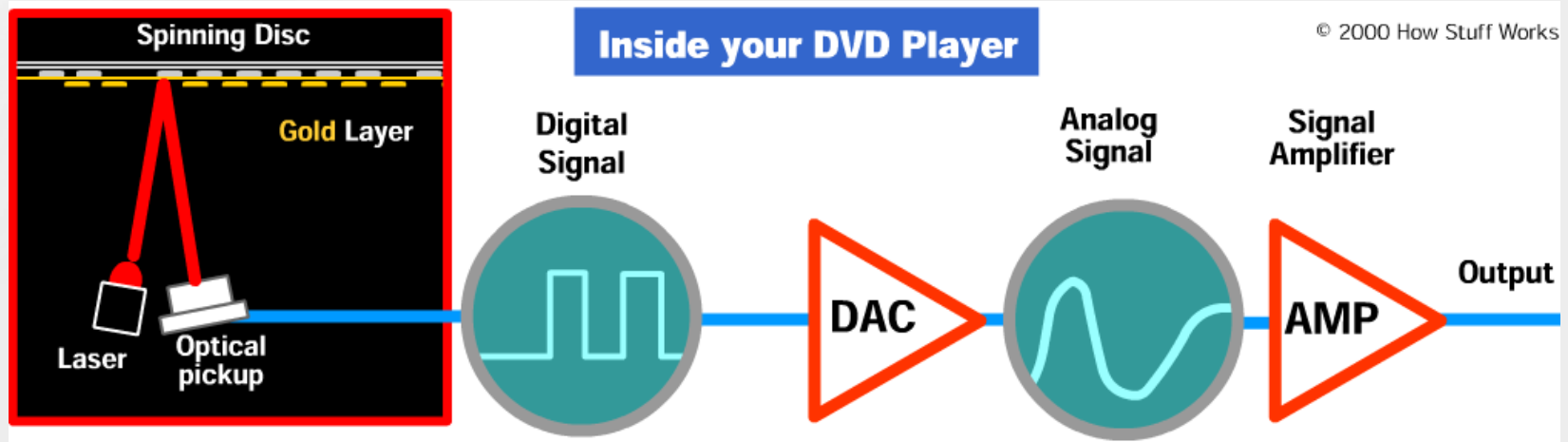
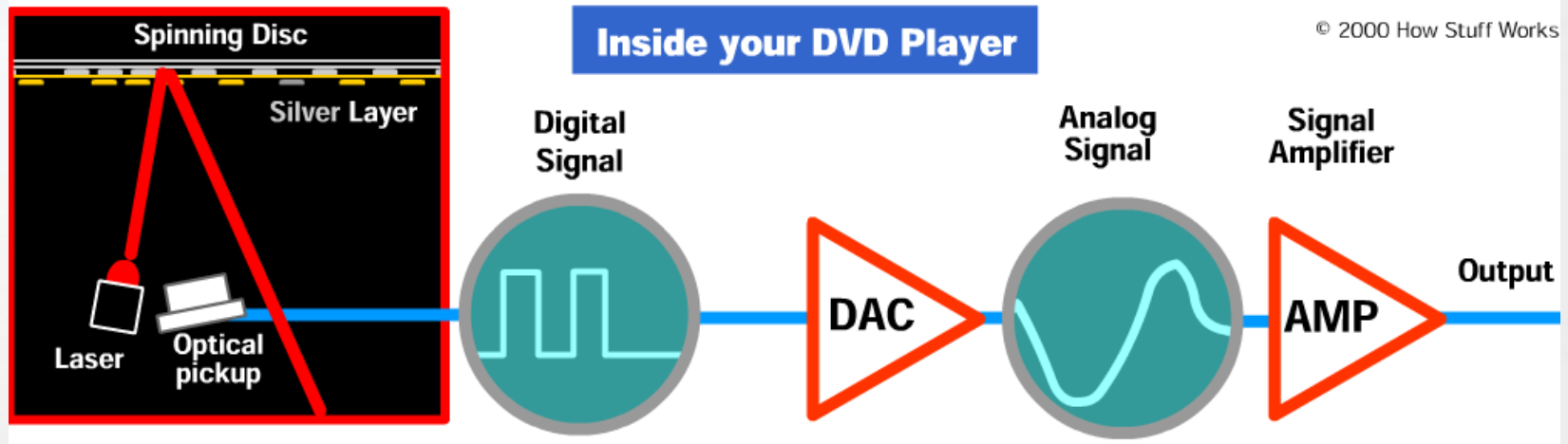
Hardwares - Storage Devices



Storage Devices

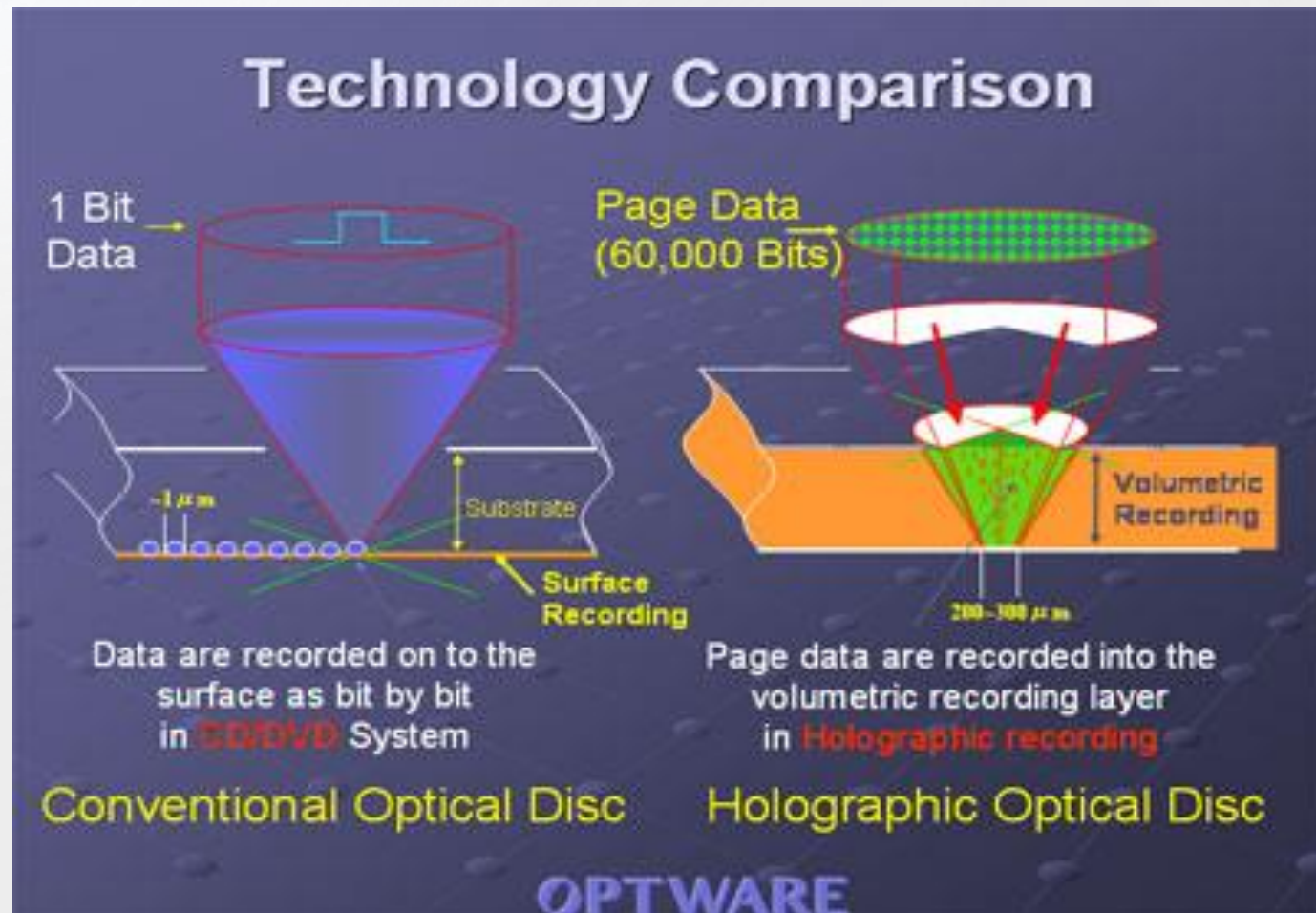


dvd-read



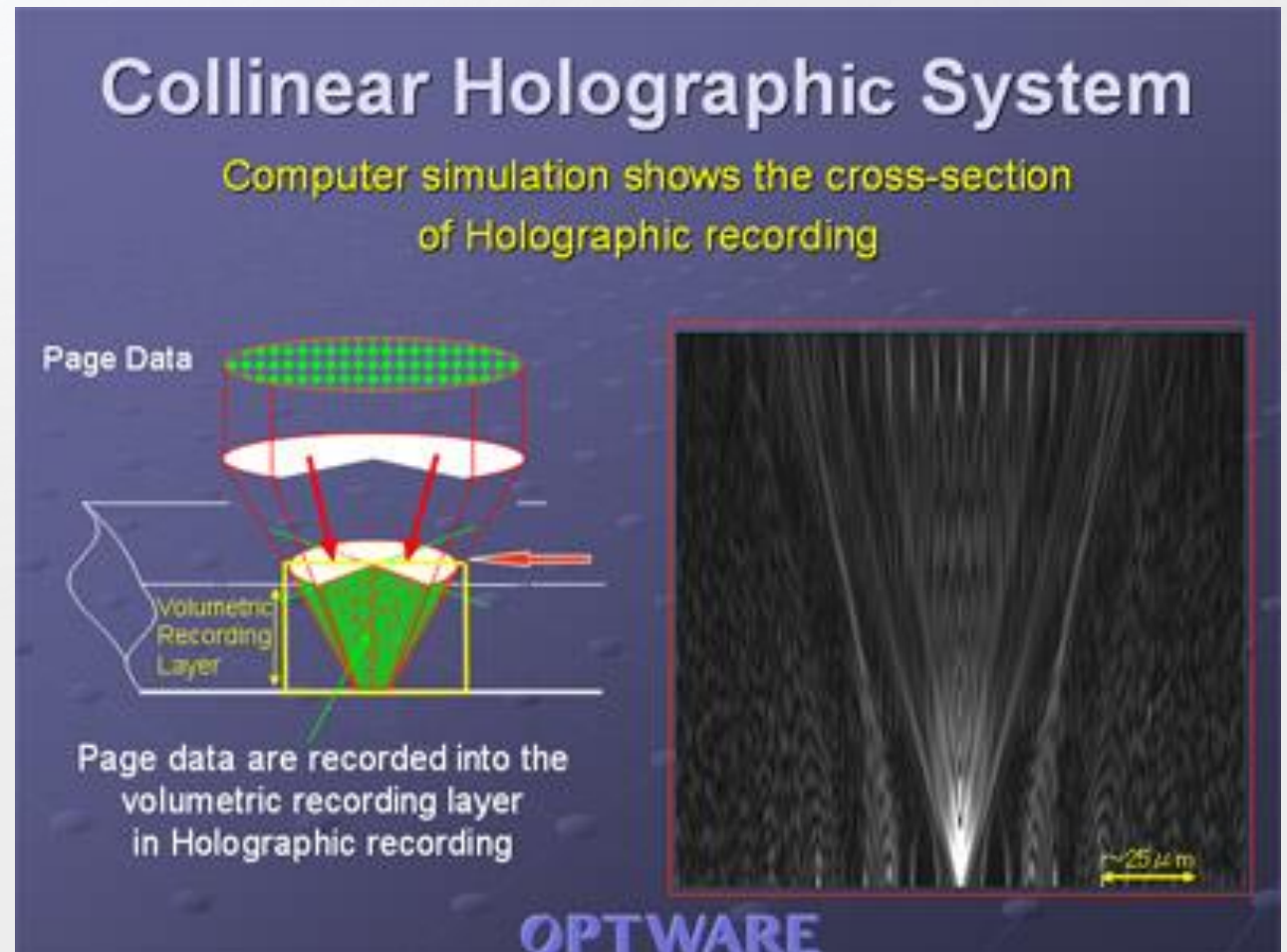
DVD vs. HVD: Recording-layer depth

The
Holographic
Versatile
Disc



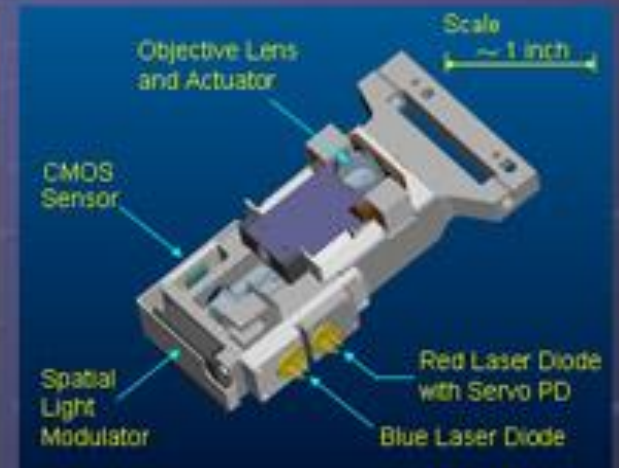
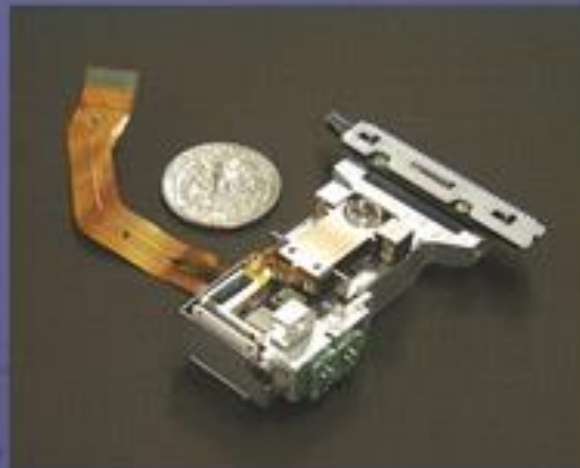
Volumetric recording method

1 gigabyte
(GB) per
second



HVD optical pickup

Collinear Holography Optics

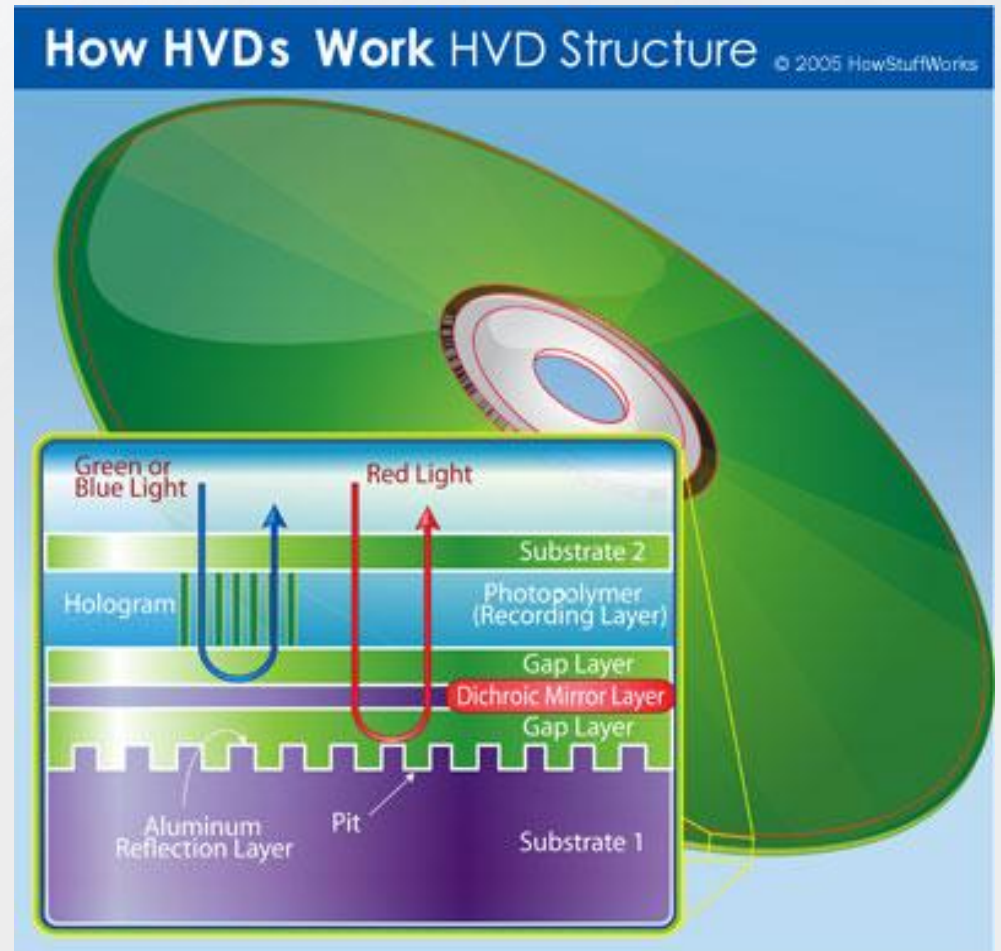


Collinear Holography Optical Pickup can be designed as small as the DVD's Optical Pickup because the Objective and Reference beams are co-axially aligned which is quite different from the 2-axis holography optics.

OPTWARE

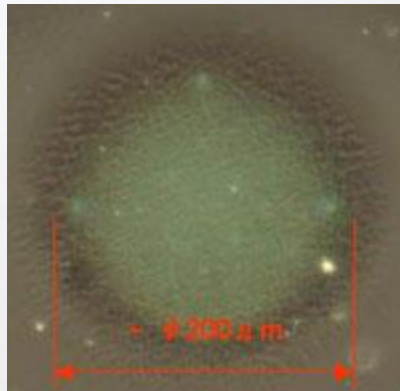
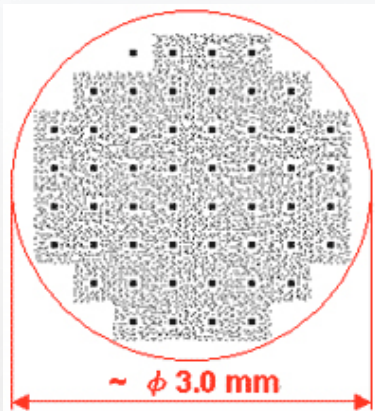
The HVD System: Writing Data

The Holographic Versatile Disc

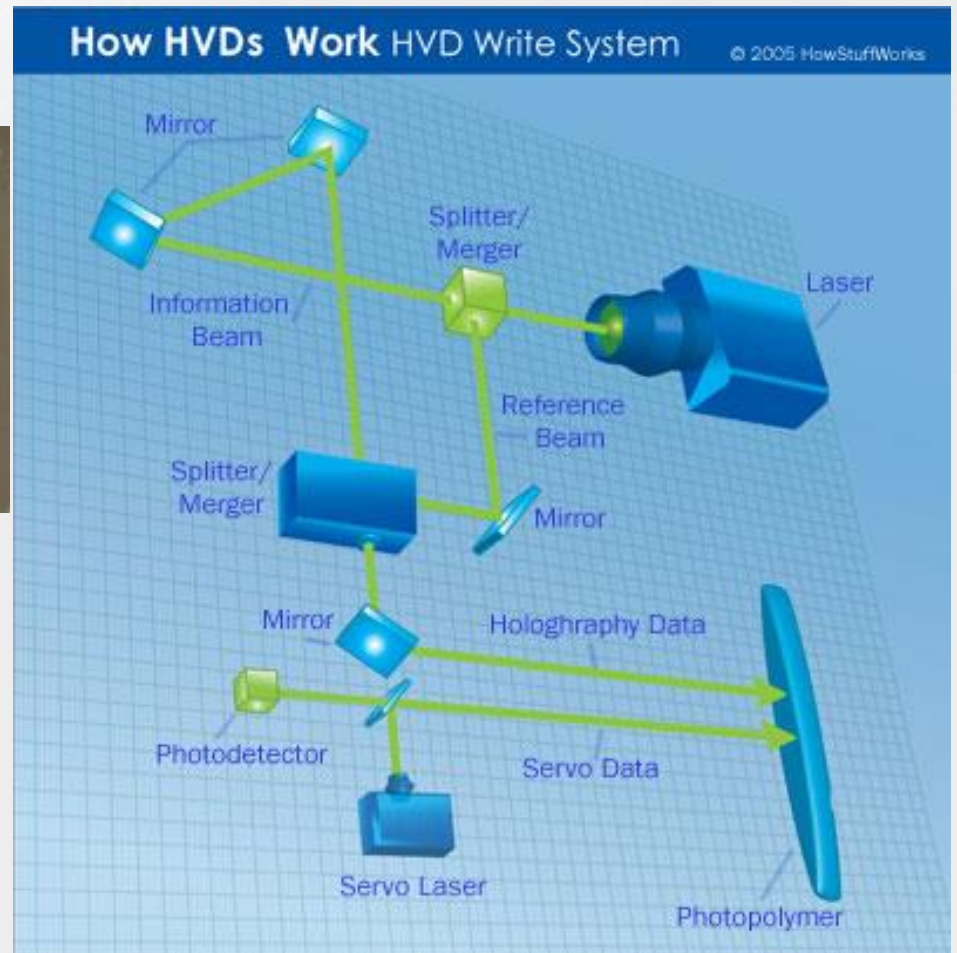


The HVD System: Writing Data

Data image

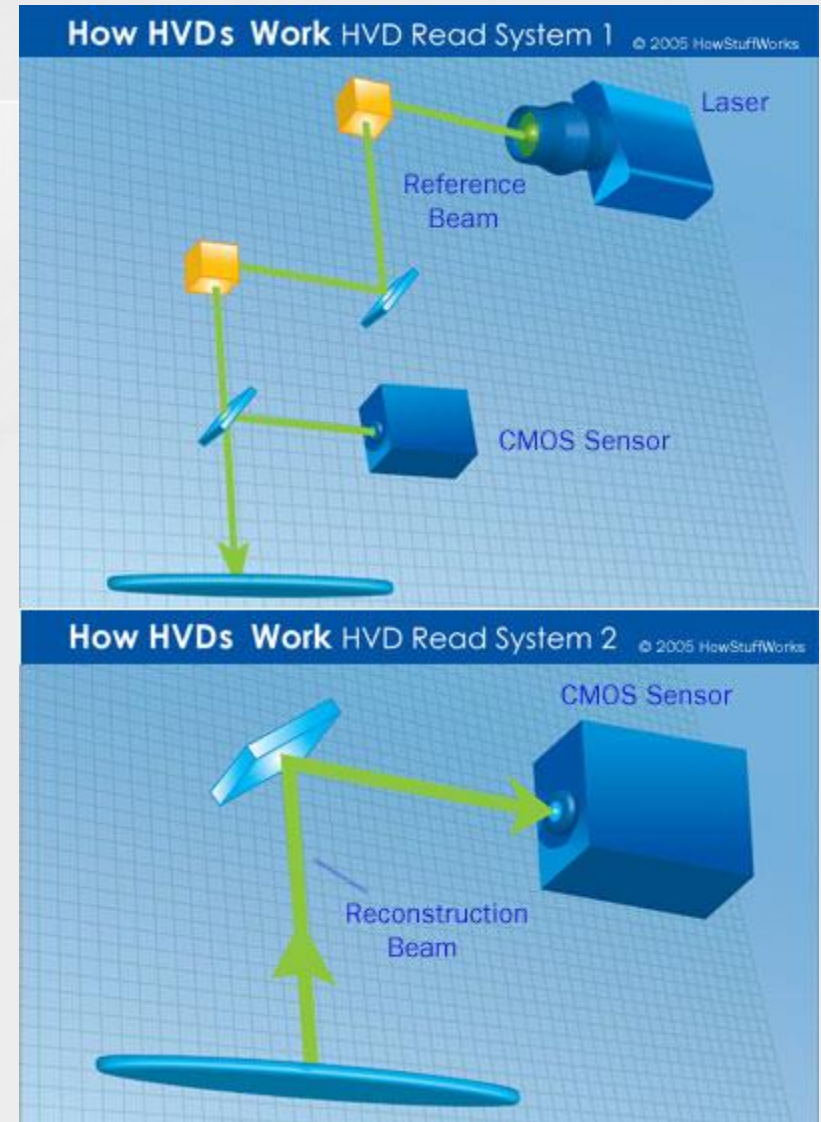
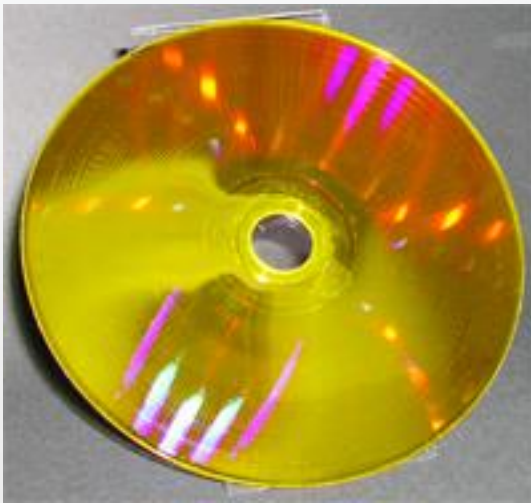


Page data (left)
stored as
a hologram (right)



To read the data
from an HVD

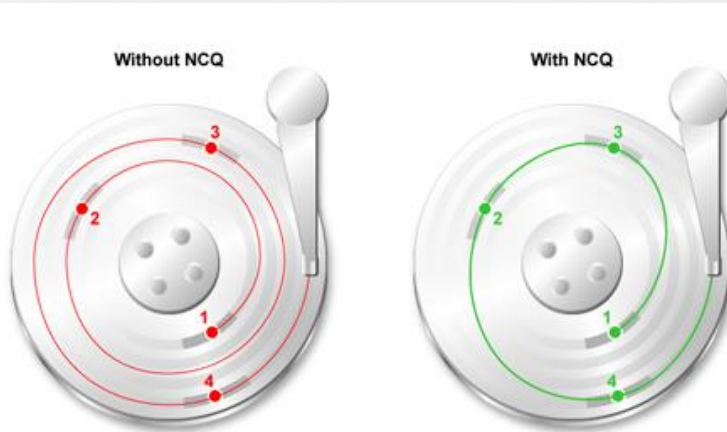
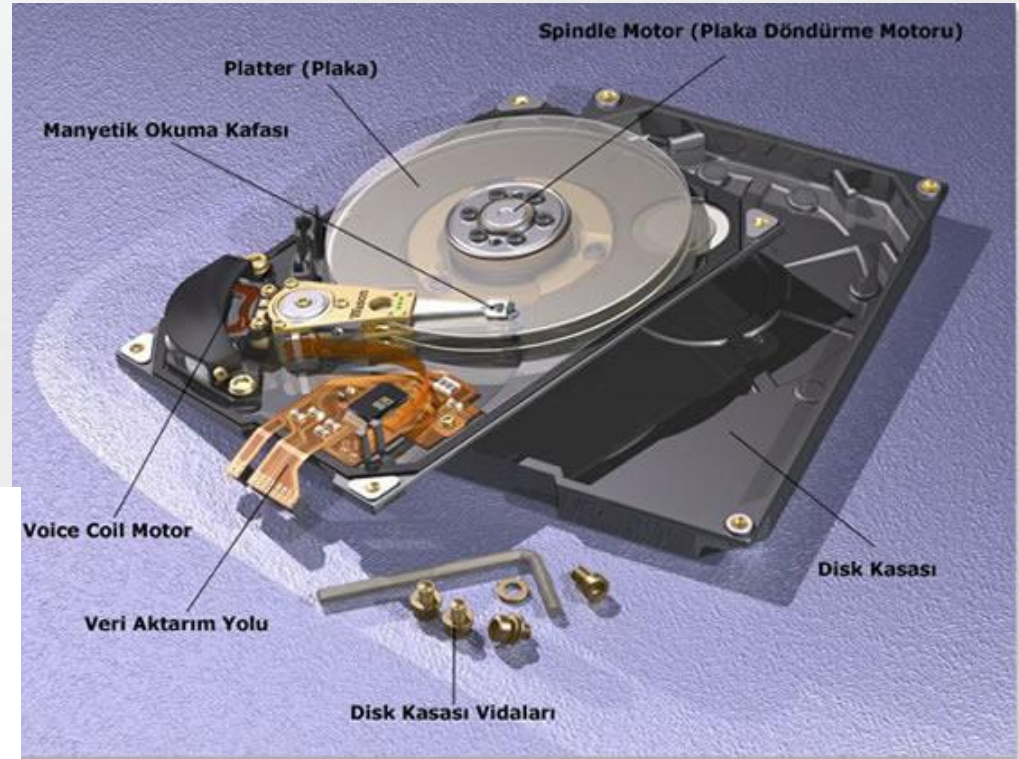
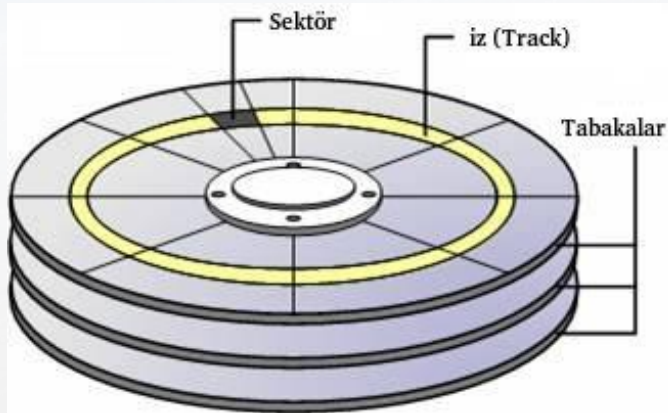
Holographic versatile disc



three technologies

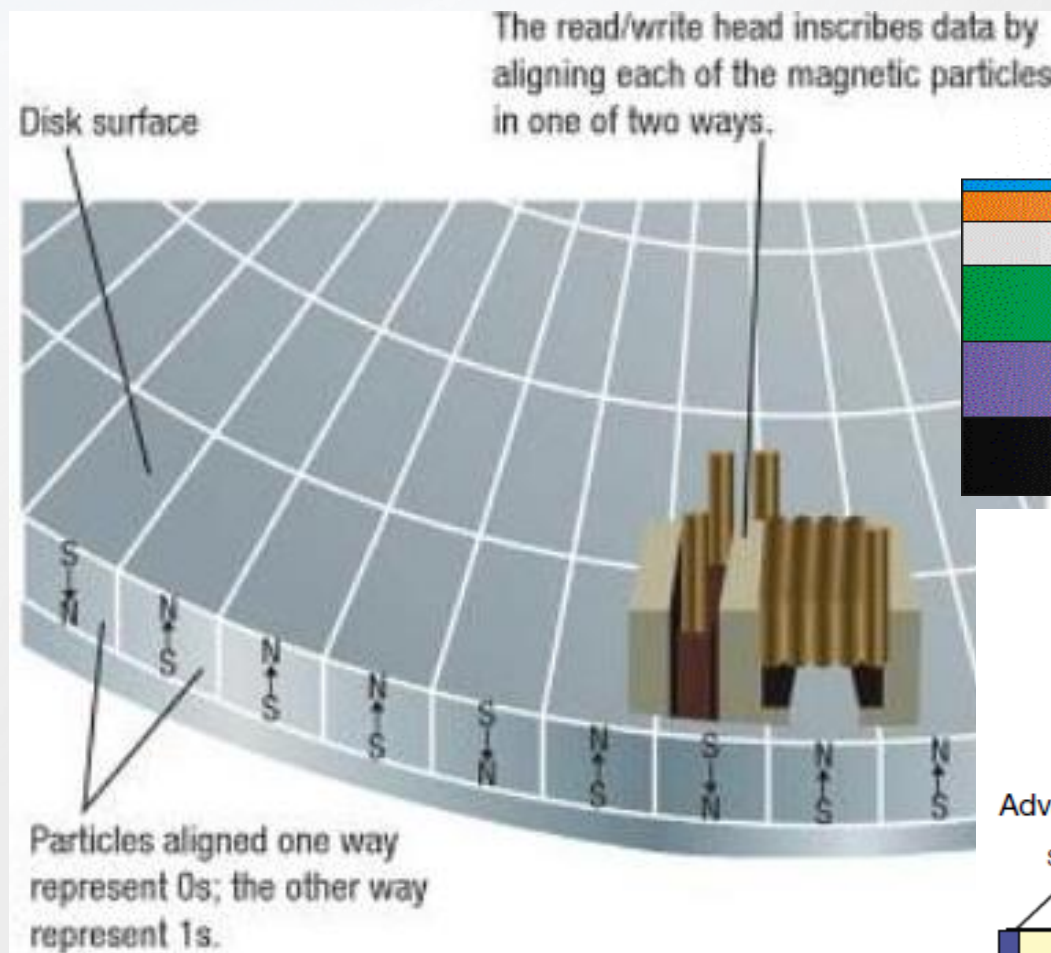
	Blu-ray	HD-DVD	HVD
Initial cost for recordable disc	Approx. \$18	Approx. \$10	Approx. \$120
Initial cost for recorder/player	Approx. \$2,000	Approx. \$2,000	Approx. \$3,000
Initial storage capacity	54 GB	30 GB	300 GB
Read/write speed	36.5 Mbps	36.5 Mbps	1 Gbps

Harddisk, tracks, clusters, sectors



Harddisk drive (HDD) magnetic recording

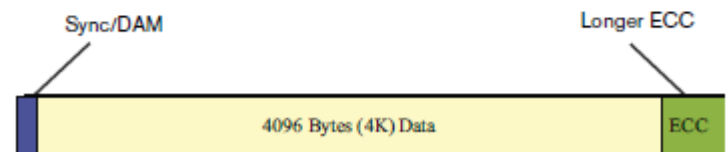
HDD layers



Lubricant, ~1 nm
Carbon overcoat, <15 nm
Magnetic layer, ~30 nm
Cr underlayer, ~50 nm
Ni-P sublayer, ~10,000 nm
Metal substrate

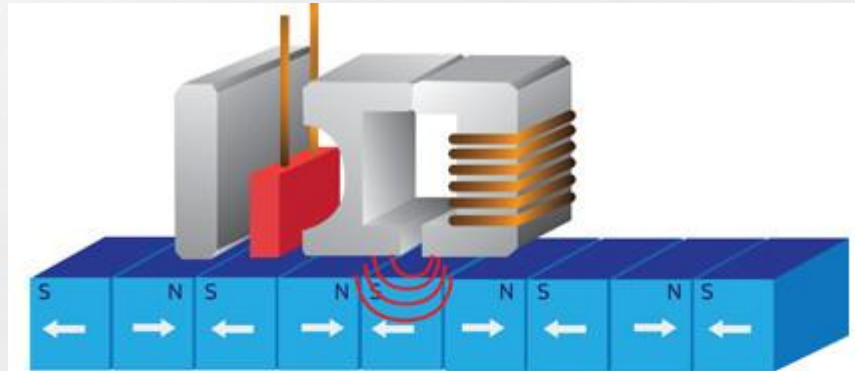


Advanced Format Architecture

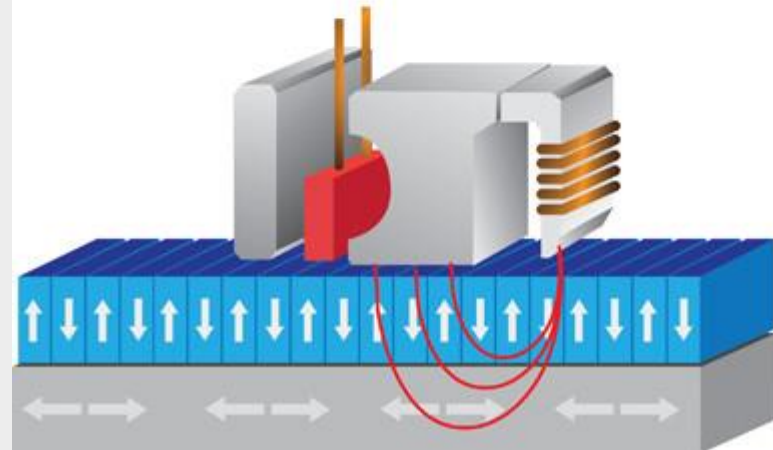


Harddisk LMR vs PMR recording

Longitudinal magnetic recording (LMR)

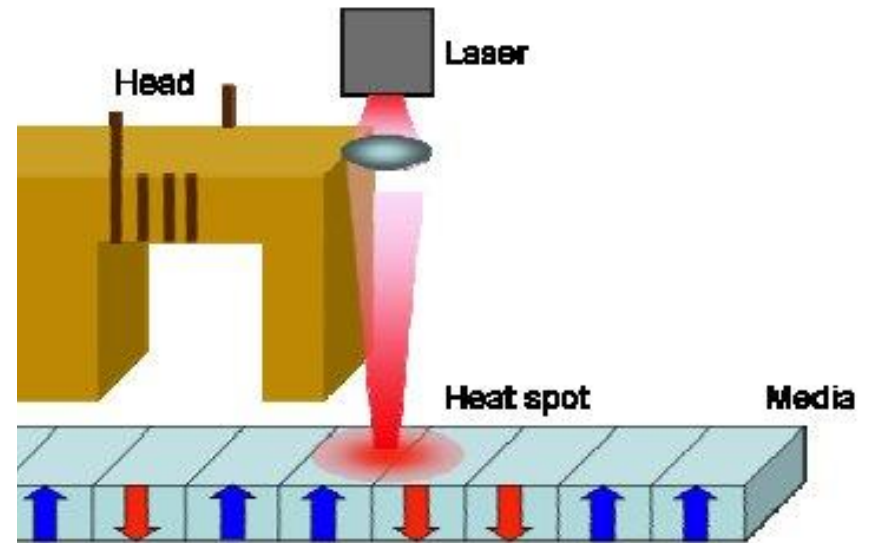
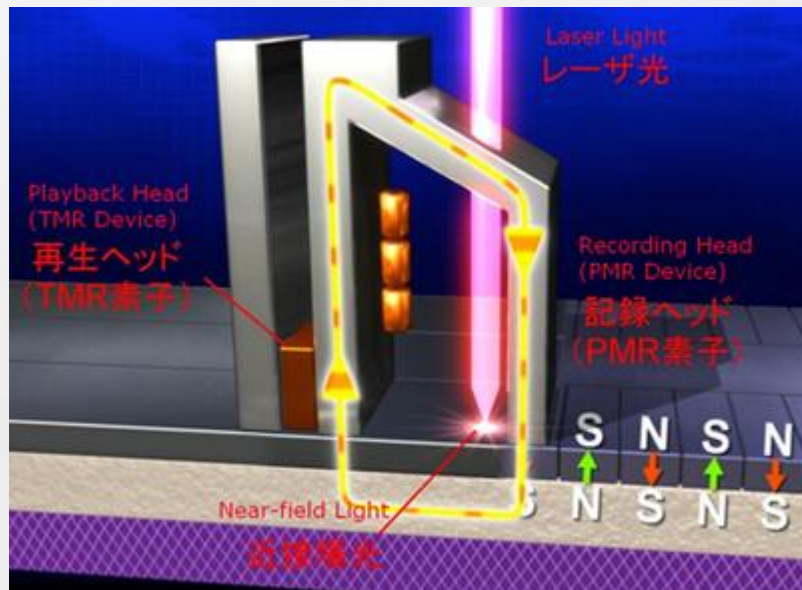


Perpendicular magnetic recording (PMR)

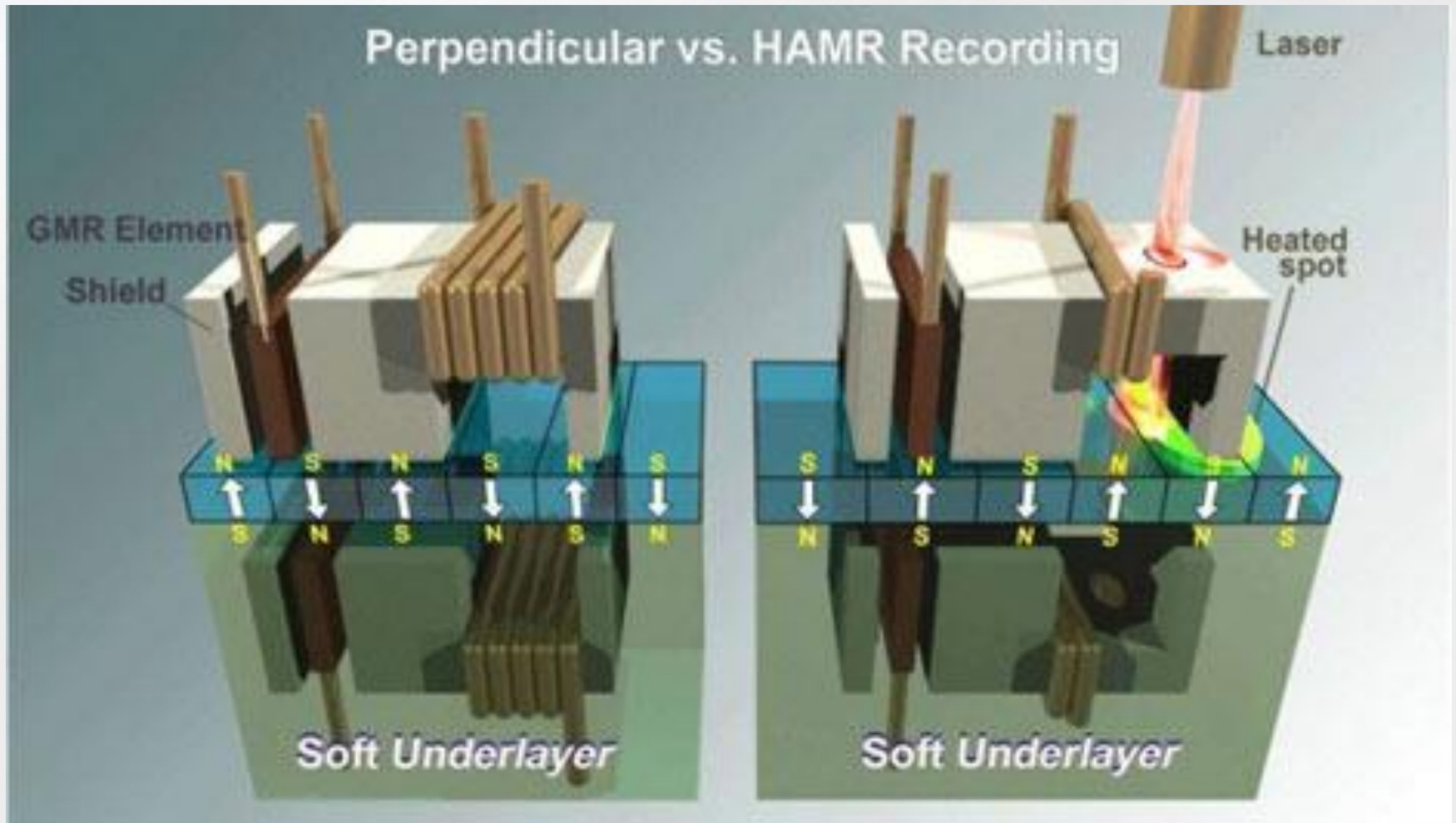


The next technology, HAMR recording

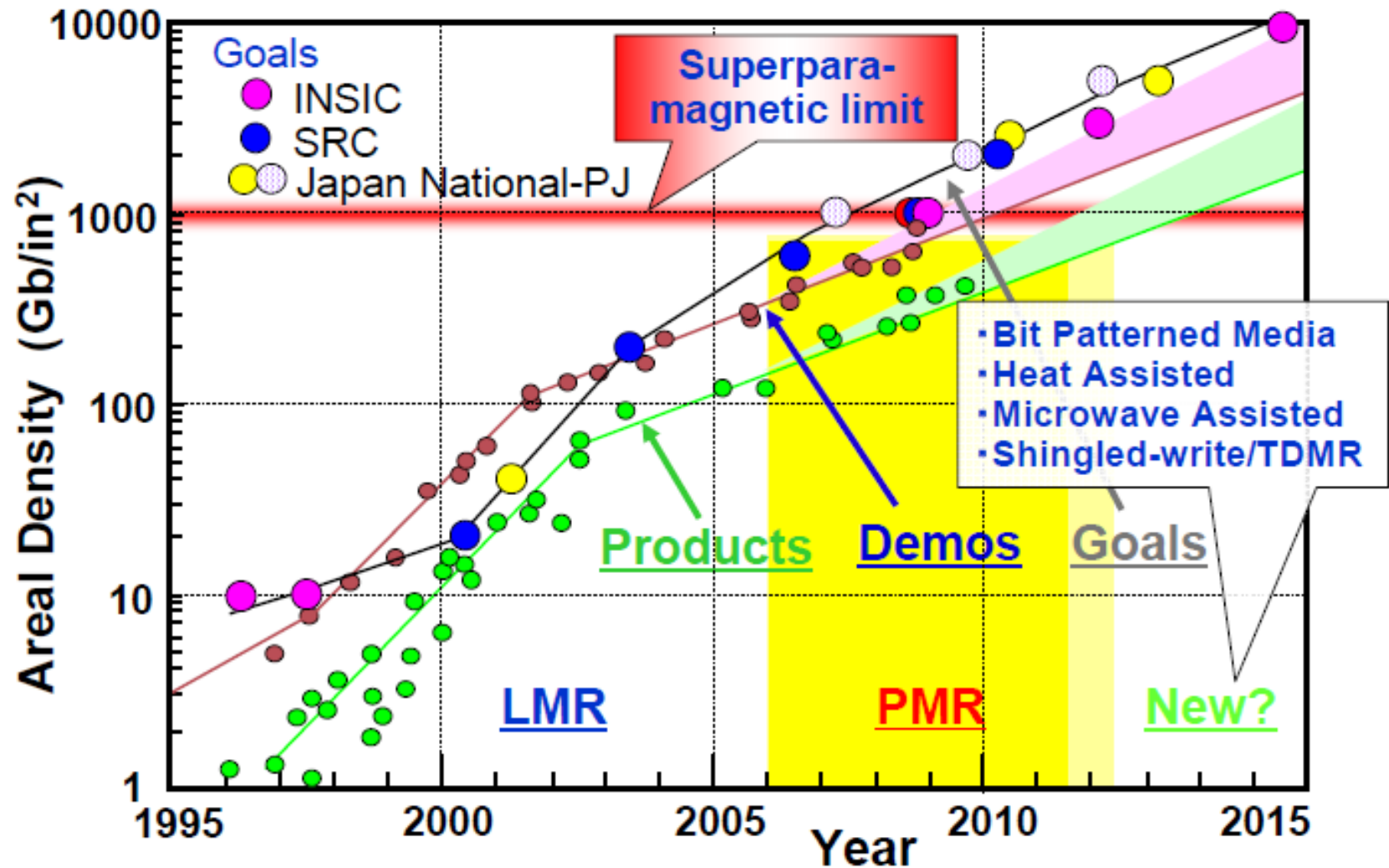
Heat Assisted Magnetic Recording



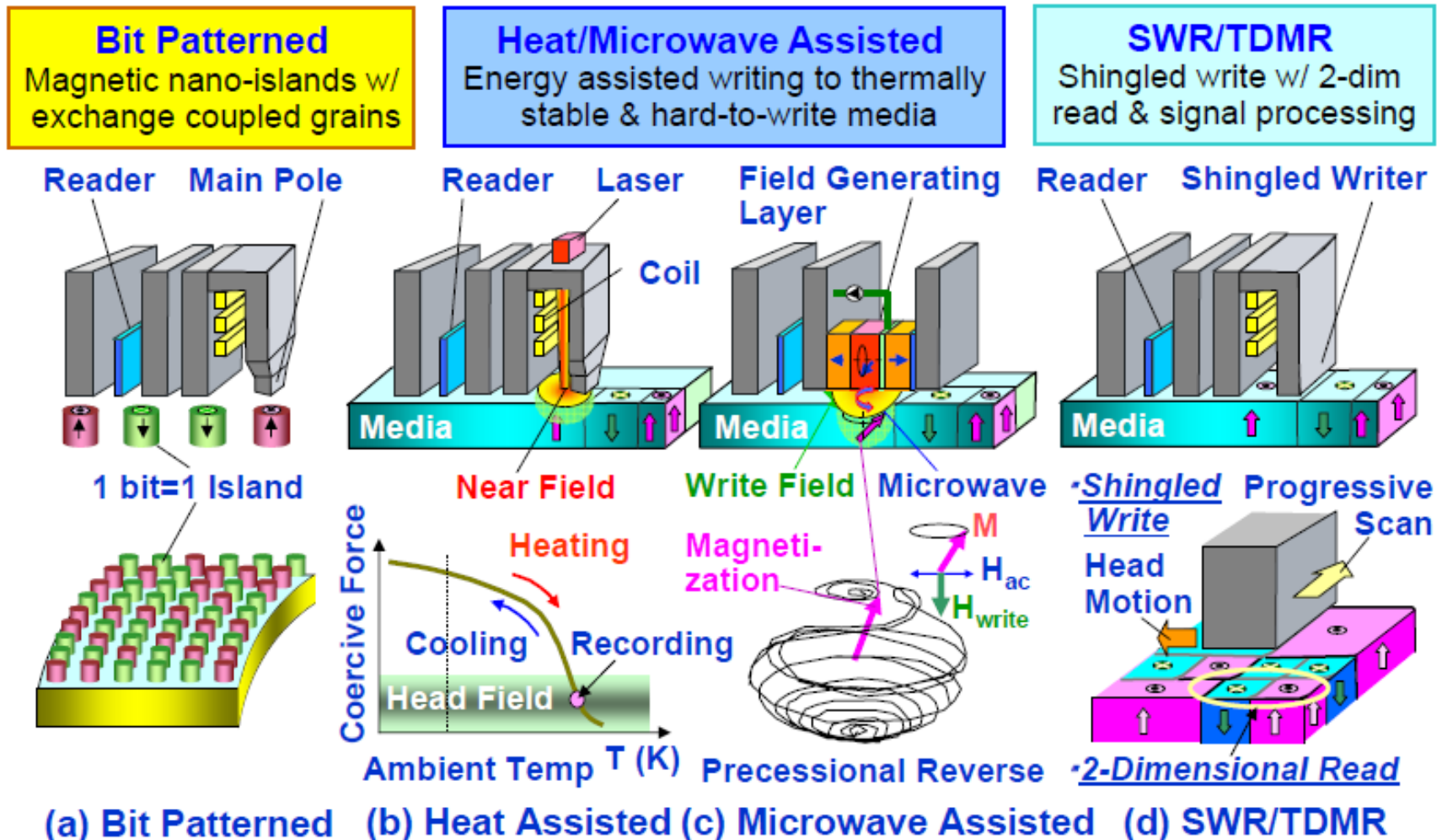
PMR vs HAMR recording



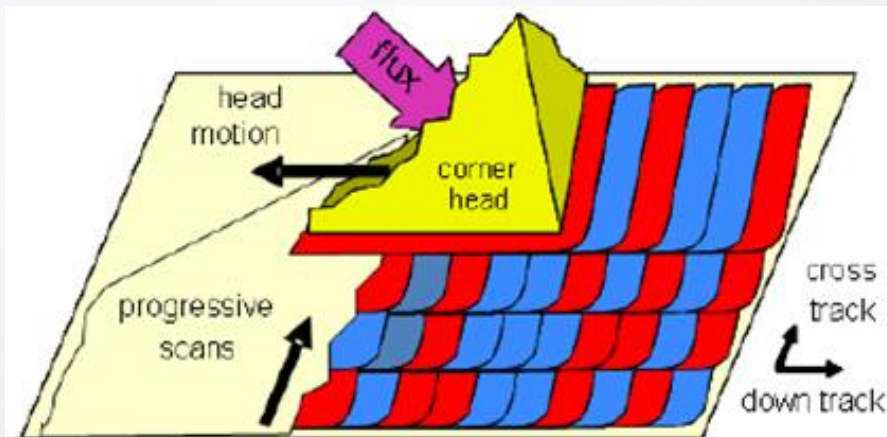
Future Recording Technology Roadmap



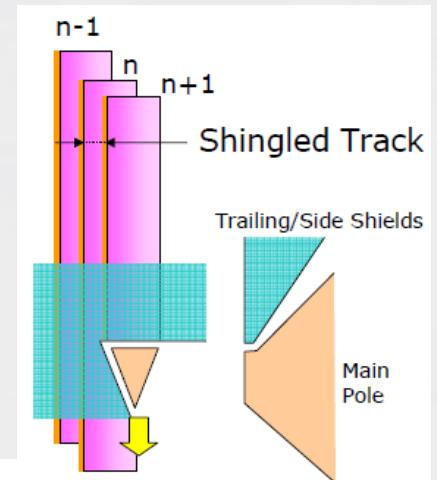
Future Recording Technology Options



SMR Concept - Much 'Stronger' Head



Shingled Writing Head



Corner Writer for Shingle
(PhysWW= $\sim 70\text{nm}$)

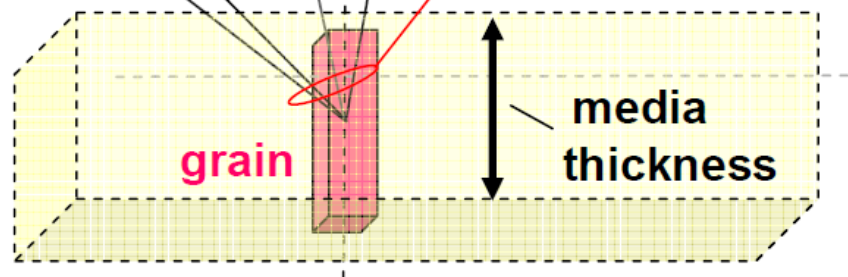
Conventional WAS writer
(PhysWW= $\sim 25\text{nm}$ required for 2Tb/in^2)

Trapezoidal Pole-Tip



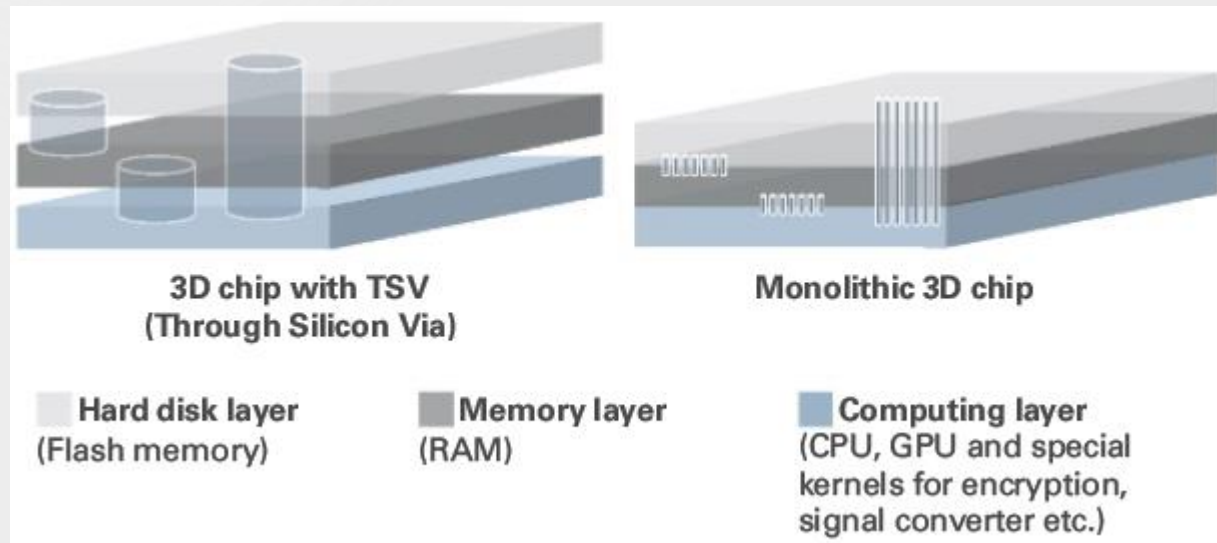
Head field in medium
is proportional to
Solid-Angle

**Solid-Angle shrinks
with pole-tip**



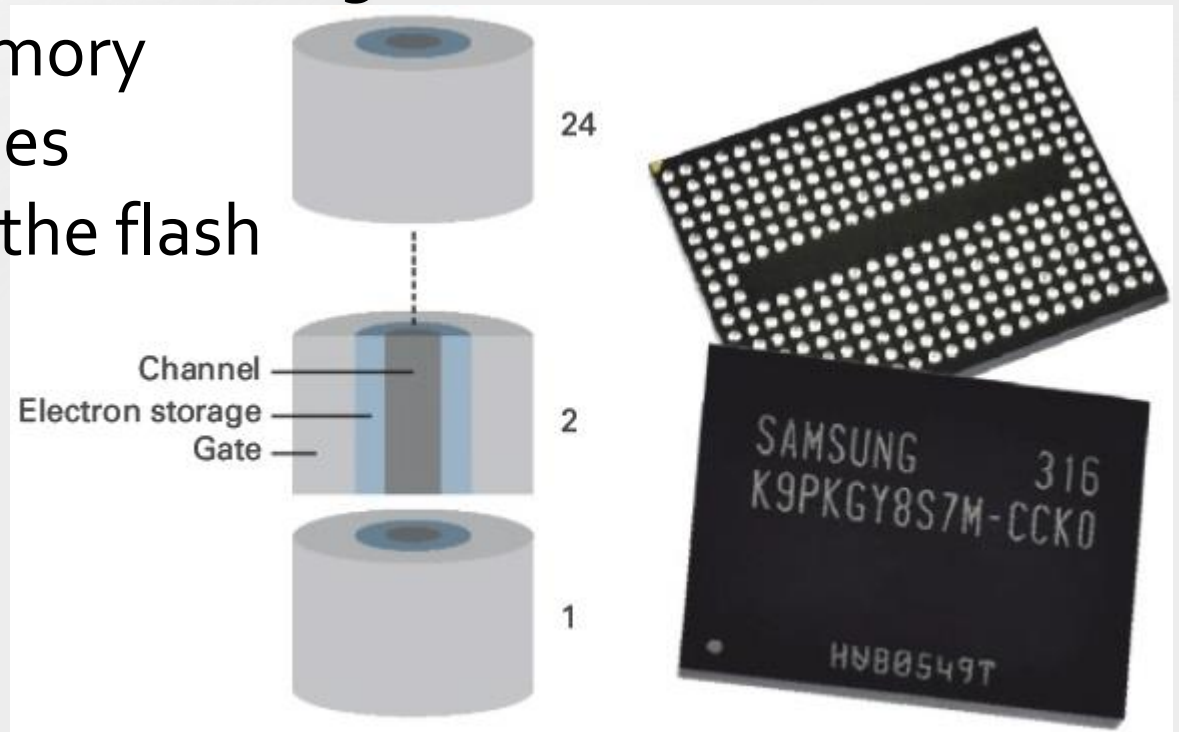
Stacking of computation kernels and memory cells

3D chips allow short data paths between the components. TSV chips, which are made of several wafers, are estimated to be available in 2015. The monolithic 3D chips, which are made of only one wafer, offer significantly more bonding between the layers.



3D Flash for durable Terabyte SSDs

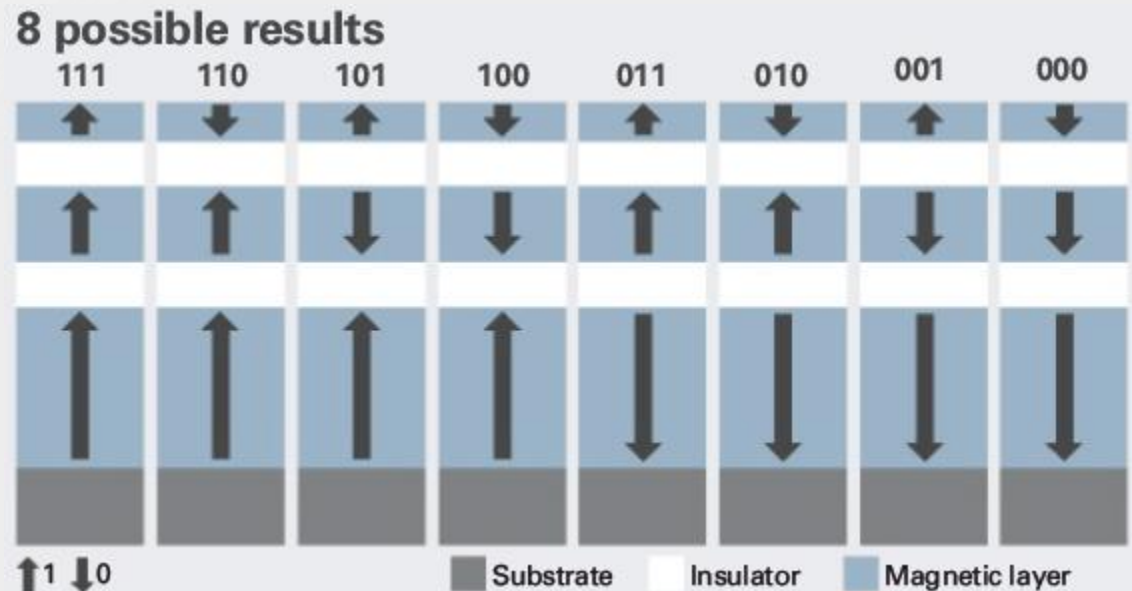
In its V-NAND SSDs, Samsung stacks 24 Flash cells on top of each other. Their electric charge is stored in a silicon nitride layer between gate and channel. This allows higher memory width and increases the service life of the flash cell by ten times.



Hard disks made of several magnetic layers

Magnetic plates too offer three-dimensional storage: a prototype of the Florida International University can magnetize three vertically grouped layers variably. The read head receives eight possible field strengths, which it interprets

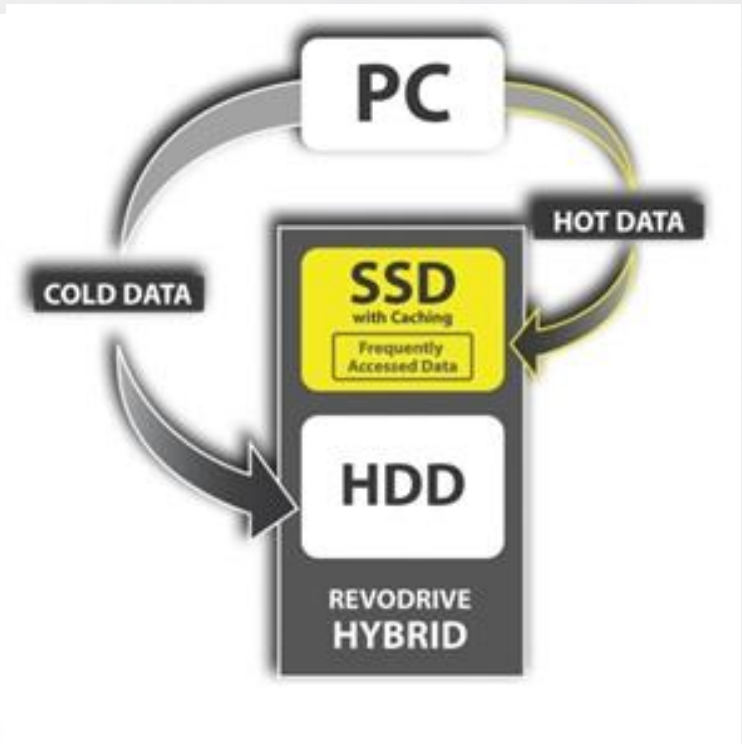
as bit values.
(storage space x 8)



Solid State Disk (SSD), Hybrid drive



Data is stored in flash memory chips located inside the drive; there are no moving parts like in magnetic hard drives.



Hardwares - Transmission Devices

- ATAPI
- IDE
- RS232
- COM,
- LPT
- USB 3
- PCMCIA
- Ethernet
- Modem
- Wireless



S-Video, DVI ve SVGA/XGA çıkışları

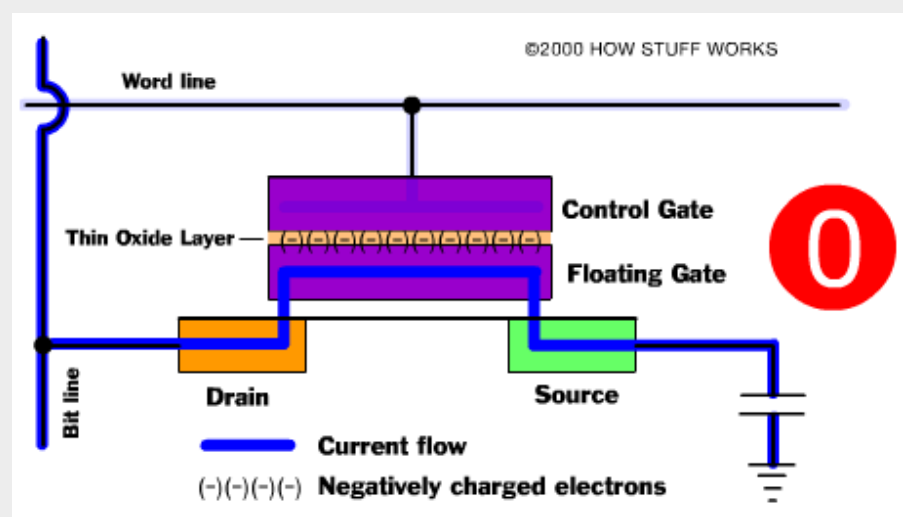
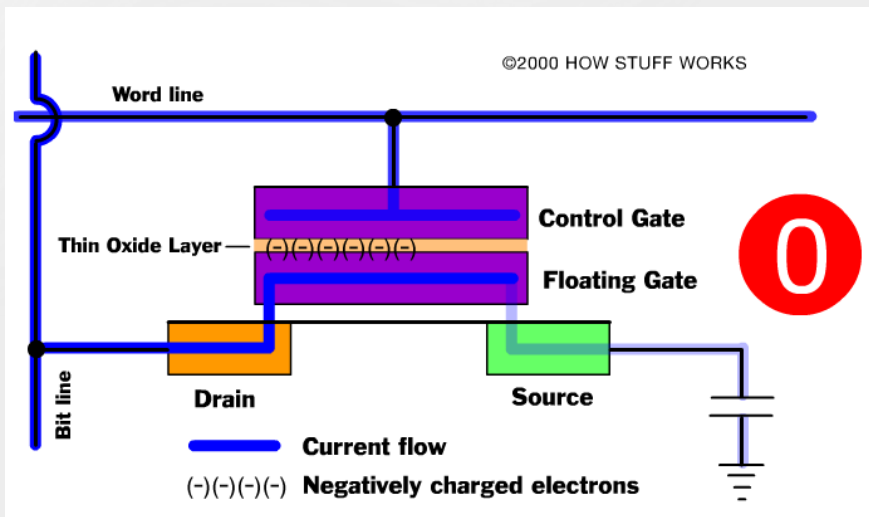
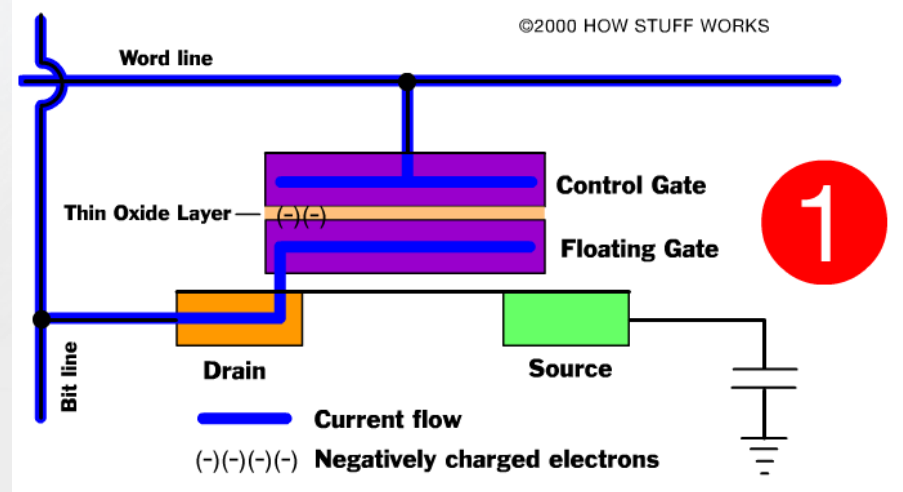
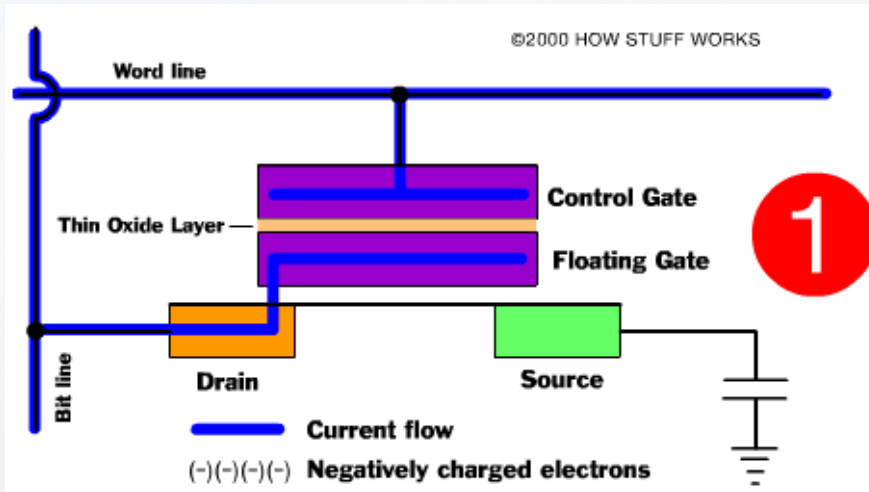


Pin

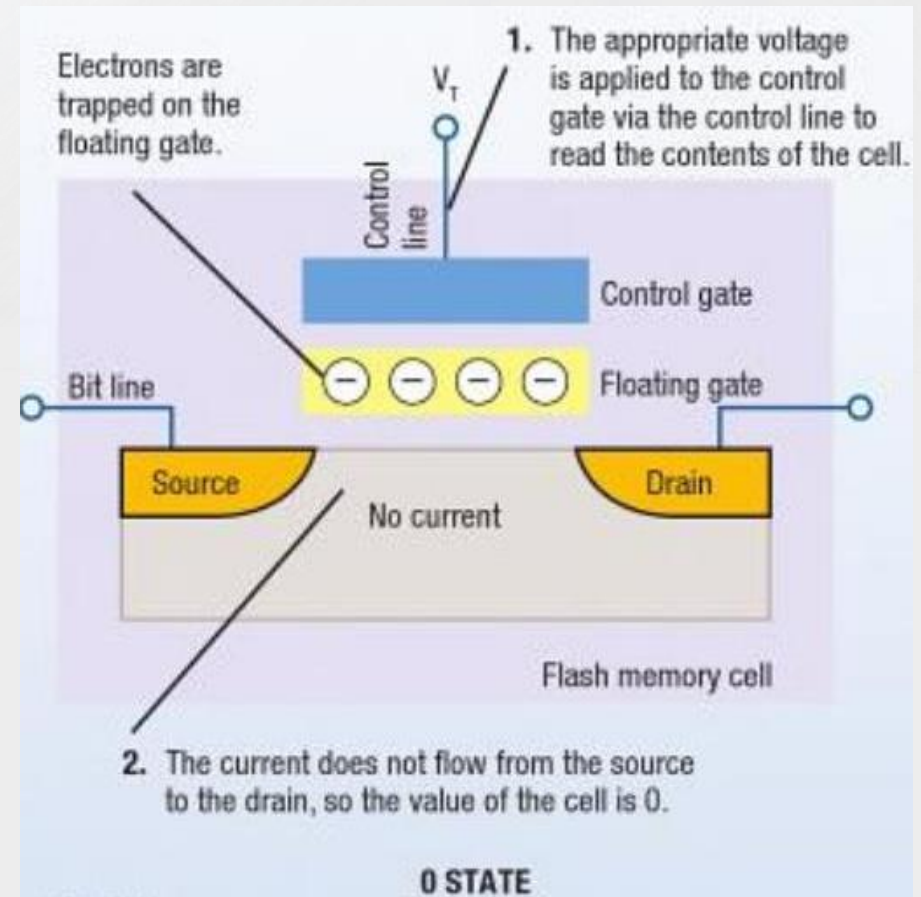
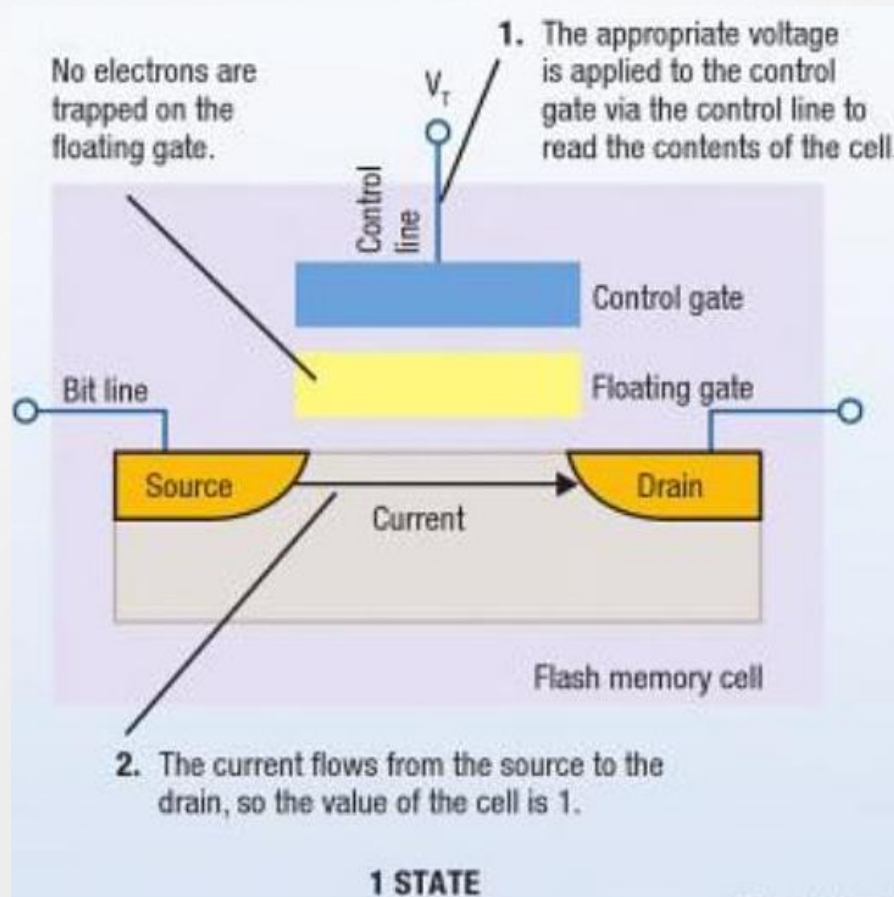
Port



How Flash Memory Works

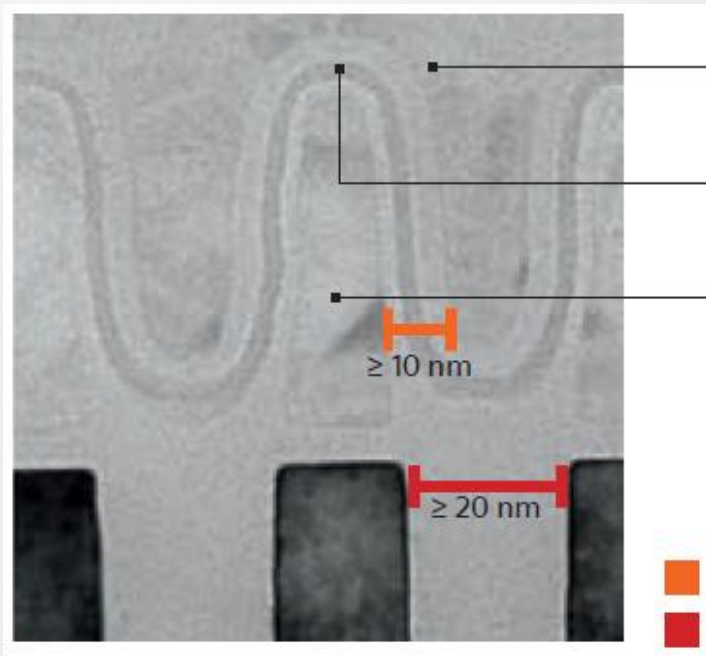


How Flash Memory Works



2D flash cell size limit

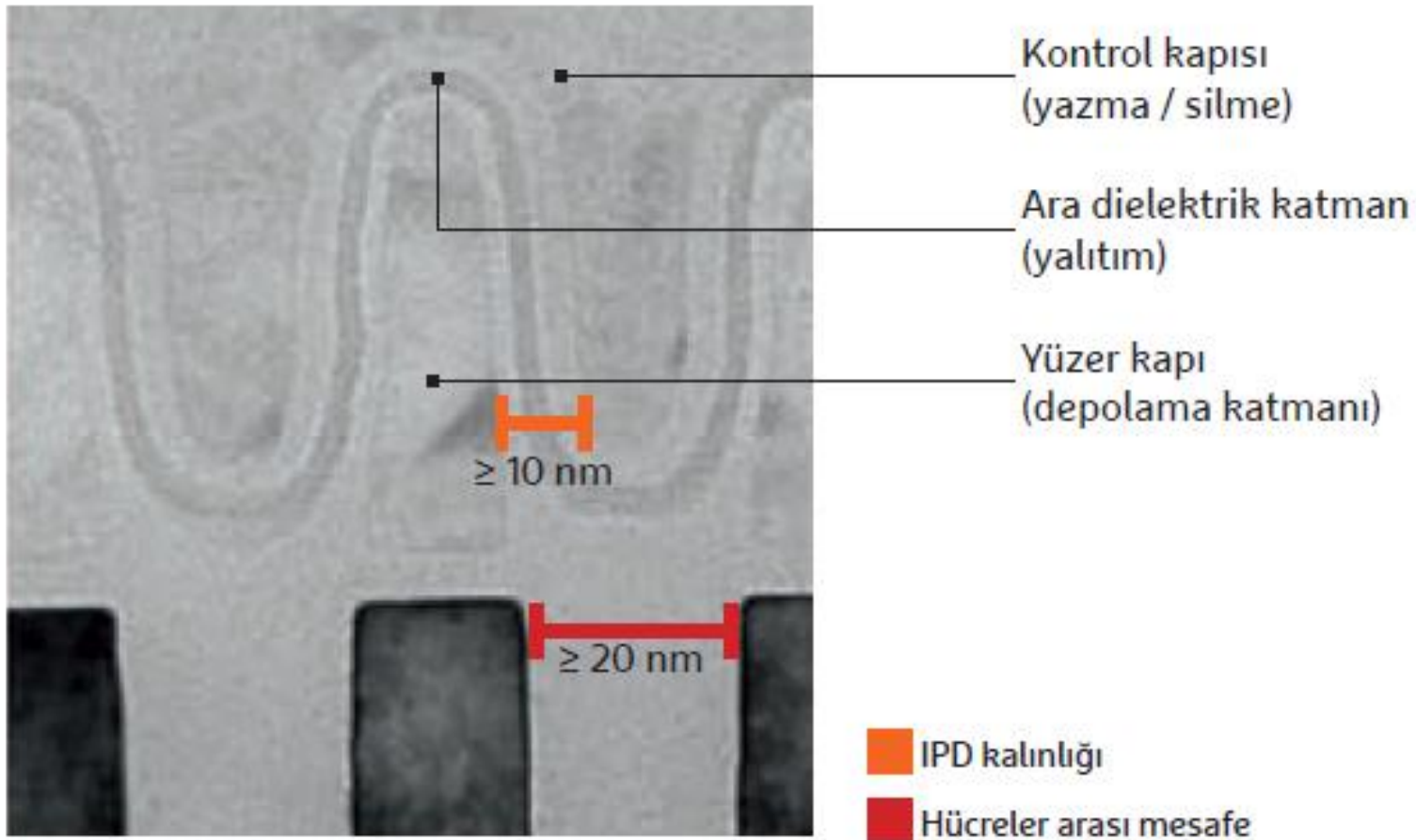
Flash cells save the electric data in floating gate (FG).
The dielectric layer (IPD) isolate the floating gate.



control gate (write/delete)
dielectric layer (isolation)
floating gate (store layer)

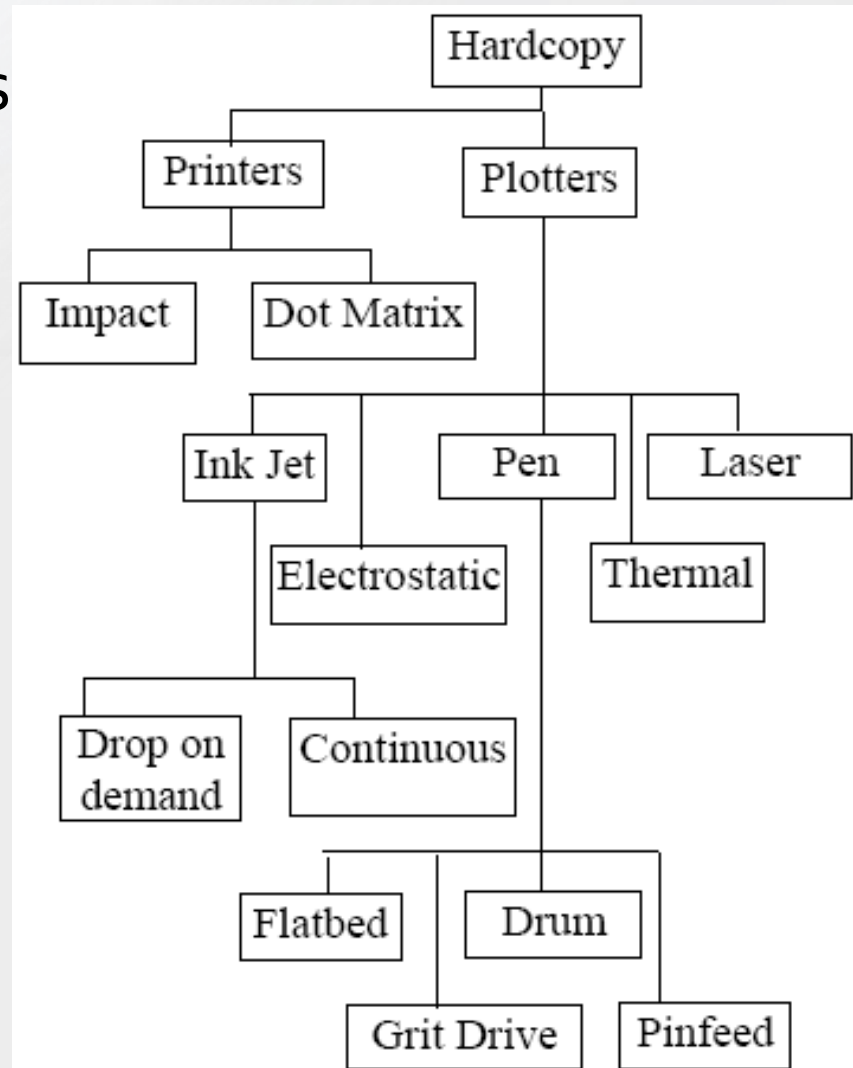
-- IPD thickness
-- Cell distance

2B flash hücreleri küçültme sınırı



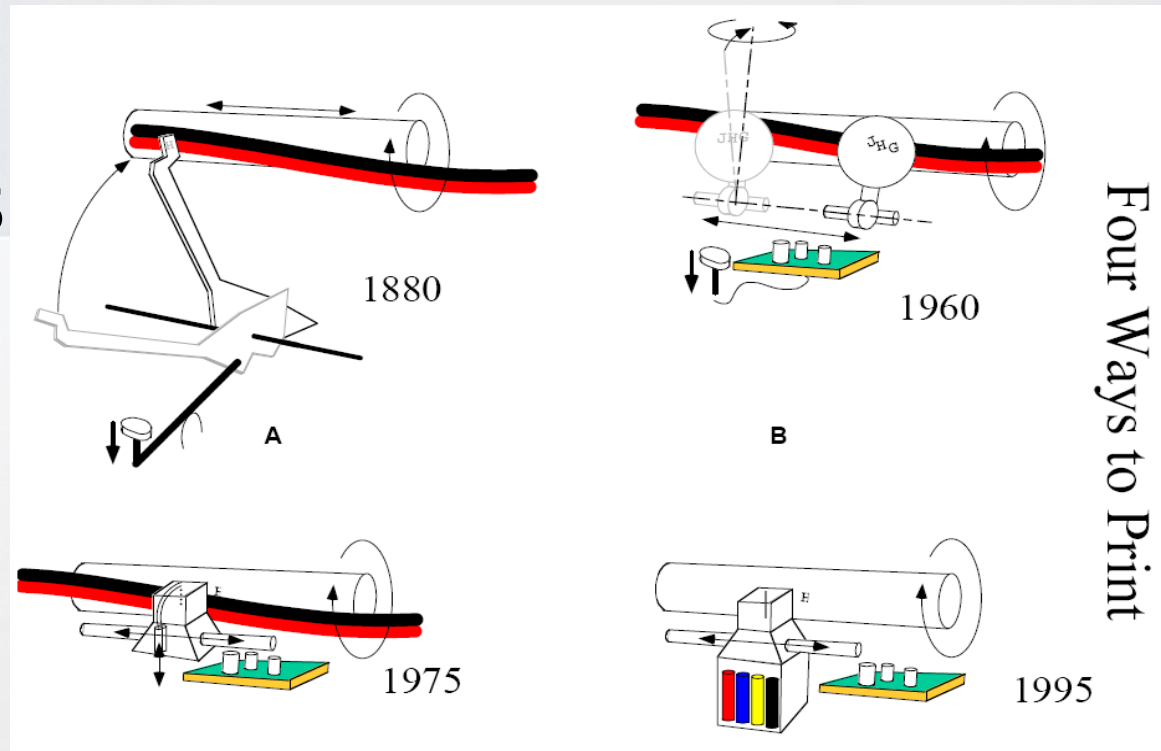
Hardwares - Output Devices

- Hardcopy Technologies



Output Devices

- pin printer
- inkjet printer
- laser printer
- pen plotter
- inkjet plotter



Hardwares - Output Devices

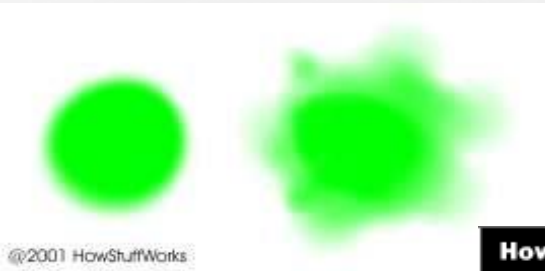
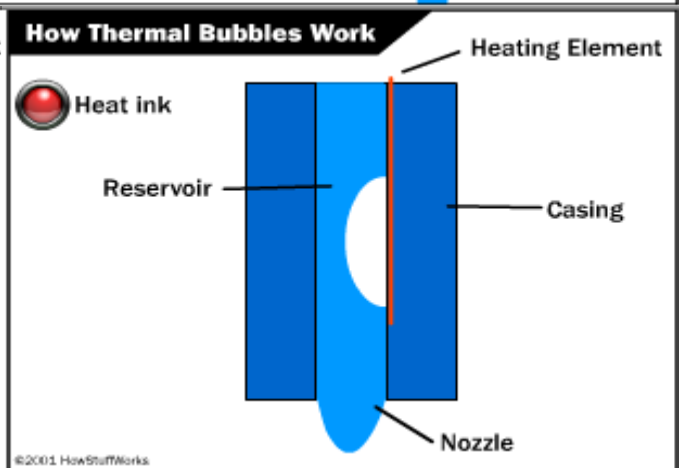
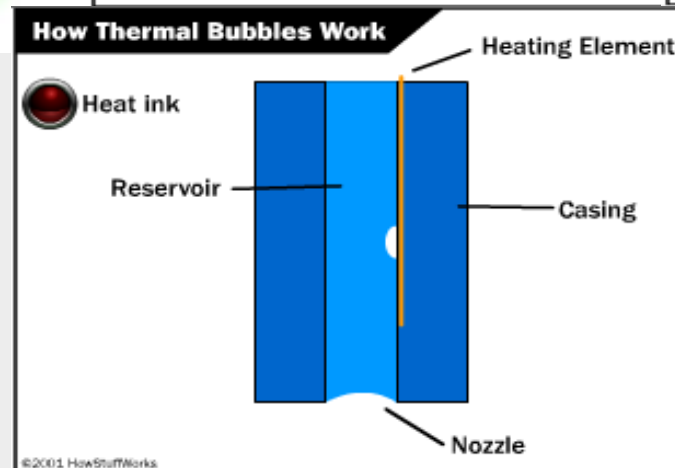
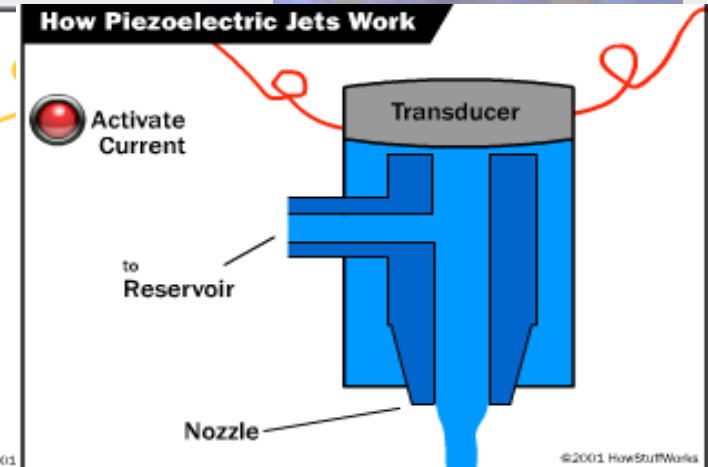
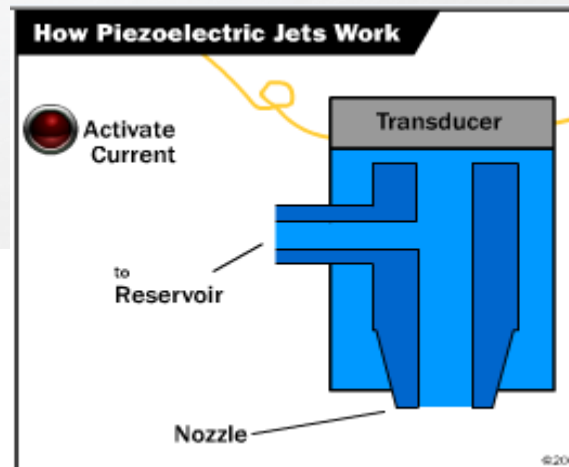
Printers

Comparing 4 Ways to Print

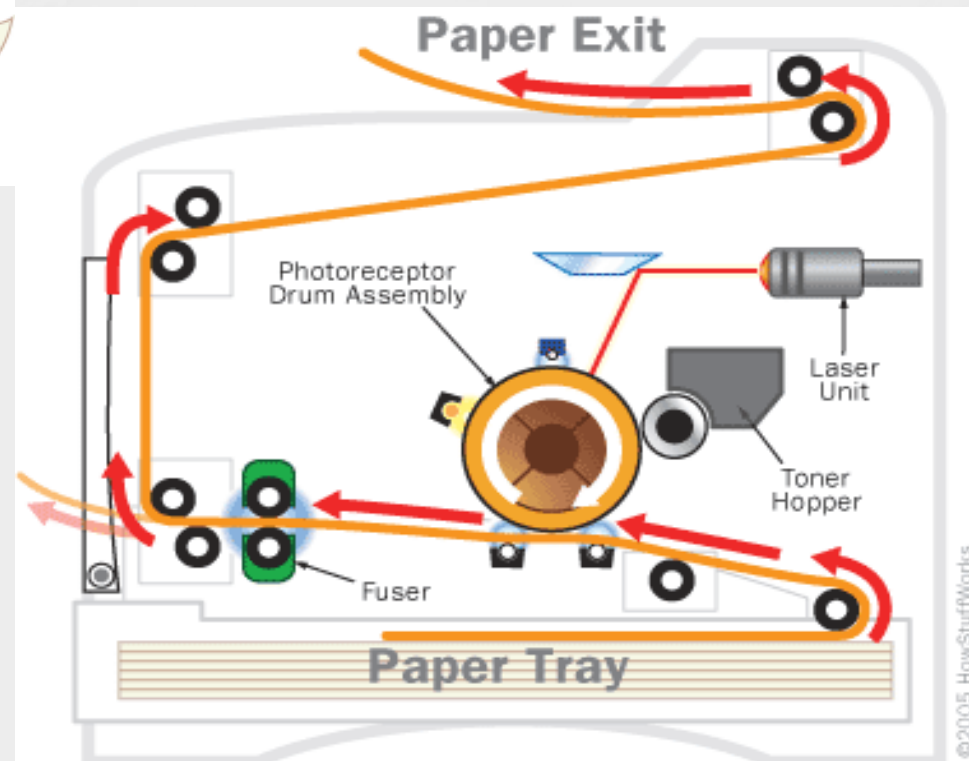
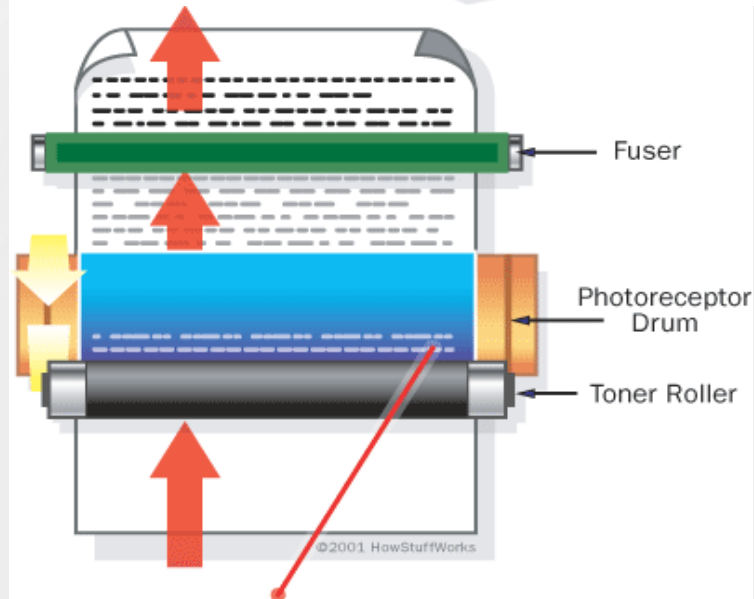
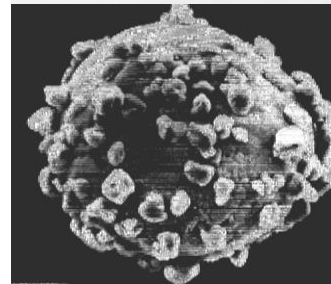
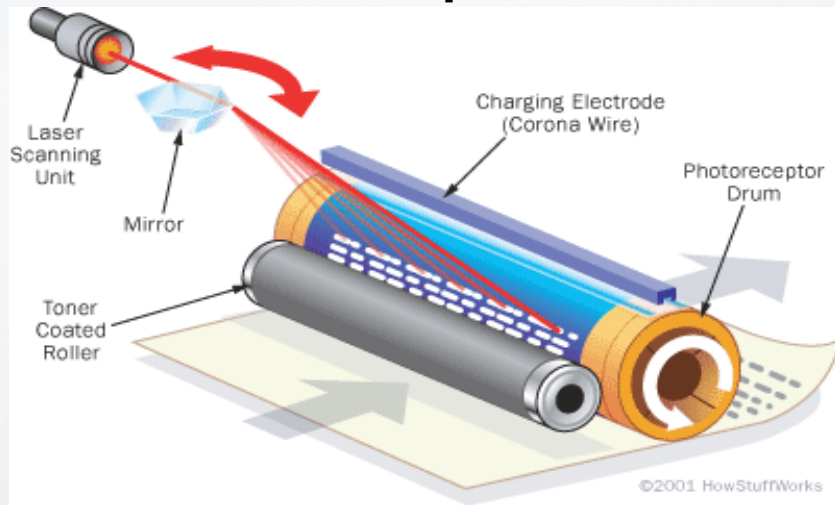
	Typewriter	Ballhead	Dot Matrix	Inkjet
Basic actuation method and power source	Manual, complex linkages	Manual input, solenoid actuation, simple linkages	Electro-magnet for each dot maker	Piezo-electric for each color of ink
# DOF	Carriage: 2 Ribbon: 2 Keys: 1 each*50+ keys*many links/key Key carrier: 1	Platen: 1 Ribbon: 2 Keys: 1 each*50+ keys electrically actuated Ball carrier: 3	Platen: 1 Ribbon: 2 No keys Dot carrier: 1 Each dot: 1	Platen: 1 No ribbon No keys Jet carrier: 1
# of parts	Many hundreds	Hundreds	25-50	10-20
Structure	Heavy metal	Heavy metal	Metal and plastic	Almost all plastic
Shapes printed	Fixed character shapes	Fixed character shapes but different balls have different fonts	Unlimited shapes but low resolution	Unlimited shapes and high resolution
Colors	Two	Two	Two	Unlimited
Media	Paper, two or three sheets	Paper, several sheets	Paper, many sheets	Any, but one sheet
Assembly	Manual, lengthy, tedious	Manual, lengthy, easy	Automatic & manual	Manual, quick, easy

Output Devices

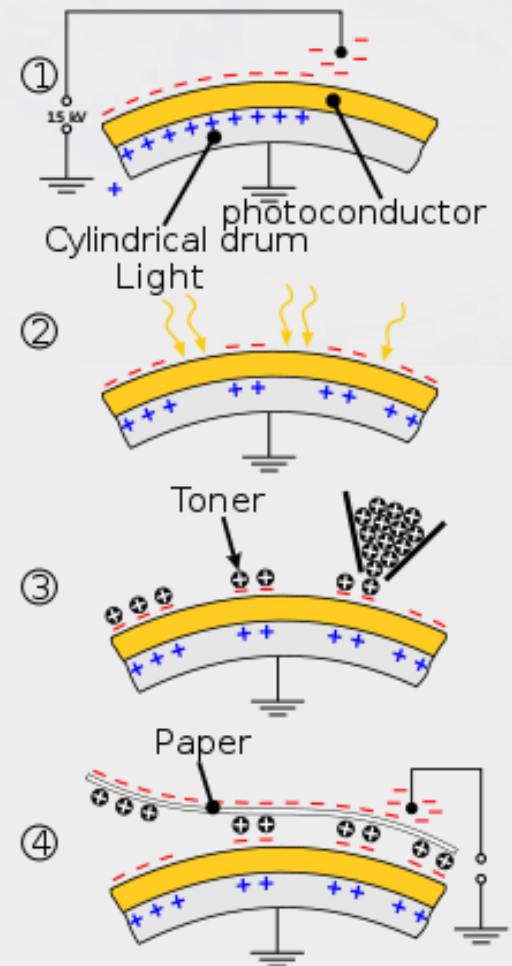
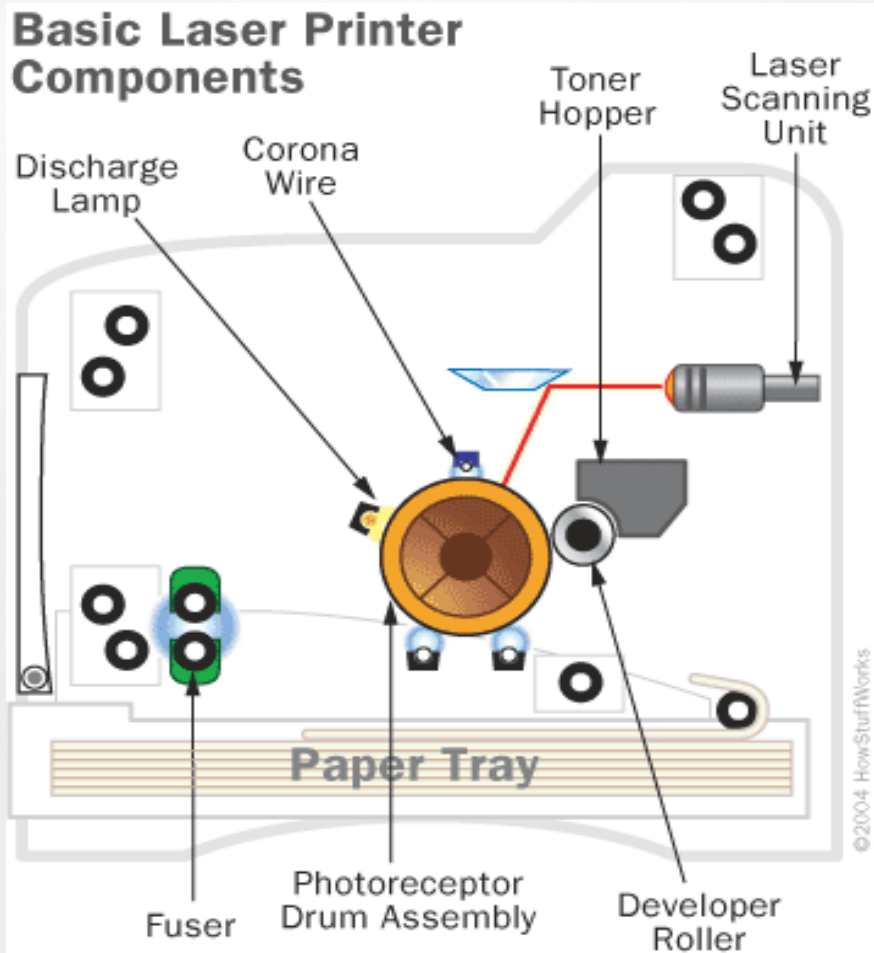
- inkjet printer
- inkjet plotter
- inkjet-nozzle
- Ink dots



How laser printer works

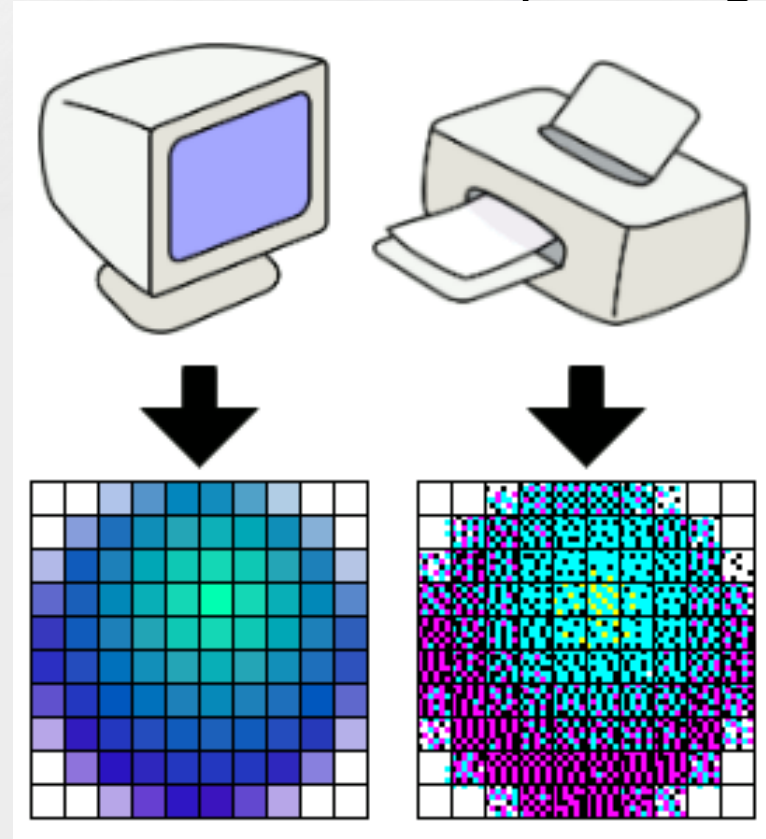


Xerographic_photocopy_process



Dots per inch

DPI measurement in monitor resolution and printing



3D printing, stereolithography (STL)

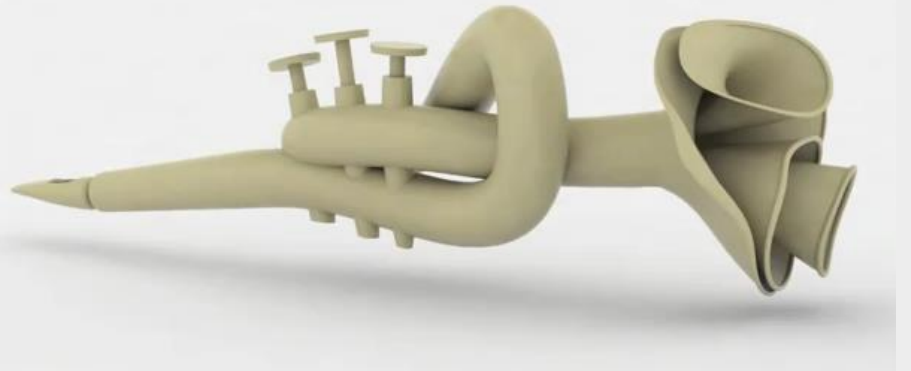
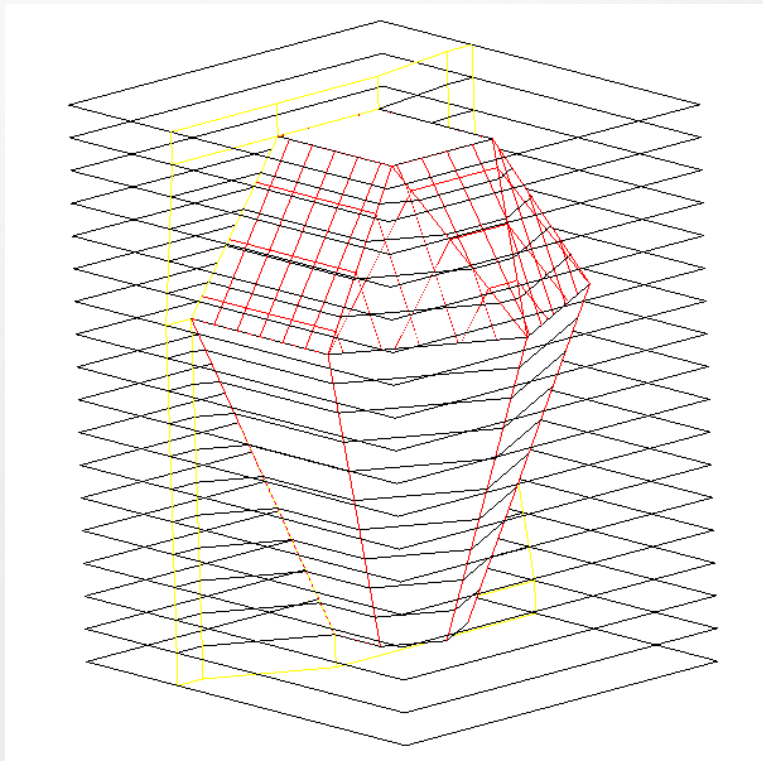


3d printed flute



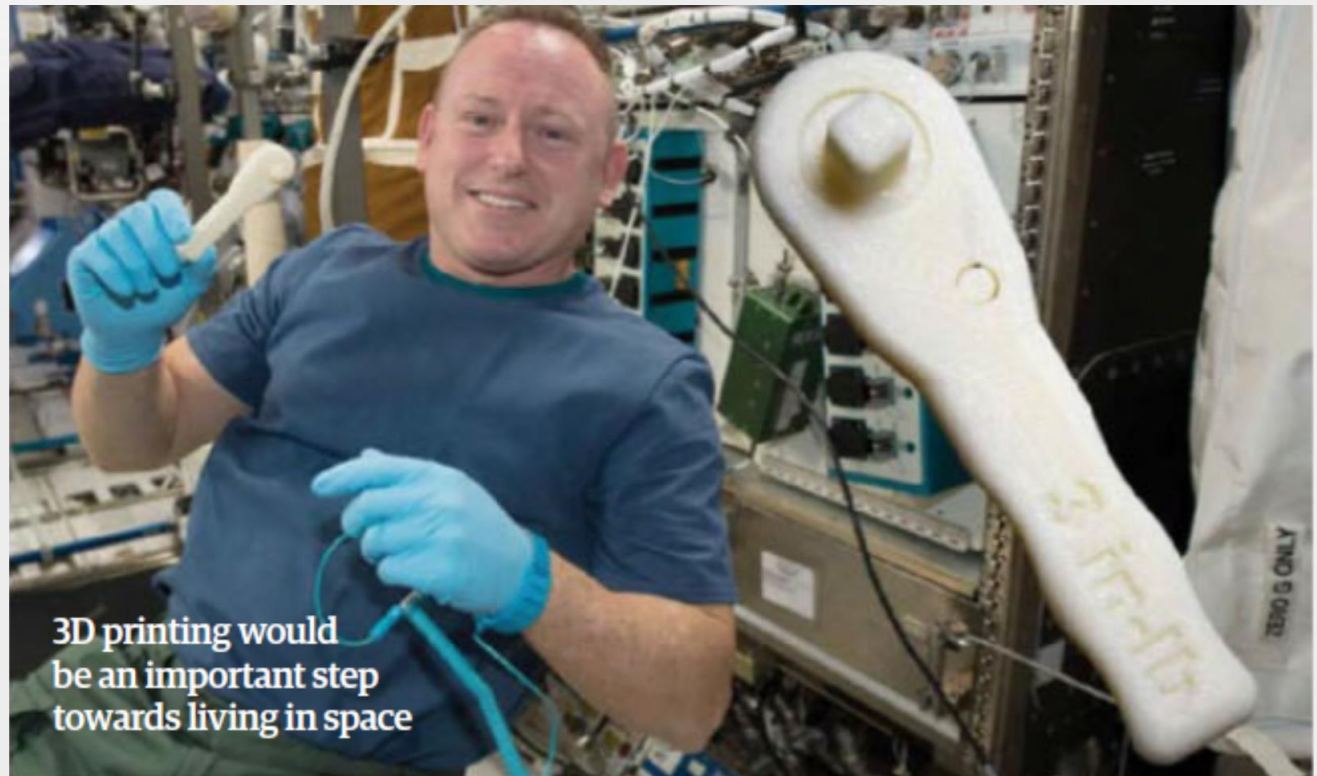
3D printing

- Slice the STL file into thin cross-sectional layers



3D printing without gravity

- In November 2014, NASA astronaut Barry became the first person to use a 3D printer in space. Four hours and 104 layers of plastic later, the wrench was finished.

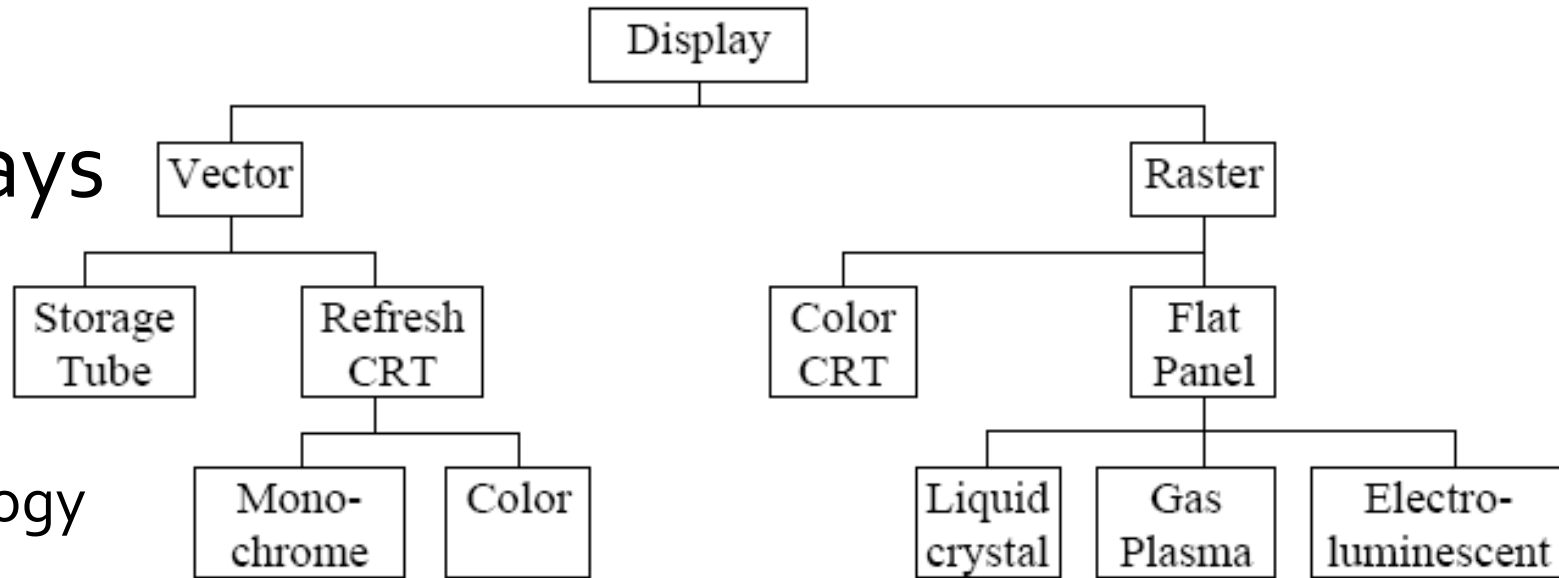


3D printing without gravity

- the wrench design is sent to the ISS for the first test of on-demand printing.
- Operating a 3D printer in space is a huge technical challenge. On Earth, gravity helps the plastic to sit in neat layers as it is extruded, but on the ISS the components would float around.
- Made In Space has tackled this problem with some innovative, but top-secret technology.

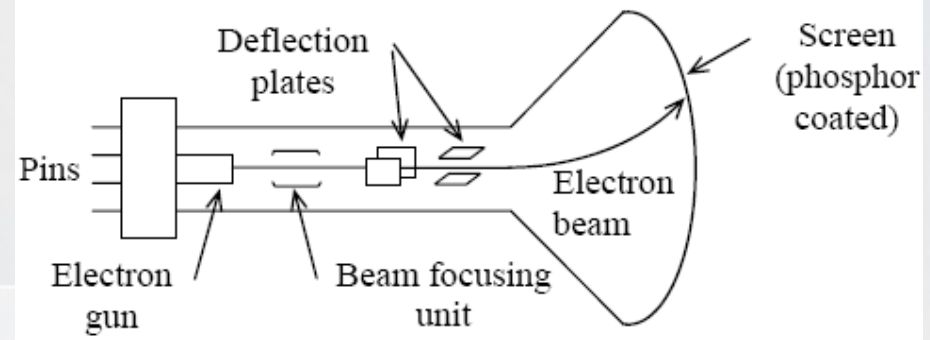
Displays

Display Technology

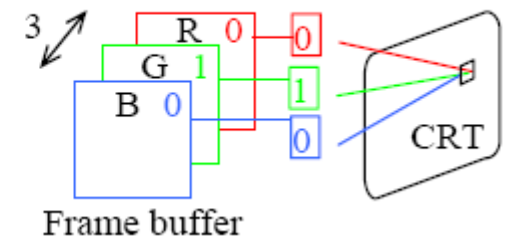
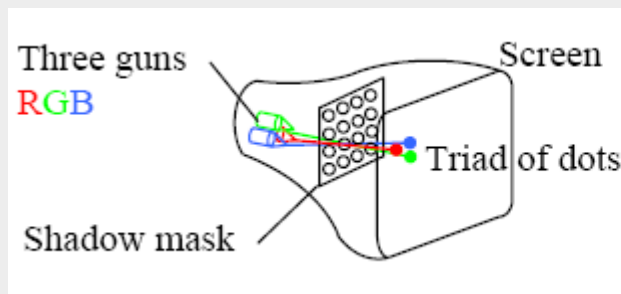
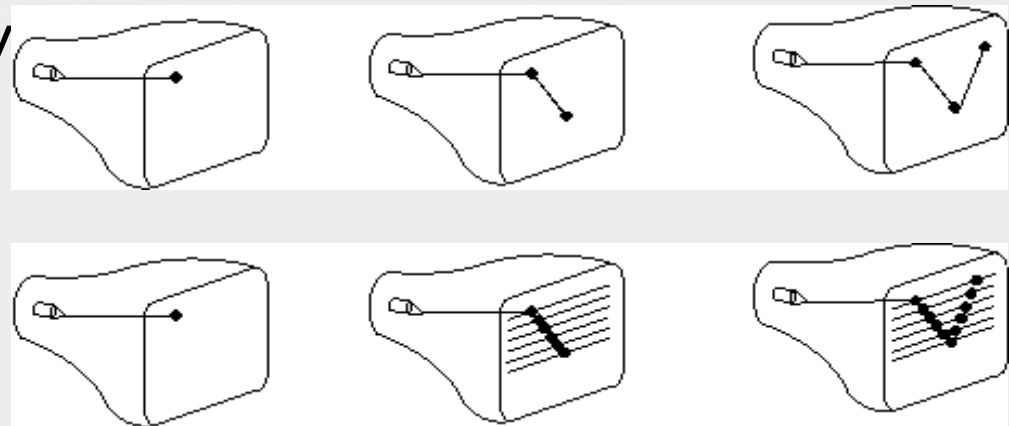


- The cost, resolution, color, and interactivity capabilities must be considered when choosing a display device.
- Resolution refers to the ability of the display to show details.
- Current (year 2014) displays reach a resolution of about 84 inch, 4K, 2160p, 3840x2160, where the numbers refer to separately distinguishable spots on the screen. Standard HD TV, 720p, 1280x720; Full HD, 1080p, 1920x1080; Sony D65 camera, Super Hi vision, 8K, 16x1080p, 8192x4320 resolution.

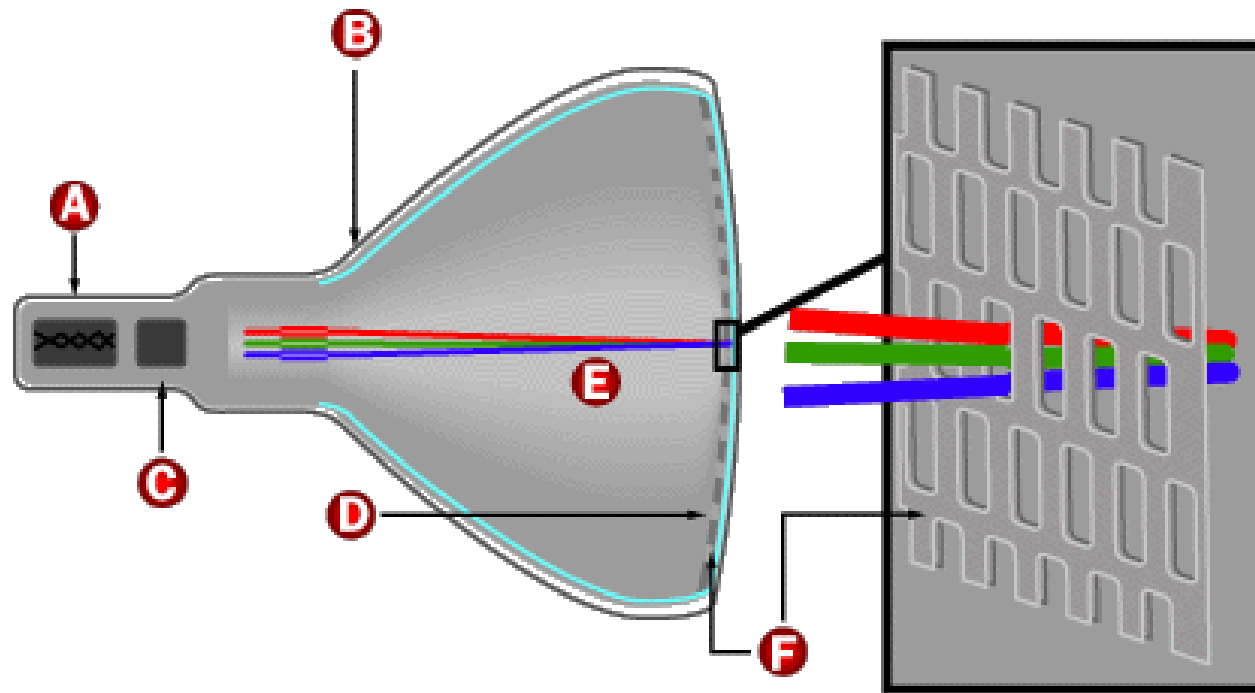
Displays



- Cathode Ray Tube (CRT) (need refreshing)
- Direct View Storage Tube (DVST) (does not need refreshing and up to 4096x4096 res.)
- Vector Refresh Display
- Raster Scan Display
- Color Raster Display



The Cathode Ray Tube (CRT)

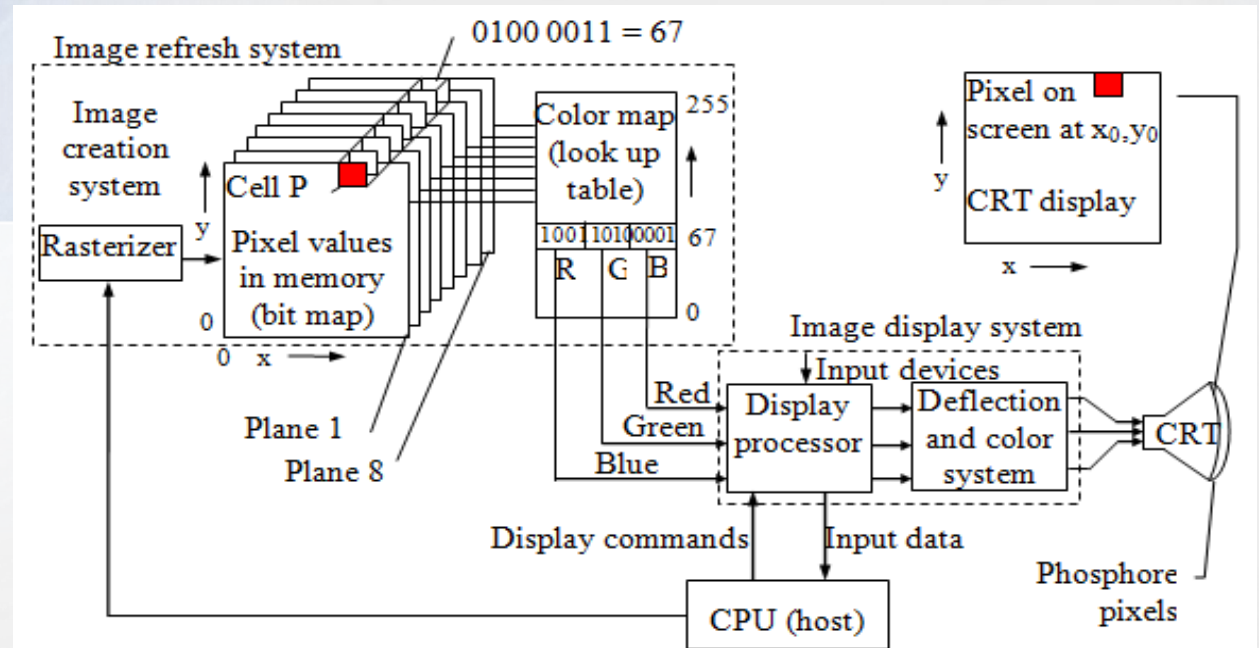


©2000 How Stuff Works

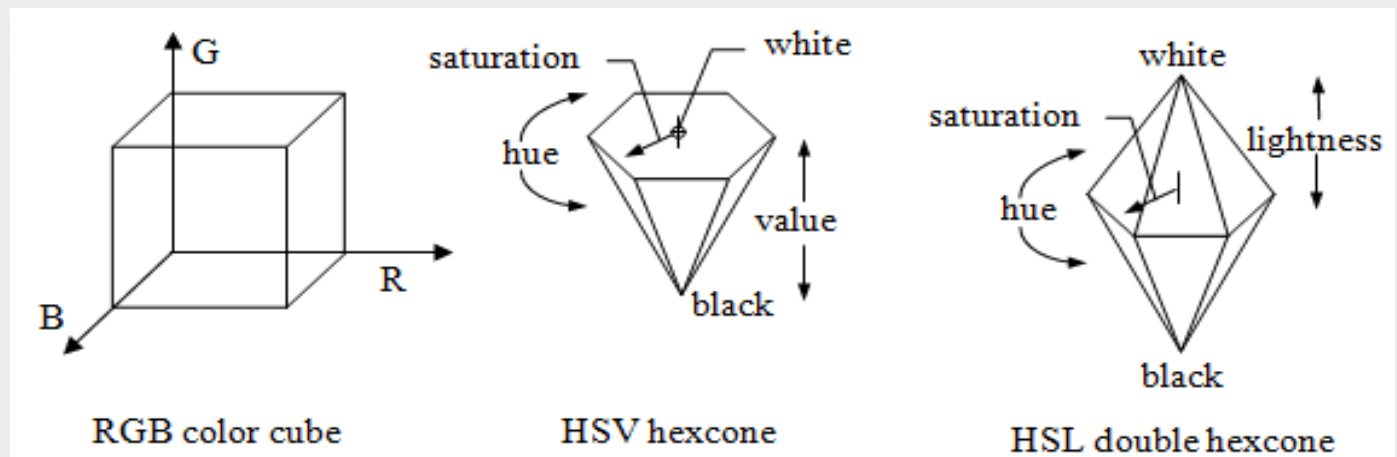
- A** Cathode
- B** Conductive coating
- C** Anode

- D** Phosphor-coated screen
- E** Electron beams
- F** Shadow mask

Displays



A video look-up table. A pixel with value 67 is shown.
Color representation



LCD display

A simple liquid crystal display (LCD) from a calculator

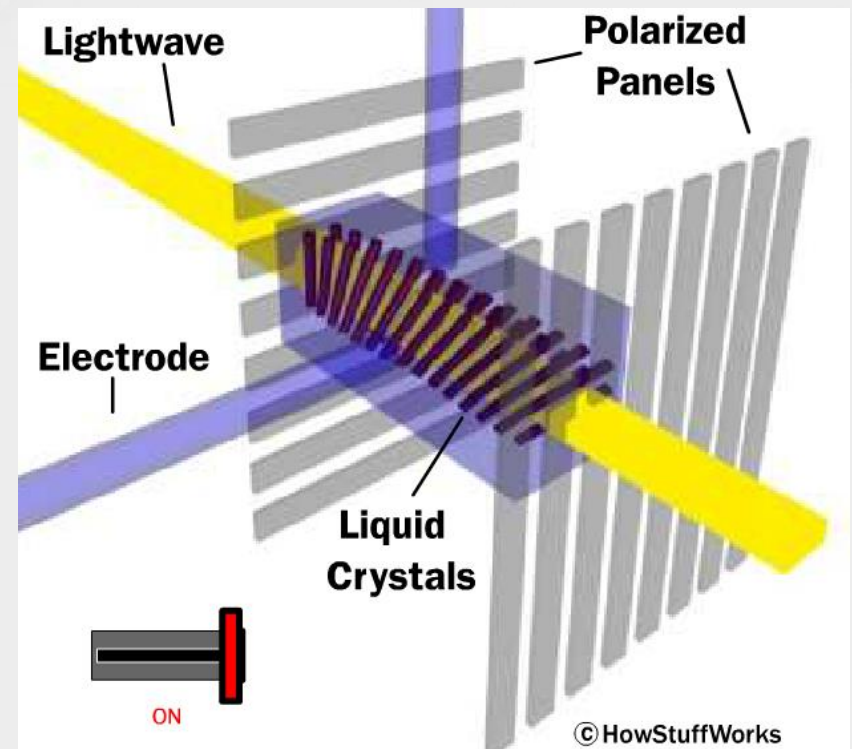
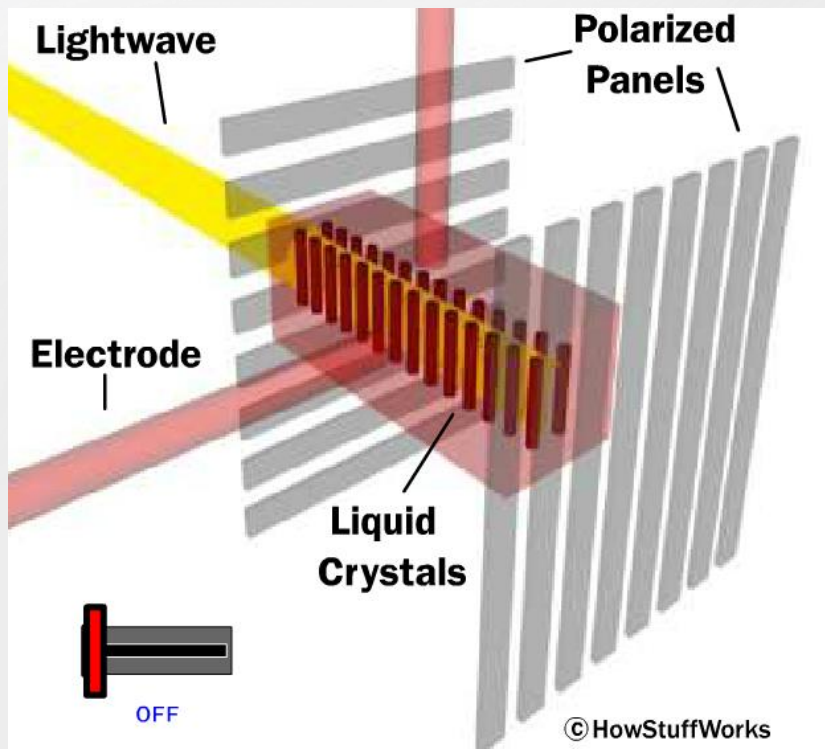


our simple LCD
required an external
light source



Creating an LCD

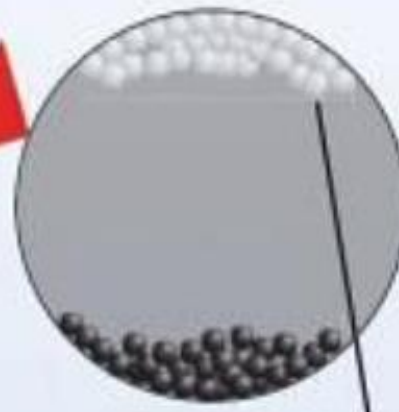
Liquid crystals can transmit and change polarized light. The structure of liquid crystals can be changed by electric current.



e-book, e-ink microcapsule



AN E-BOOK



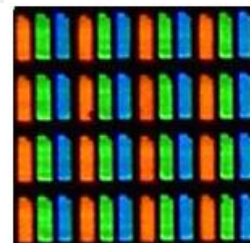
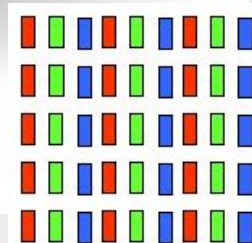
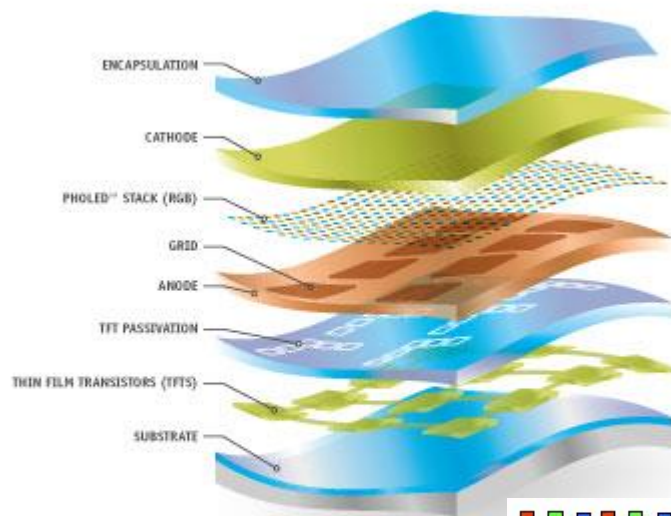
The white particles are at the top, so this pixel appears white.

AN E-INK MICROCAPSULE

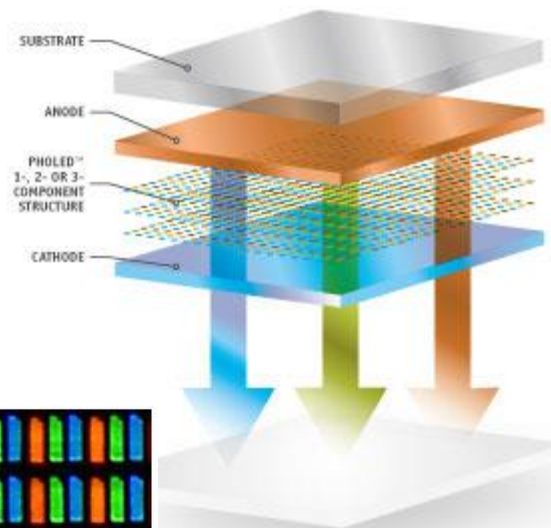
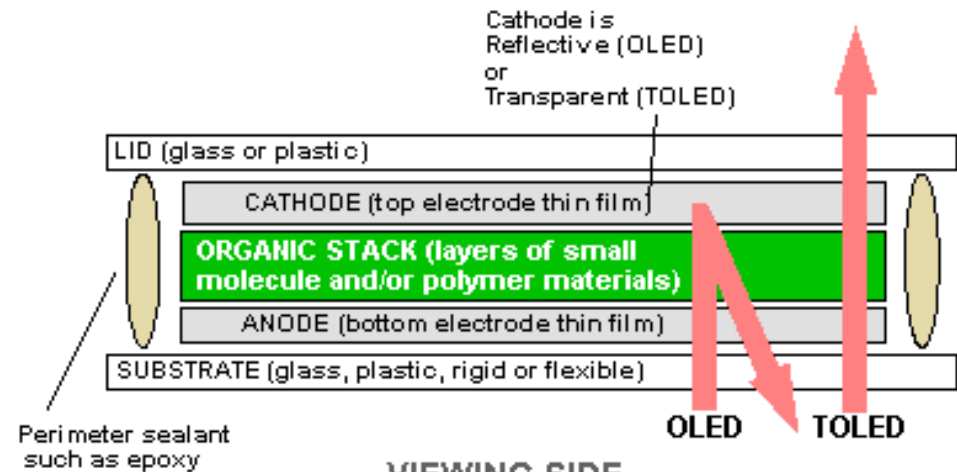


OLED

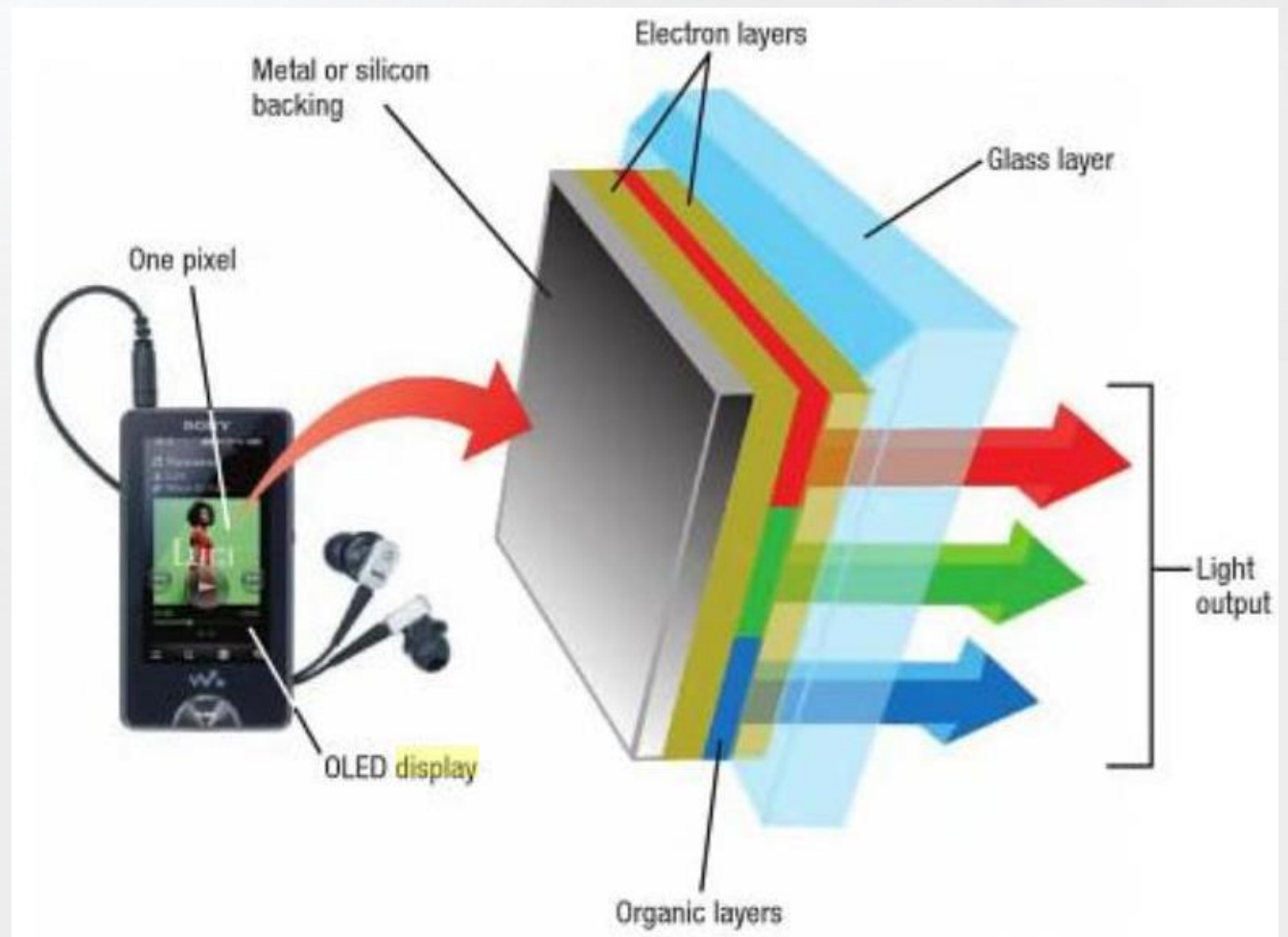
Organic light emitting diode



From Computer Desktop Encyclopedia
Reproduced with permission.
© 2009 Universal Display Corporation



OLED

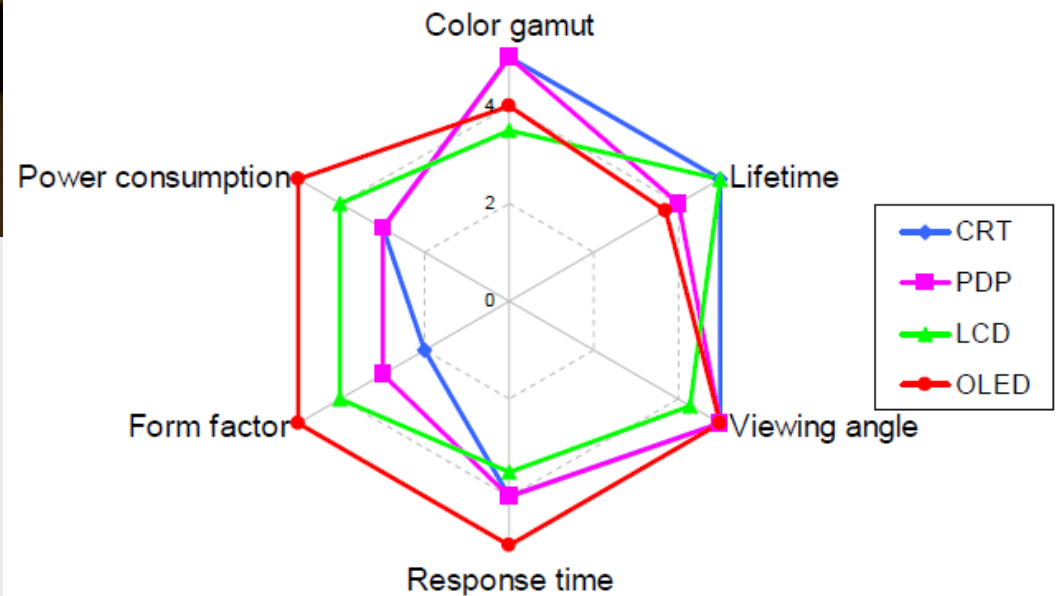


FOLED

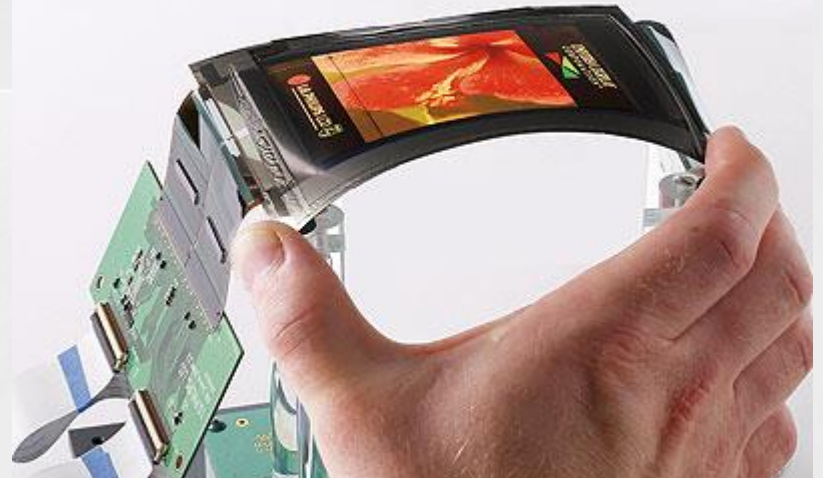
FOLED means Flexible Organic light emitting diode
Flexible Displays at CES-2011



Flexible amoled panels



Flexible amoled panels



Flexible amoled panels

Samsung YOUM technology



Flexible amoled panels



Flexible amoled panels

- YOUM



Touch Screen Display



Holograms, japan

http://www.youtube.com/watch?v=Wdl-P5yBKBk&feature=related

Dosya Düzen Görünüm Sık Kullanılanlar Araçlar Yardım

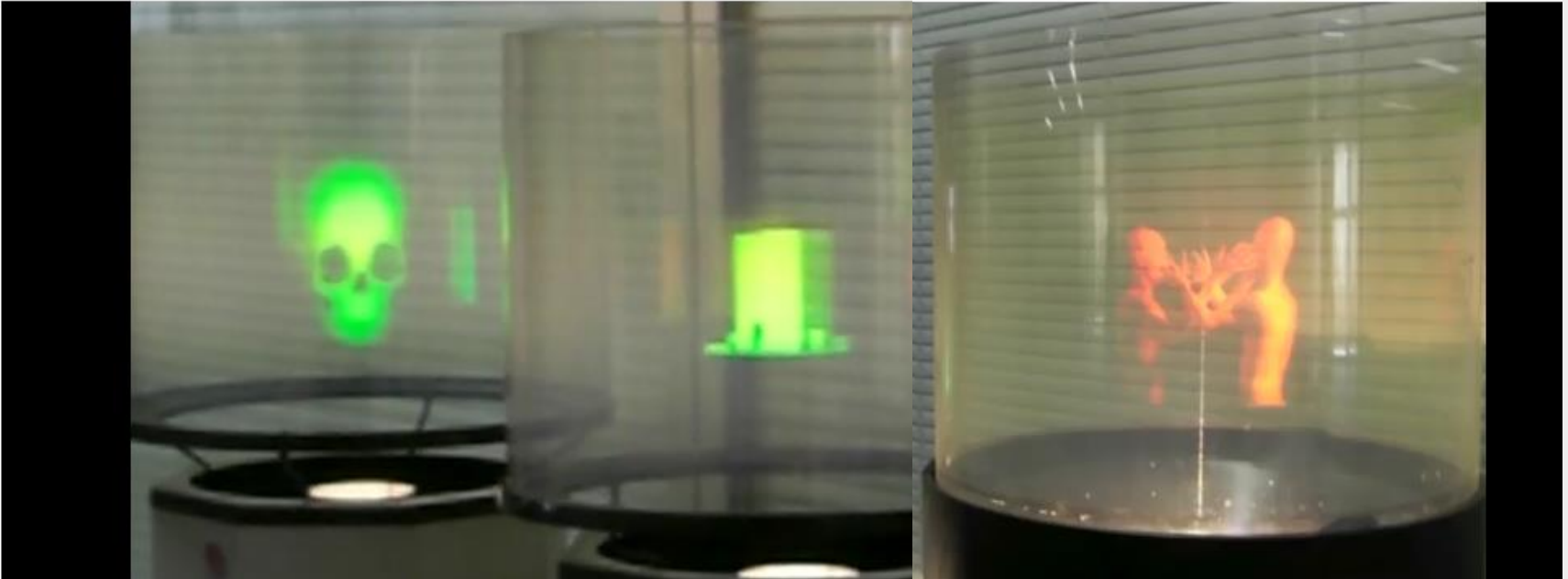
Sık Kullanılanlar YouTube - holograms, Japan

YouTube

holograms, Japan

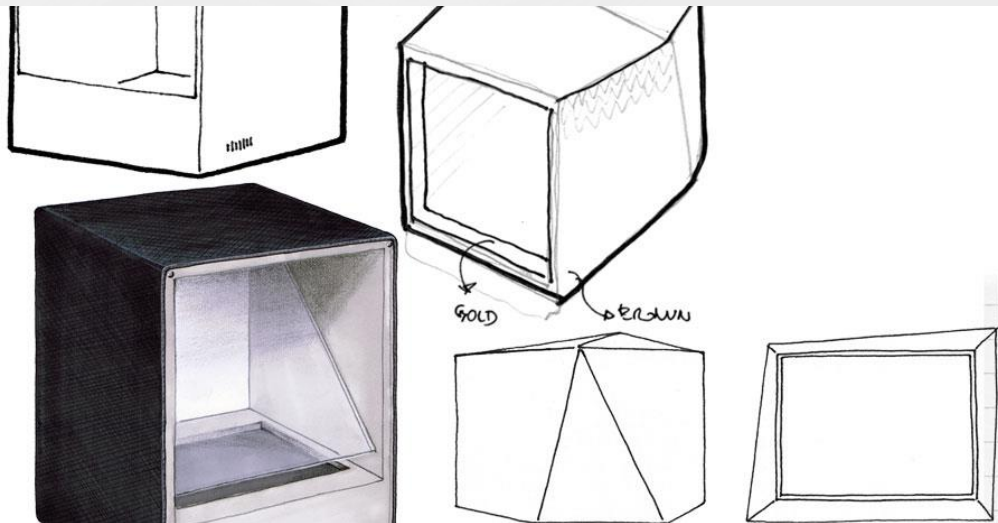
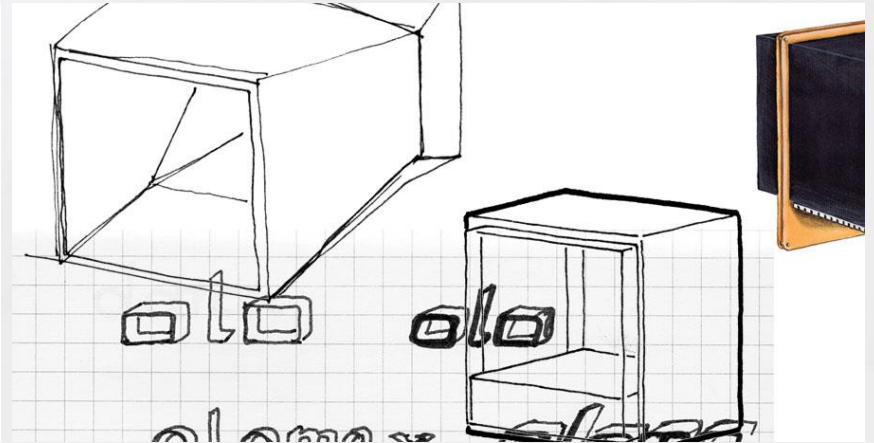
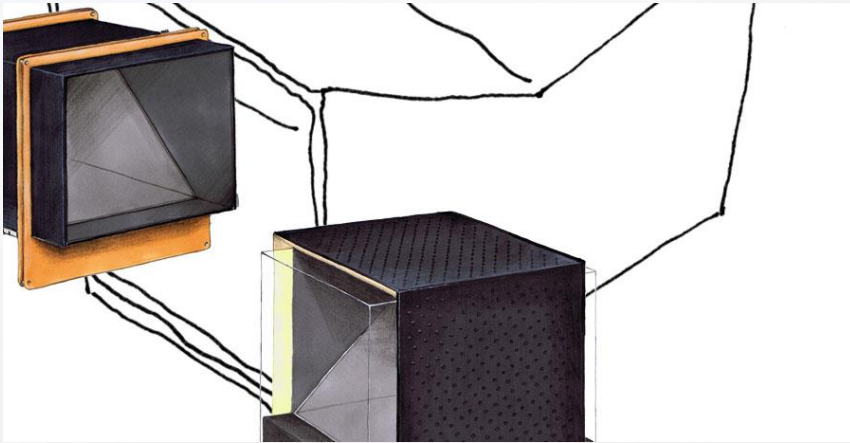
zarathustrawild 46 videos Subscribe

Subscribe



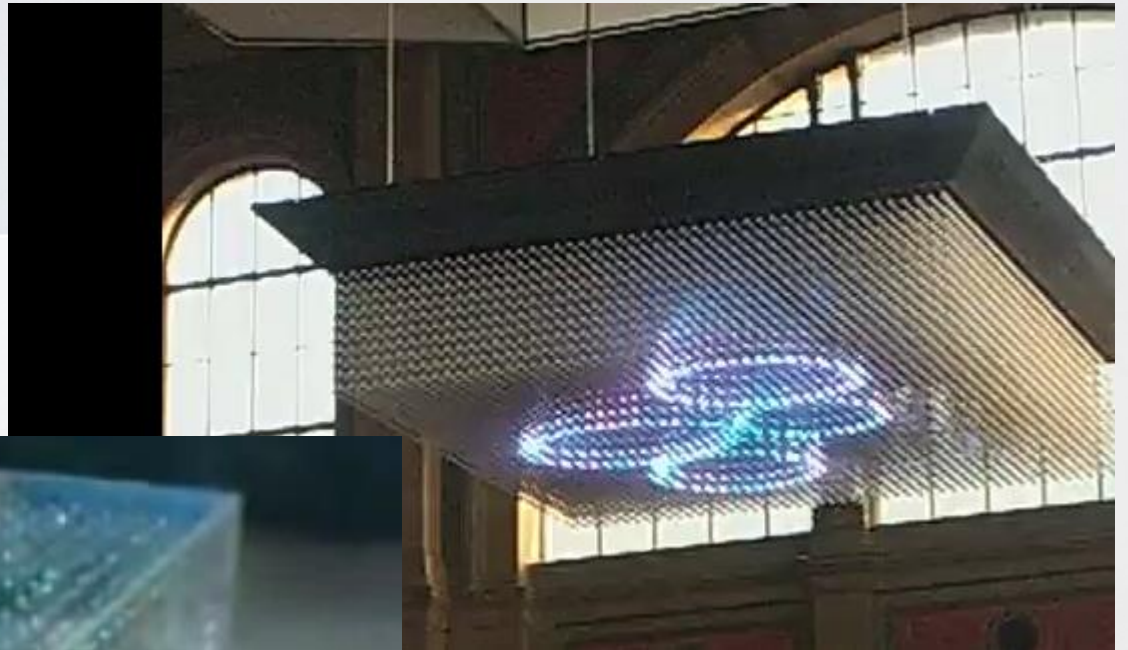
The image displays two side-by-side photographs of holographic projections. The left photograph shows two distinct green holograms: a skull-like shape on the left and a rectangular block on the right, both appearing to float within a transparent cylindrical enclosure. The right photograph shows a single, more complex orange and yellow hologram that resembles a flame or a stylized figure, also contained within a similar transparent cylinder. The background of both images is slightly blurred, suggesting an indoor setting with other equipment visible.

Holograms Olomax design

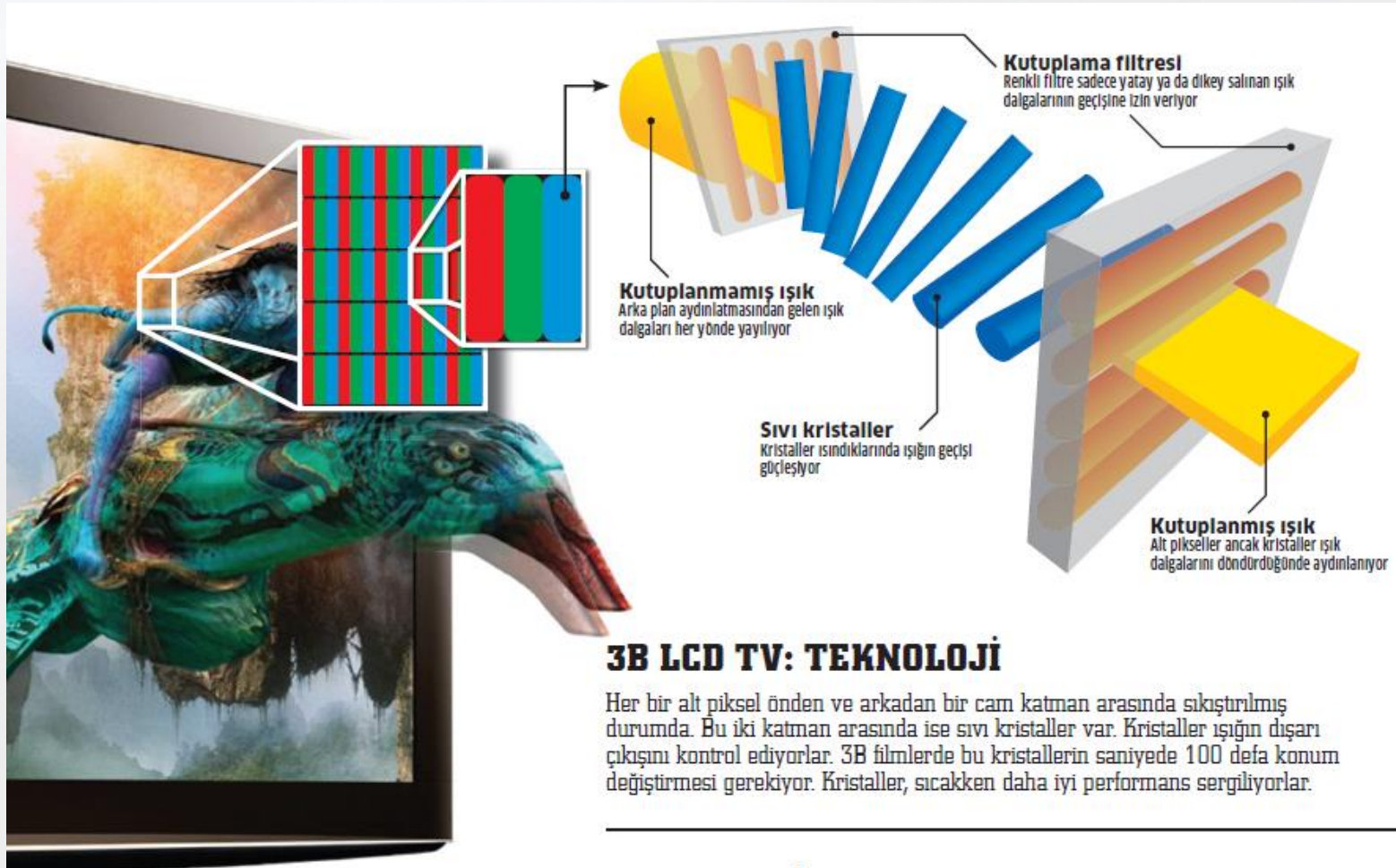


3D Display

- 3D LED Cube

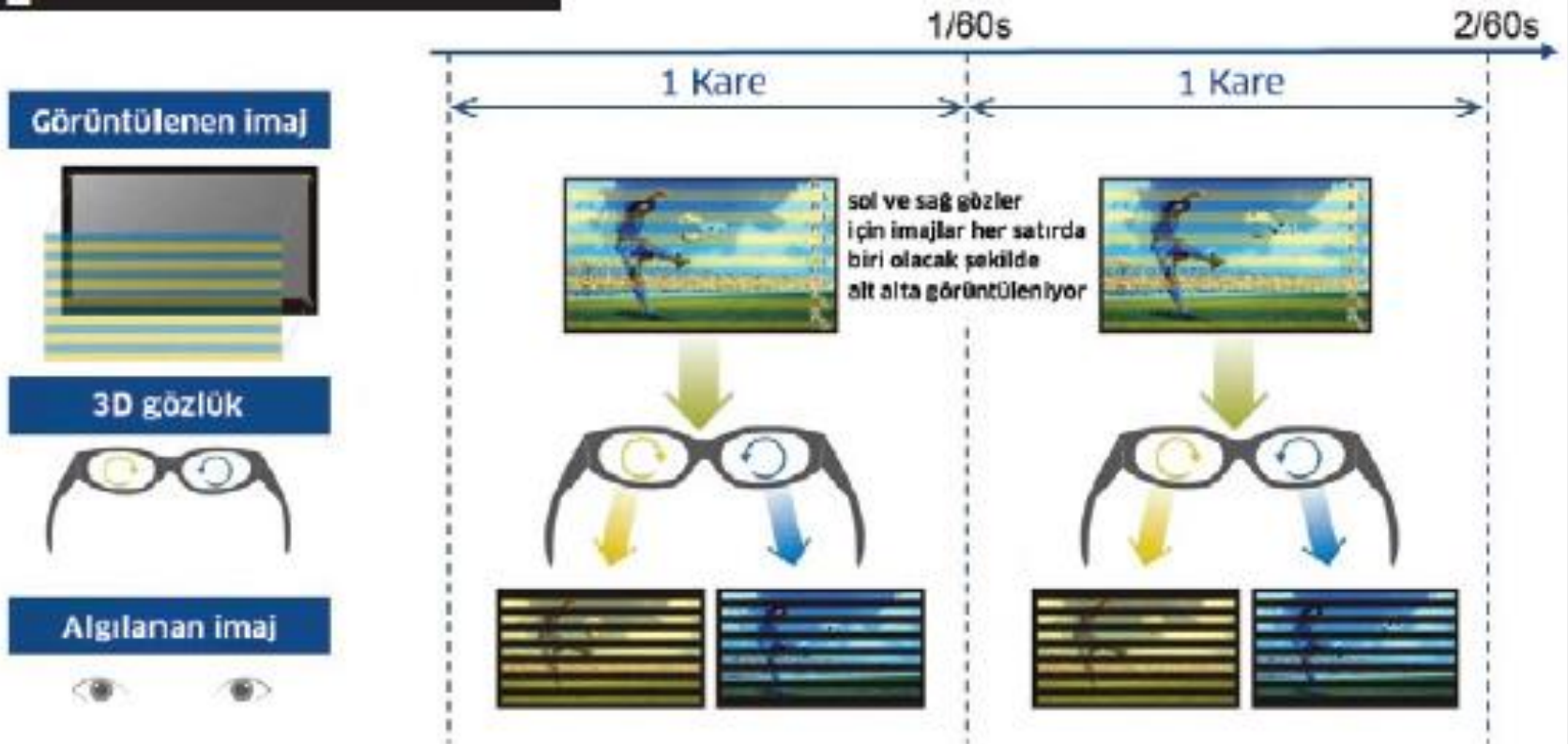


3D tv technology, polarized light system



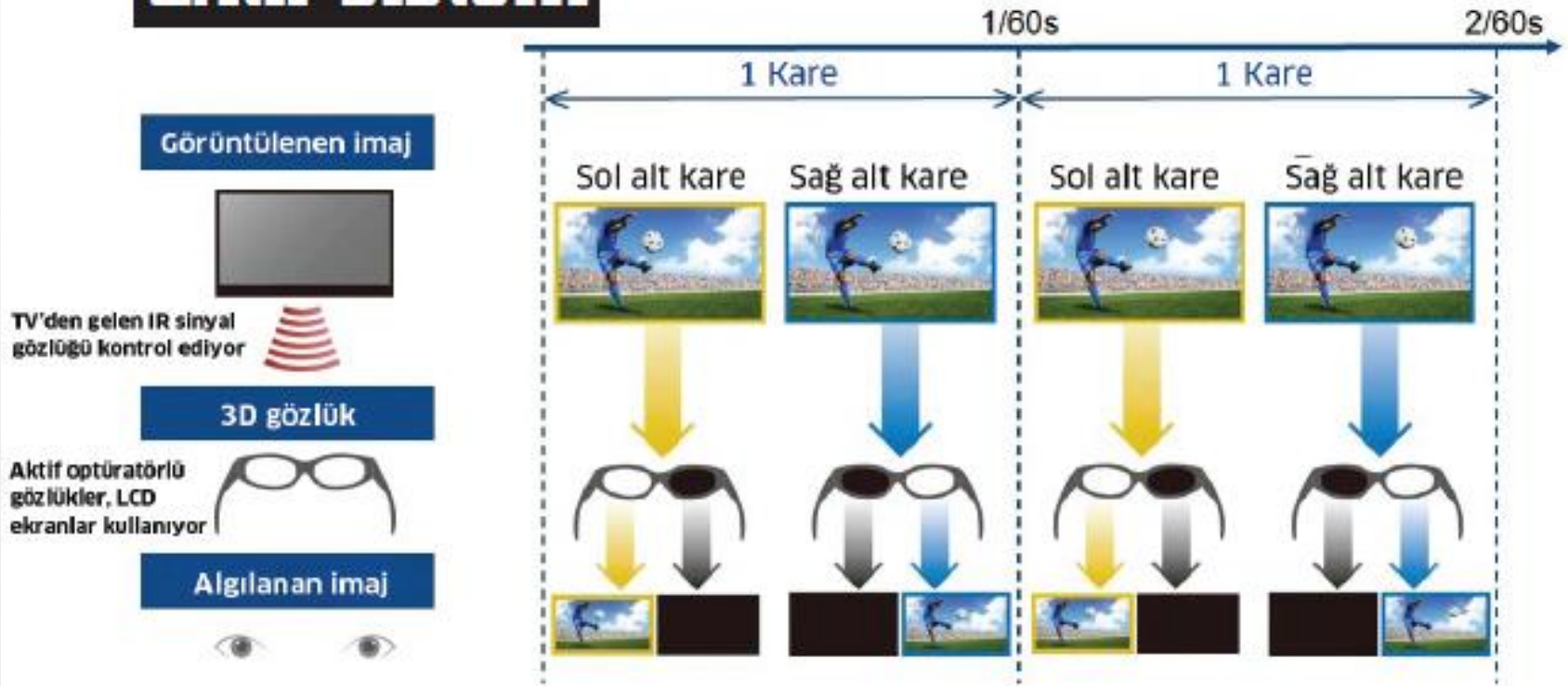
3D TV technology, passive shutter system

pasif sistem

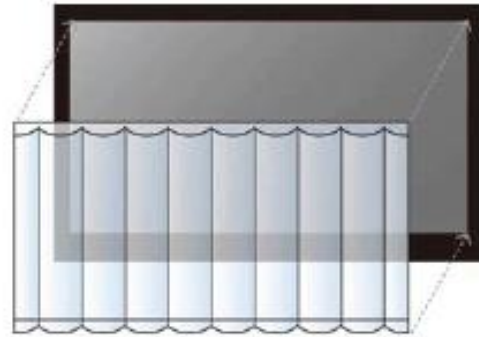


3D TV technology, active shutter system

aktif sistem



3D TV technology, lenticular system



**Merceksel lens sistemi
nasıl çalışıyor (konsept)**



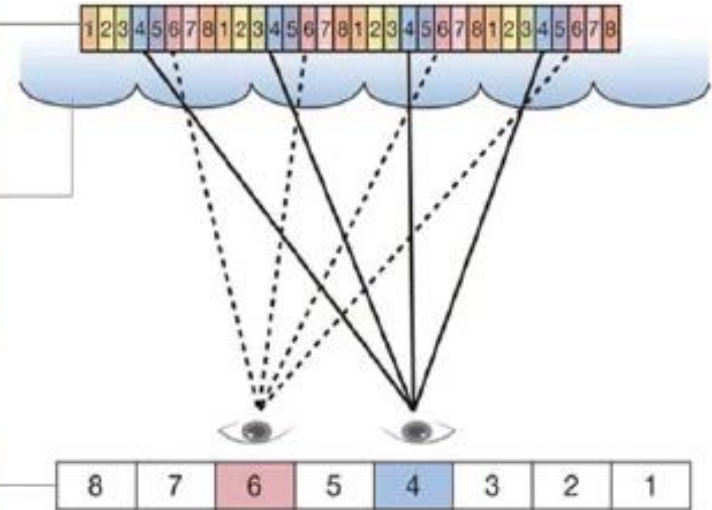
lenticular sistem

Şu an televizyona uyarlamak için uygun değil

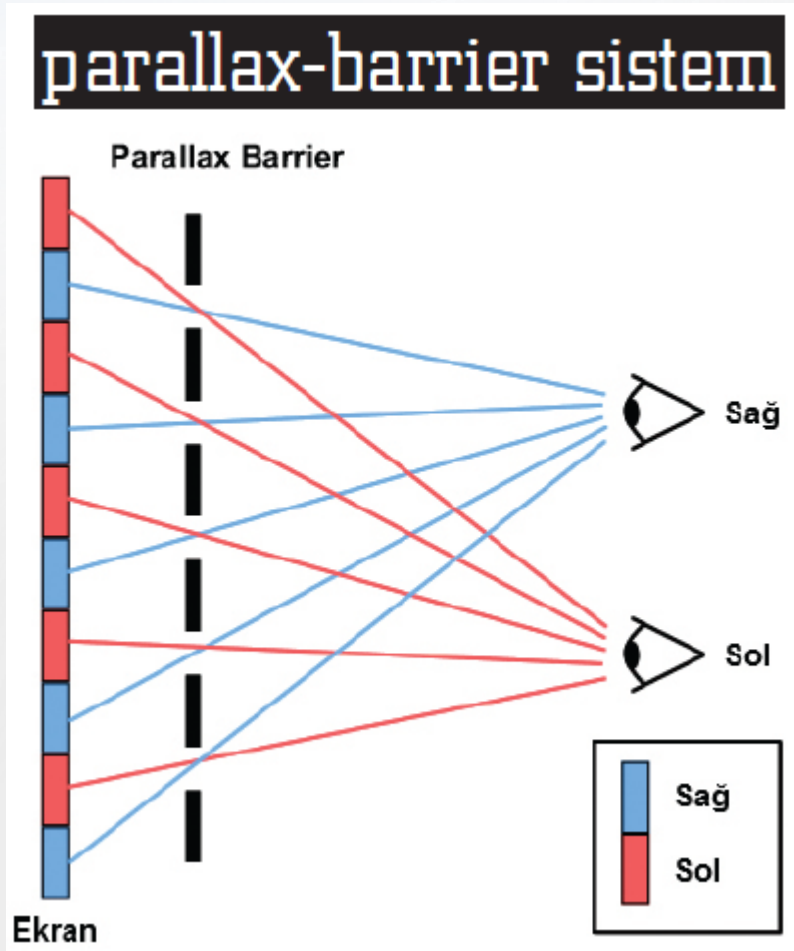
Görüntü

Bir merceksel lens sistemi ışığı kırıyor. Böylece sol ve sağ göz farklı imajlar görüyor.

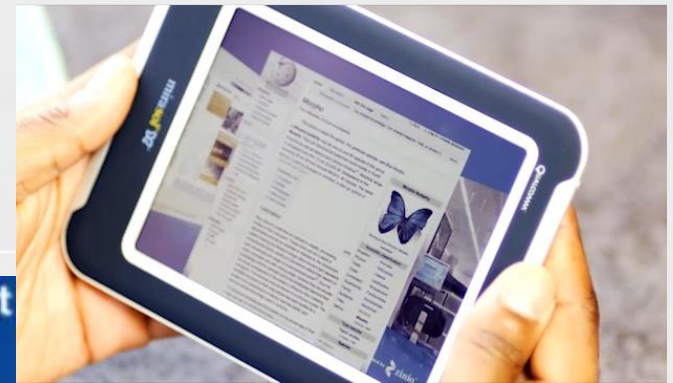
İzleyenin gördüğü görüntü izleme konumuna göre farklılaşıyor.



3D TV technology, parallax-barrier system



how mirasol display works



How It

By manipulating each miniscule pixel, a wide spectrum of color generation is possible.

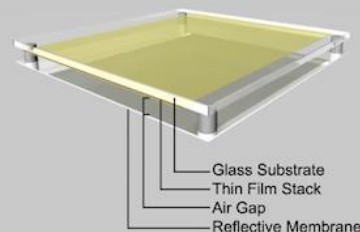
Each sub-pixel moves to either open or closed state to create the overall pixel color.

Pixel

Sub-Pixels

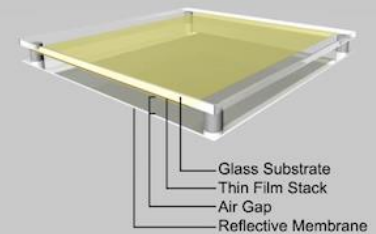
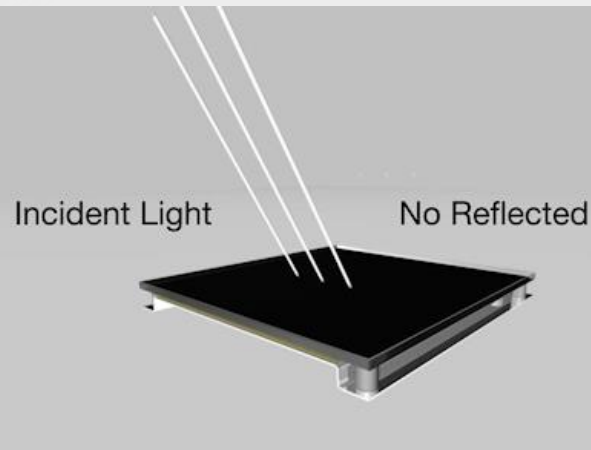
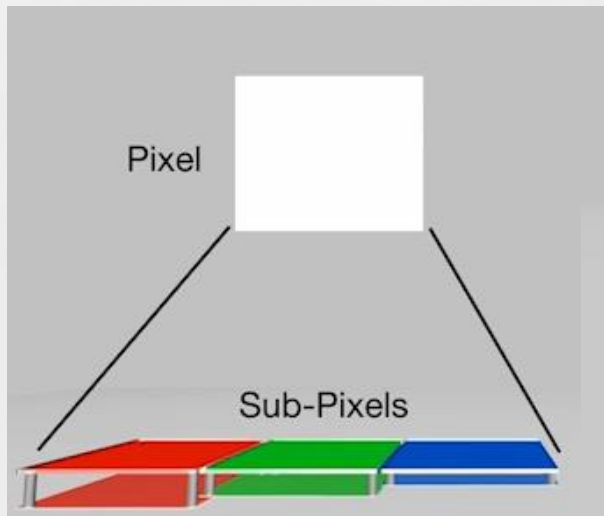
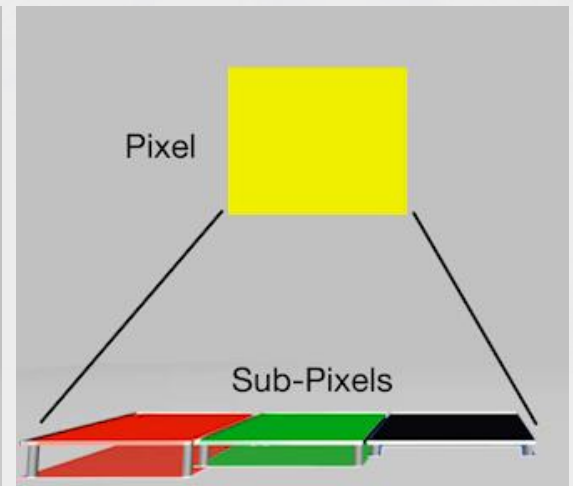
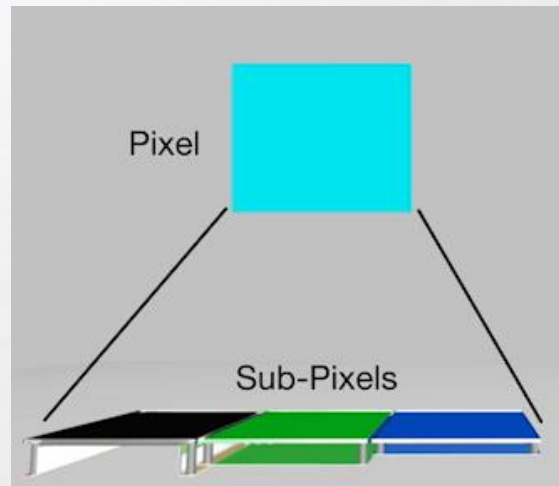
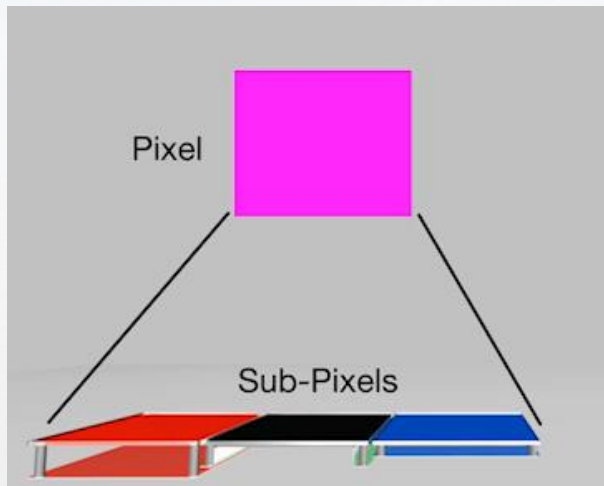
Incident Light

Reflected Light

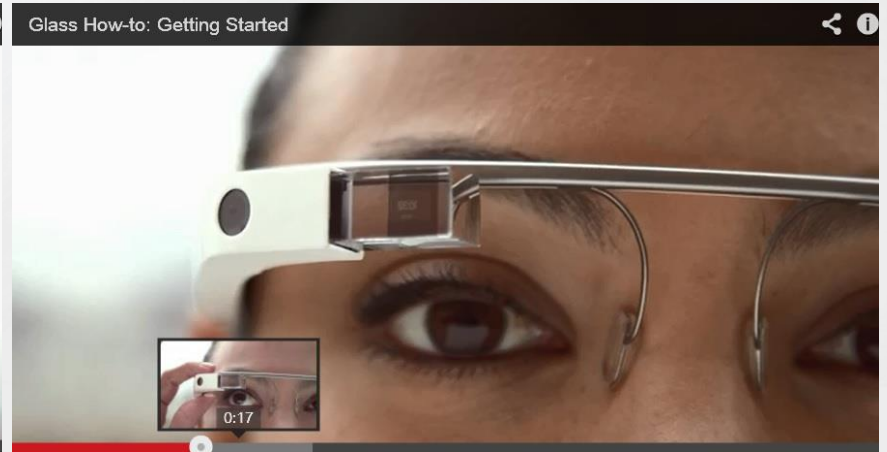


Glass Substrate
Thin Film Stack
Air Gap
Reflective Membrane

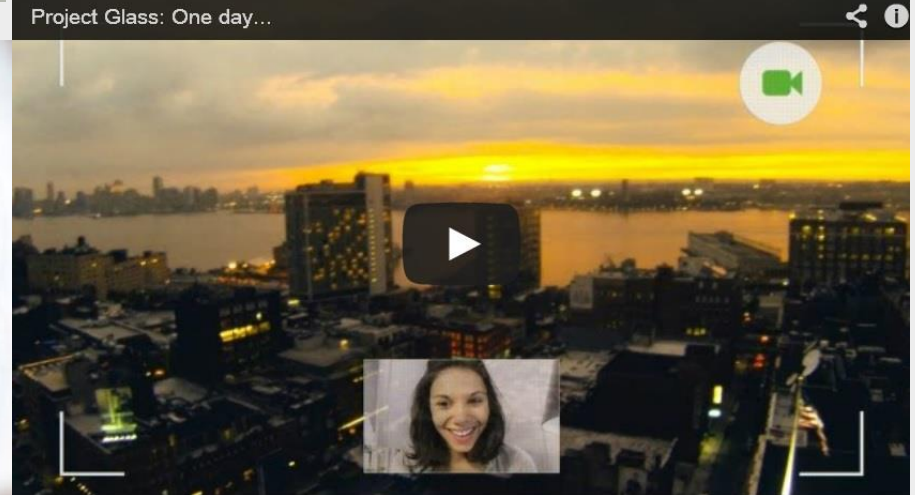
how mirasol display works



Google glass (2013)



Google glass (2013)



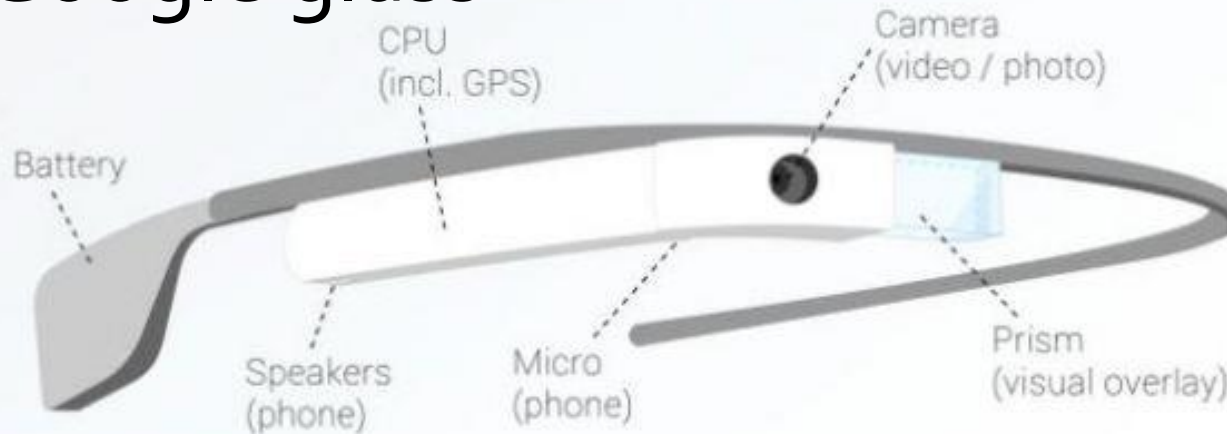
Google glass



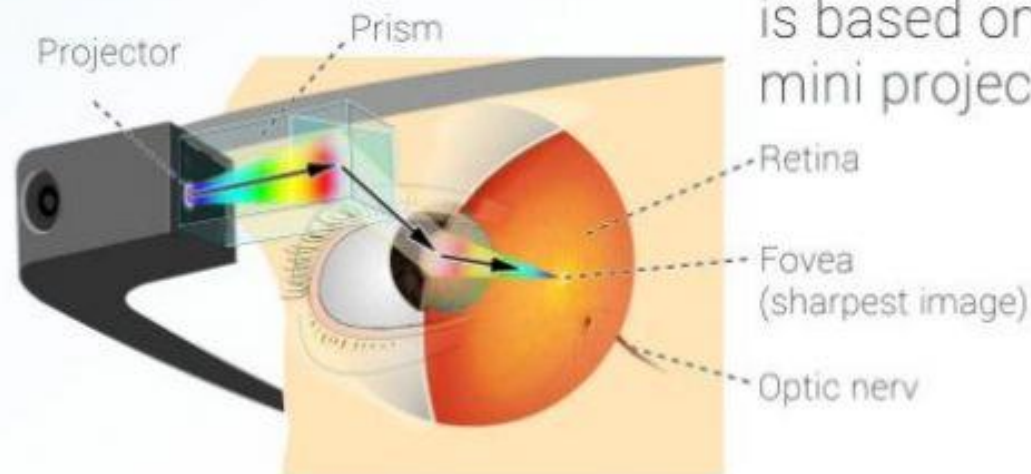
How Google GLASS works

Google glass

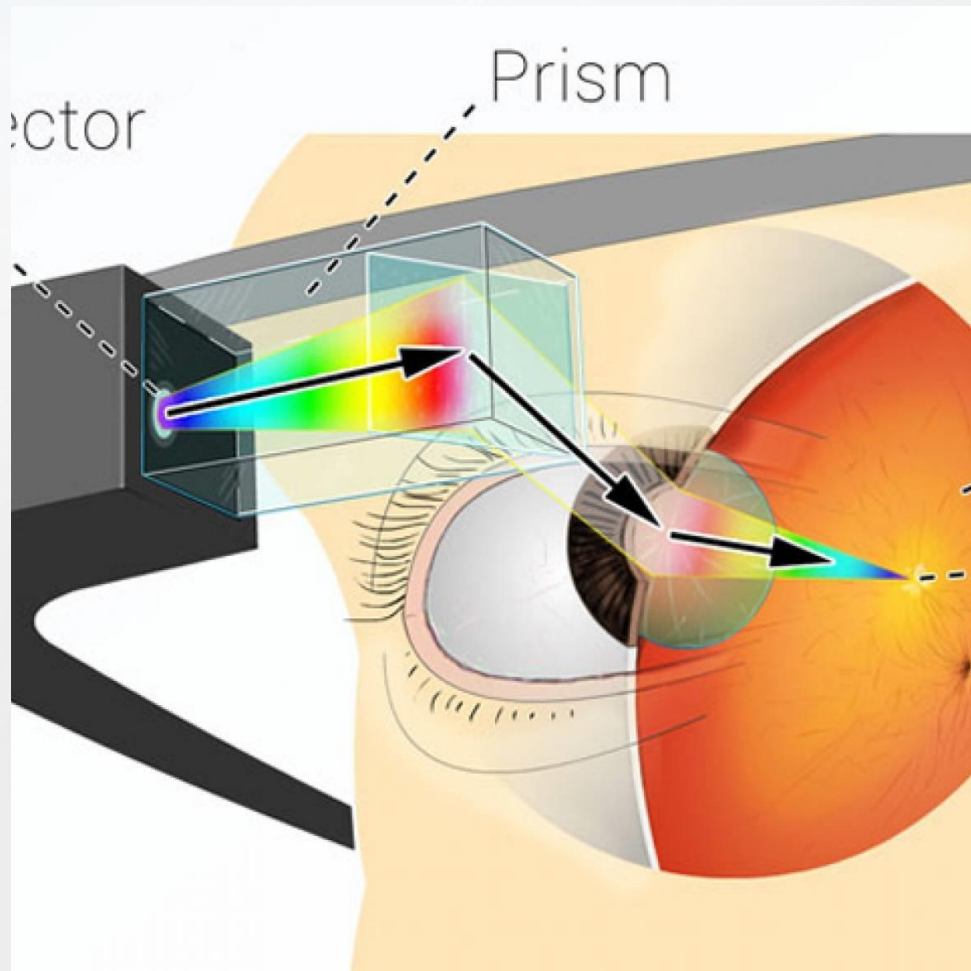
Infographic by M. Missfeldt
www.brille-kaufen.org



The main function is based on a mini projector.



Google glass



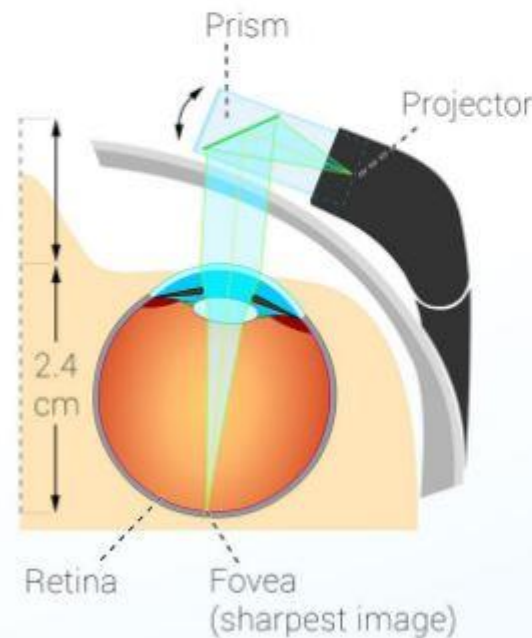
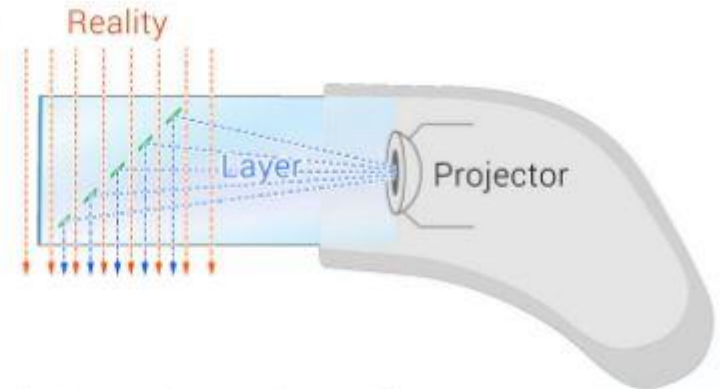
Google glass



Reality

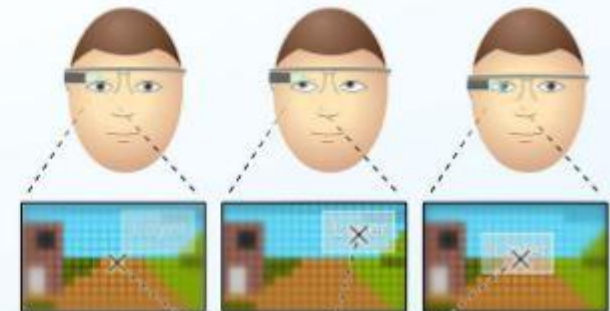
Layer

A clever prism projects a layer over reality light.



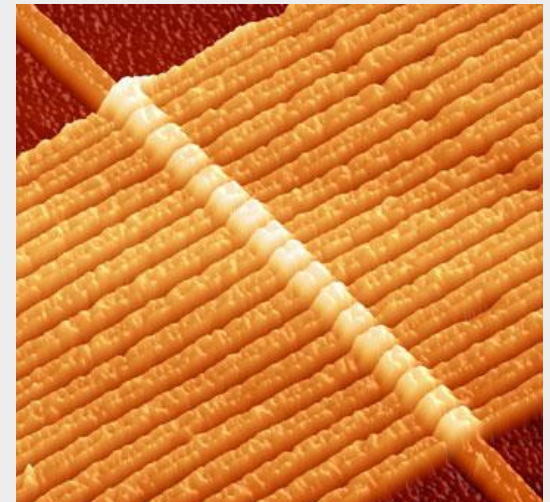
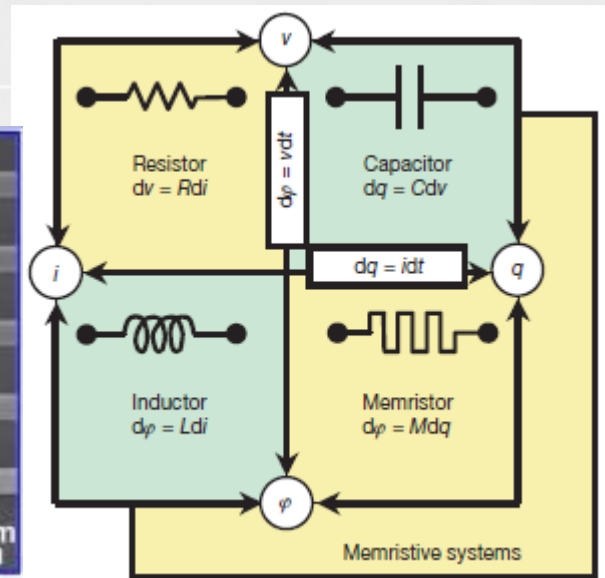
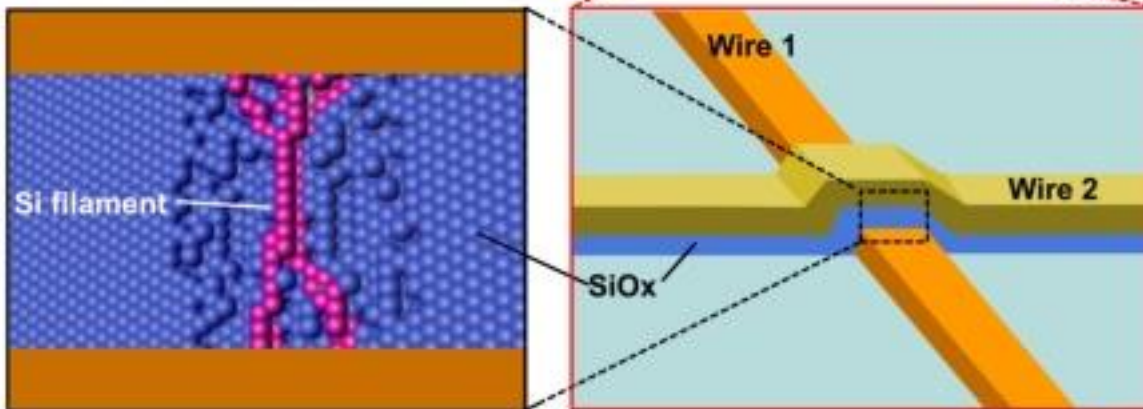
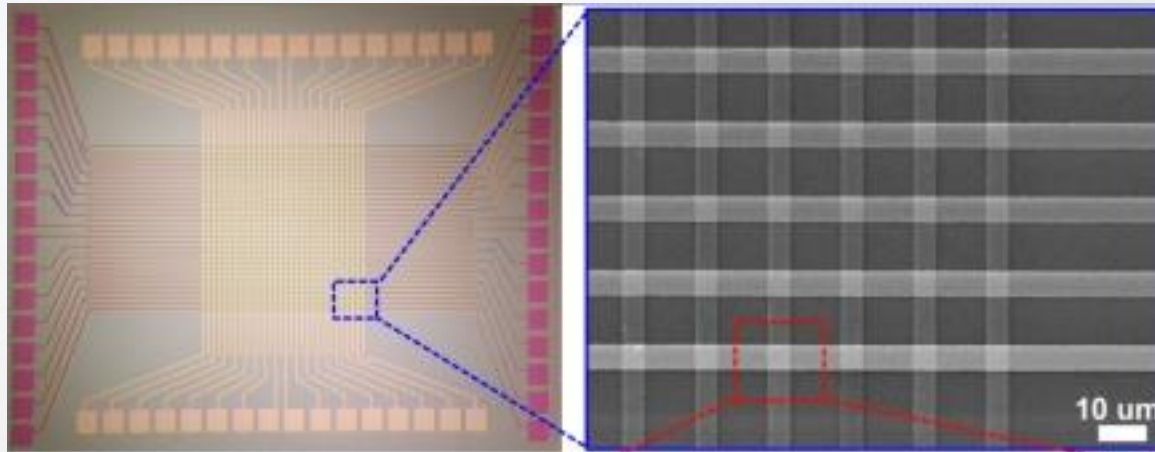
The prism focuses the image directly on the retina.

Position of layer depends on position of Google Glass:



Visual focus

Memristor memory



Graphics Standards

Several graphics standards have been developed over the years, including CORE (1977-1979), GKS (Graphical Kernel System, 1984-1985), GKS-3D (Added three-dimensional capabilities), PHIGS (Programmer's Hierarchical Graphics System, 1984), PHIGS+ include more powerfull three-dimensional graphics functions, X-Windows system (1987), and OpenGL graphics standard is adapted from Unix system.

Graphics Standards

