HEADPHONE

Outline

- **History**
- Transducer Technology
- **Electrical characteristics**
- **Types & construction**

History

Brandes radio headphones, circa 1920

Old telephone earpiece

Headphones originated from the earpiece, and were the only way to listen to electrical audio signals before amplifiers were developed. The first truly successful set was developed by Nathaniel Baldwin, who made them by hand in his kitchen and sold them to the United States Navy.

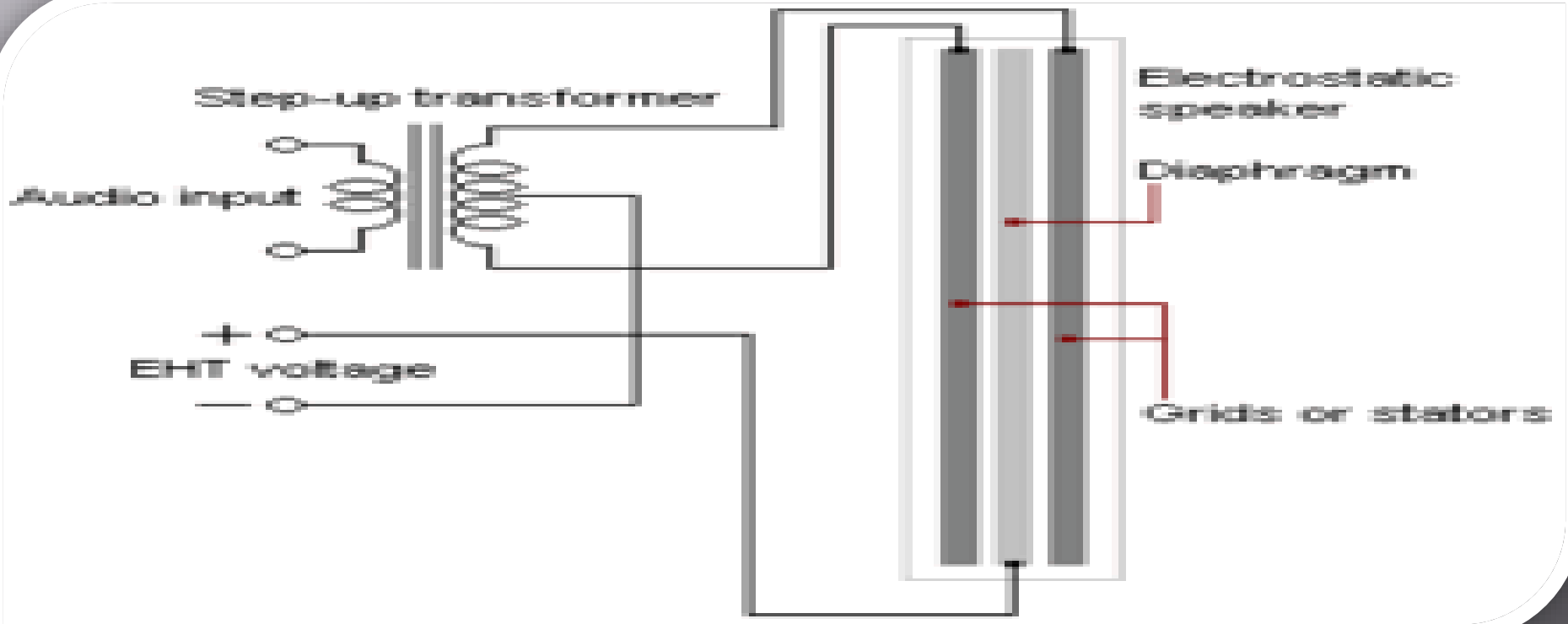
Transducer Technology

- Moving-coil
- Electrostatic
- Balanced armature

Moving-coil

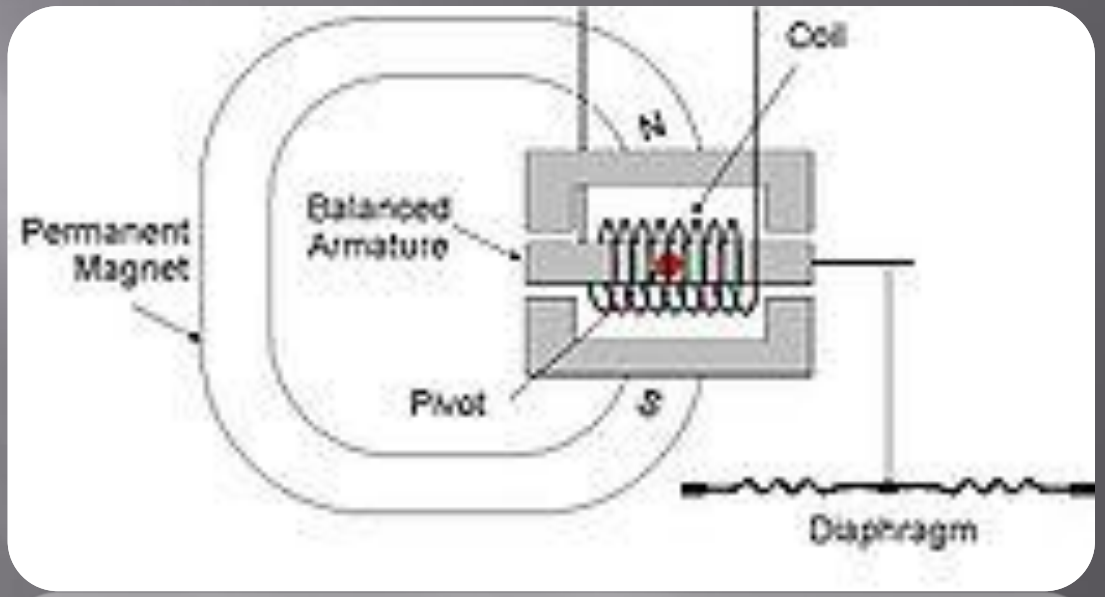
The moving coil driver, more commonly referred to as a "dynamic" driver is the most common type used in headphones. The operating principle consists of a stationary magnetic element affixed to the frame of the headphone which sets up a static magnetic field

Electrostatic



Electrostatic drivers consist of a thin, electrically charged diaphragm, typically a coated PET film membrane, suspended between two perforated metal plates (electrodes).

Balanced armature



A balanced armature is a sound transducer design primarily intended to increase the electrical efficiency of the element by eliminating the stress on the diaphragm characteristic of many other magnetic transducer systems.

Impedance

Headphones are available with low or high impedance . Low-impedance headphones are in the range 16 to 32 ohms and high-impedance headphones are about 100-600 ohms. As the impedance of a pair of headphones increases, more voltage but less current is required to drive it, and the loudness of the headphones for a given voltage decreases

In recent years, impedance of newer headphones has generally decreased to accommodate lower voltages available on battery powered CMOS-based portable electronics. This results in headphones that can be more efficiently driven by battery powered electronics. Consequently, newer amplifiers are based on designs with relatively low output impedance.

Sensitivity

Sensitivity is a measure of how effectively an earpiece converts an incoming electrical signal into an audible sound. It thus indicates how loud the headphones will be for a given electrical drive level. It can be measured in decibels of sound pressure level per milliwatt, or dB SPL/mW, which may be abbreviated to dB/mW. The sensitivity of headphones is usually between about 80 and 125 dB/mW.

Types

- Circumaural
- Supra-aural
- Clip-on earphones
- Canalphones

Circumaural

Circumaural headphones (sometimes called full size headphones) have circular or ellipsoid earpads that encompass the ears. Because these headphones completely surround the ear, circumaural headphones can be designed to fully seal against the head to attenuate external noise.

Circumaural

Supra-aural

Supra-aural headphones have pads that press against the ears, rather than around them. They were commonly bundled with personal stereos during the 1980s. This type of headphone generally tends to be smaller and lighter

Supra-aural

Clip-on earphones

Earbuds and earphones refer to very small headphones that are fitted directly in the outer ear, facing but not inserted in the ear canal; they have no band or other arrangement to fit over the head.

Clip-on earphones

Canalphones

headphones like earbuds, are small and without headband, but are inserted in the ear canal itself. They are sometimes known as canalphones. Price and quality range from relatively inexpensive to very high.

Canalphones

Genral construction of Ear phones

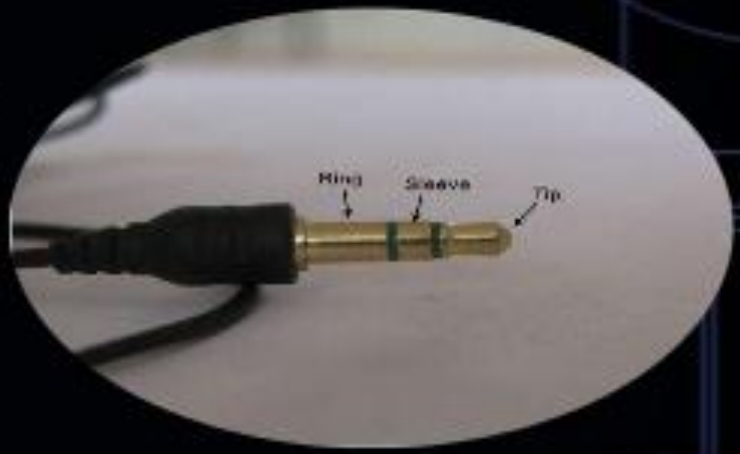
WORKING OF EARPHONES

- Earphones are transducers : Converting Electrical Energy into Sound Energy.
- Earphones are available in many shape, size and colors with pricing depending on quality.
- The image shows a glimpse of commonly used earphones.

JACK

Components : Jack

- Jack : Part of the earphone which takes electrical signals from the audio output port of the devices like mobile phones, laptop, computers, music player etc.



- There are three contact areas known as the TIP, RING and the Sleeve as shown in the image and therefore this connector is also called as **TRS** connector.

Housing

Housing

- The housing is made up of rubber and is designed to give a good grip while connecting and disconnecting the connectors.
- The housing encloses the wires soldered to the contacts as shown in the above image.

Connecting Wires

- There are three wires each soldered to one of the metal contact of the jack. One wire is for ground, and the other two corresponding to the left and the right earphone.

- The below image shows the junction from where wires get distributed to the left and right ear piece.

- Each ear piece has two wires out of which one is common/ground. The other carries the electrical signal for the respective ear piece.

Filter

- The image shows the ear tip and the filter. Ear tip is that part of the earphone which makes contacts with the ear.

- The circular shaped tip is made up of silicone. It holds the earpiece in the ears and therefore needs to be soft and comfortable.

- The job of the filter is to protect the earwax and other dust particles from entering into the earpiece which in turn spoils the sound quality.

Structure of Filter

- The filter consists of two parts: a) metal jacket and b) metallic grill sheet.
- The metal jacket is the outermost part of the earphone from where the sound enters the ear.
- The design of the grill sheet is very important as it needs to provide a clear passage for the sound.
- Sound quality is highly dependent on the grill sheet.
- Both the metal jacket and the grill sheet serves the same purpose of protecting internal audio components from outside particles like ear wax and dust.

Driver Unit

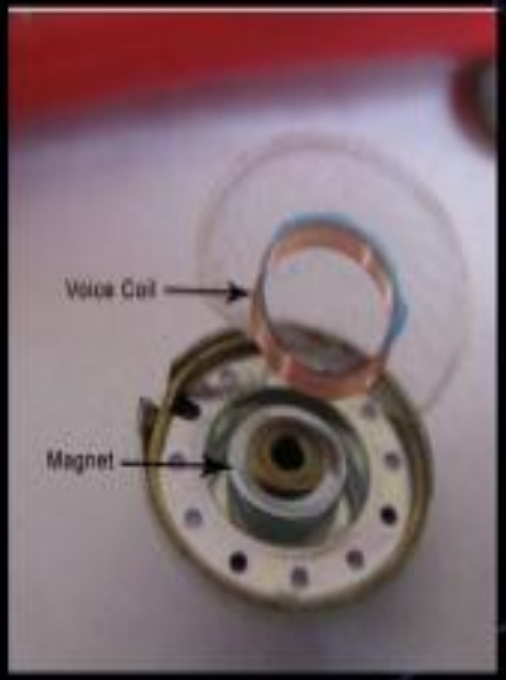
- Removing the back casing we can see the wires soldered to the driver unit
- Driver unit of the earphone are connected to the voice coil.

Diaphragm

- The diaphragm is made up of a thin film of plastic.
- It is the motion of the diaphragm which produces vibration of the surrounding air particles thereby producing sound.
- The vibration is dependent on the electrical signal from the device.

Voice Coil

- Diaphragm is connected to the voice coil and is placed in the slot surrounding the permanent magnet.
- The voice coil receives the analog audio signals and behaves as electromagnet.
- The resultant force produced by the two magnetic fields causes the diaphragm to vibrate, thus producing sound.



- THANK YOU

TYPES OF LOUDSPEAKER

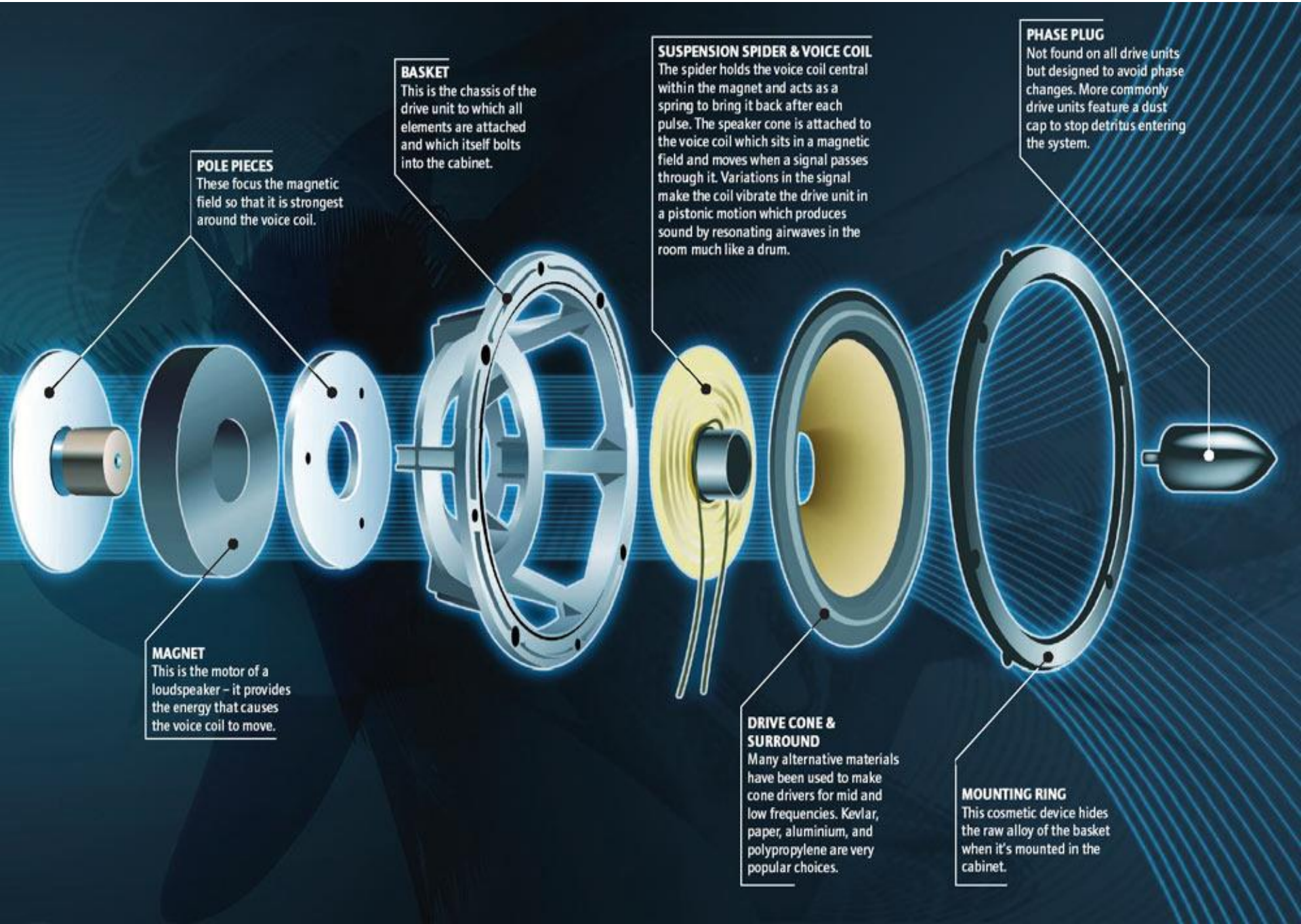
BY
KMN

WHAT IS A LOUDSPEAKER

- A LOUDSPEAKER IS TRANSDUCER WHICH CONVERTS ELECTICAL SIGNALS OF AUDIO FREQUENCY INTO SOUND WAVES OF THE SAME FREQUENCY.

- IT IS ALSO CALLED AS OUTPUT TRANSDUCER OR REVERSE TRANSDUCER.

- A loudspeaker must be able to reproduce a wide range of audio frequencies (i.e., 20 Hz to 20 kHz).


POLE PIECES
These focus the magnetic field so that it is strongest around the voice coil.
BASKET
This is the chassis of the drive unit to which all elements are attached and which itself bolts into the cabinet.
SUSPENSION SPIDER & VOICE COIL
The spider holds the voice coil central within the magnet and acts as a spring to bring it back after each pulse. The speaker cone is attached to the voice coil which sits in a magnetic field and moves when a signal passes through it. Variations in the signal make the coil vibrate the drive unit in a pistonic motion which produces sound by resonating airwaves in the room much like a drum.
PHASE PLUG
Not found on all drive units but designed to avoid phase changes. More commonly drive units feature a dust cap to stop detritus entering the system.
MAGNET
This is the motor of a loudspeaker – it provides the energy that causes the voice coil to move.
DRIVE CONE & SURROUND
Many alternative materials have been used to make cone drivers for mid and low frequencies. Kevlar, paper, aluminium, and polypropylene are very popular choices.
MOUNTING RING
This cosmetic device hides the raw alloy of the basket when it's mounted in the cabinet.

Types Of Loudspeaker

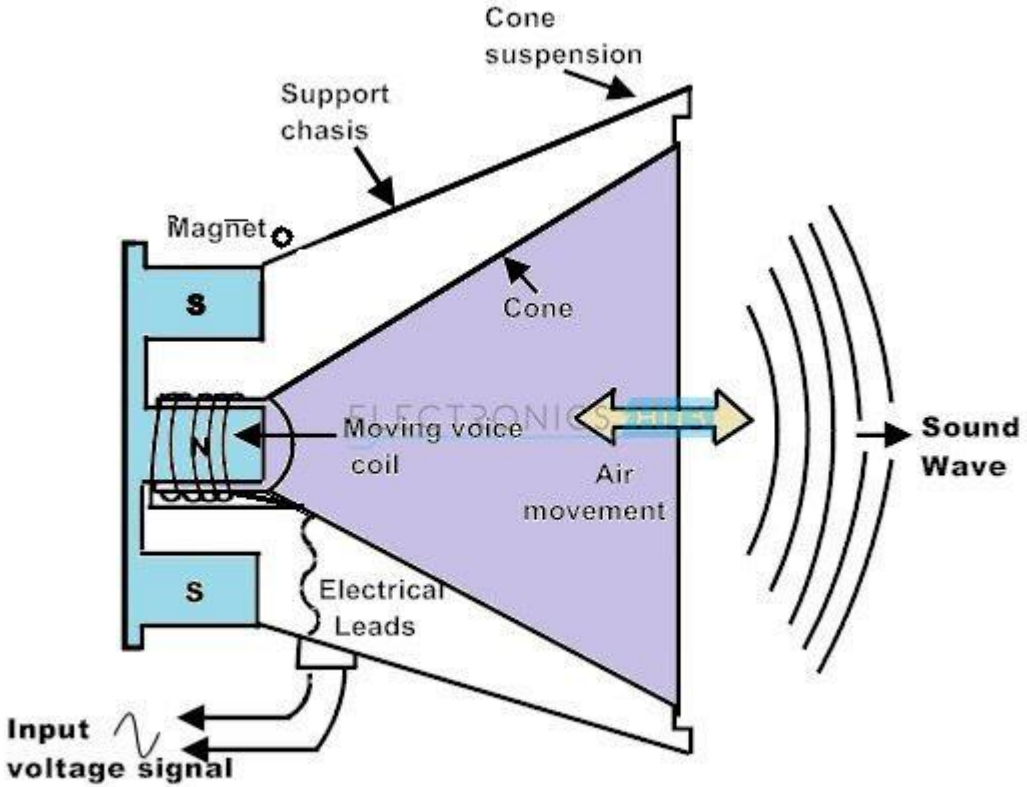
- Basically there are three types of loudspeaker, they are listed as follows.
- MOVING COIL LOUDSPEAKER OR CONE TYPE LOUDSPEAKER
- ELECTRODYNAMIC LOUDSPEAKER
- HORN TYPE LOUDSPEAKER

MOVING COIL LOUDSPEAKER

Principle-

- The moving coil loudspeaker works on the interaction between a magnetic field and current flowing through the coil.
- A coil called voice coil,is placed in a uniform magnetic field. when the audio current passes through the voice coil,there is an interaction between the magnetic field and the current,resulting in a force working on the movable coil.
- This force is proportional to the audio current , and hence causes vibratory motion in the coil , which makes a conical paper diaphragm to vibrate and produce pressure variations in air , resulting in sound waves.

Diagram


Cone
suspension
Support
chasis
Magnet
S
Cone
N
Moving voice
coil
Air
movement
Sound
Wave
S
Electrical
Leads
Input
voltage signal

Features

- Here are some characteristics given below
- SNR = 30 DB
- FREQUENCY RESPONSE = MEDIUM FREQUENCY
- DISTORTION = 10%
- DIRECTIVITY = OMNIDIRECTION

Construction

- The moving coil loudspeaker consist of a voice coil,wound on a cardboard
- Audio current is fed to the loudspeaker through two terminals. The coil is placed in a magnetic field
- The magnet is a permanent magnet
- The coil is attached to the conical diaphragm,.
- The cone is corrugated having circular corrugation to increase surface area for better efficiency.
- A flexible strip of rubber round its periphery is used to support it.
- The spider springs are used to support the complete diaphragm and also provides the required stiffness to restrain the motion.
- The spider also keep the coil centered so that cone moves forward and backward only.

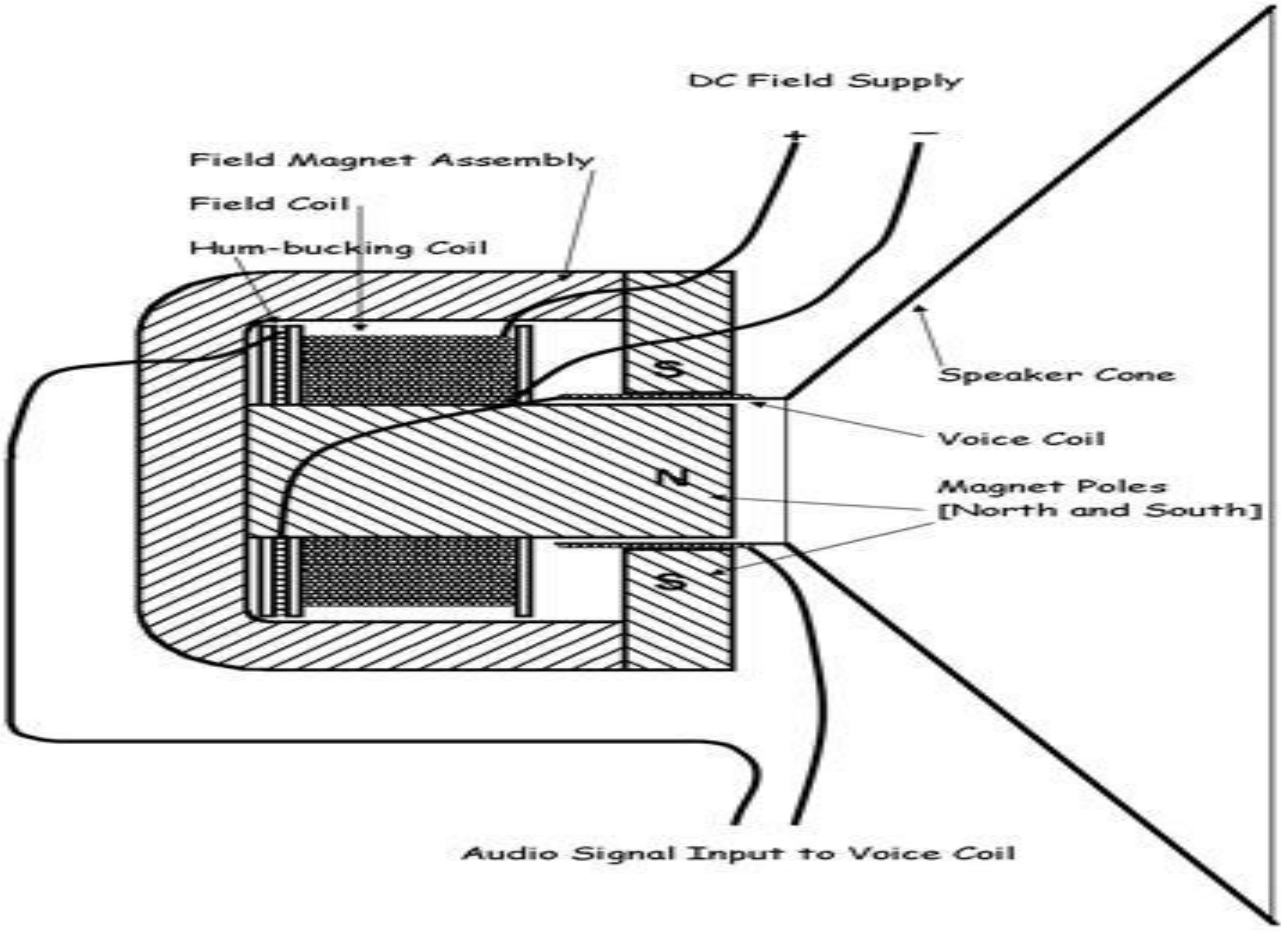
Working

- At the front of a loudspeaker, there is a fabric, plastic, paper, or lightweight metal **cone** called a **diaphragm**.
- The outer part of the cone is fastened to the outer part of the loudspeaker's circular metal rim. The inner part is fixed to an iron coil sometimes called the **voice coil**, that sits just in front of a permanent magnet sometimes called the field magnet.
- When you hook up the loudspeaker to a stereo, electrical signals feed through the speaker cables into the coil.
- This turns the coil into a temporary magnet or **electromagnet**.
- As the electricity flows back and forth in the cables, the electromagnet either attracts or repels the permanent magnet. This moves the coil back and forward, pulling and pushing the loudspeaker cone.

ELECTRODYNAMIC LOUDSPEAKER

- An electrodynamic loudspeaker or field coil loudspeaker is a dynamic loudspeaker in which the field is produced by an electromagnet rather than by a permanent magnet.
- An electrodynamic loudspeaker therefore has two coils:
- The voice coil common to all dynamic loudspeakers, positioned in the air gap between the pole pieces, the motion of which moves the loudspeaker cone.
- A fixed field coil which together with its magnetic core replaces the permanent magnet of other dynamic loudspeakers.

Diagram


DC Field Supply
+
−
Field Magnet Assembly
Field Coil
Hum-bucking Coil
Speaker Cone
Voice Coil
Magnet Poles
[North and South]
N
S
S
Audio Signal Input to Voice Coil

Features

- To provide strong magnetic field for high wattage speakers an electromagnet is used instead of permanent magnet.

- Some characteristics are given below
- EFFICIENCY 30-50%
- FREQUENCY RESPONSE - 30HZ-10KHZ
- DISTORTION - LOW
- SNR-30-40db

Construction

- The strong and steady magnetic field is produced by a large field coil wrapped around a core.
- The shape of the magnet is pot type with the south pole in the centre and the north pole in the periphery.
- The special shape of the core allows magnetic flux to remain concentrated in the angular gap between pole pieces.

Working

- The voice coil is wound on fibre or aluminium it is a placed in the angular gap. The audio signal from the amplifier's output transformer is applied to the voice coil.

- This signal causes a varying magnetic field. The resultant interaction between the two magnetic field produces mechanical vibrations in the coil assembly, which corresponds to the audio signals.

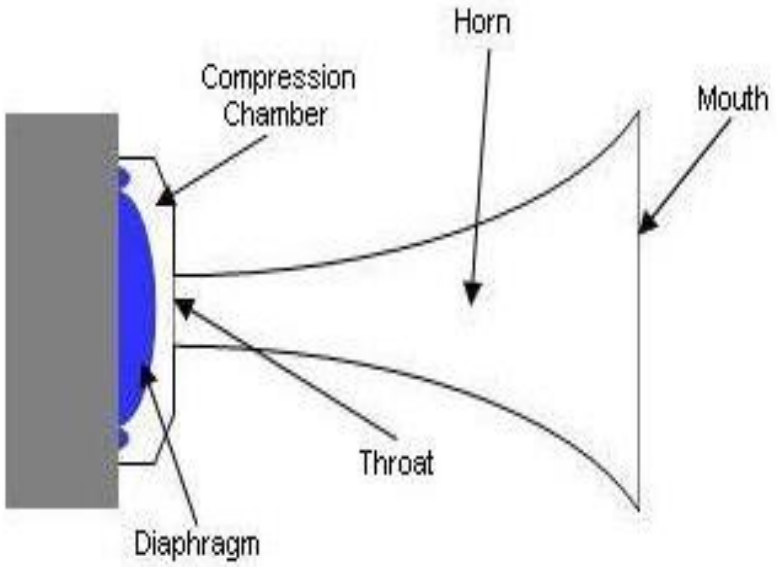
HORN-TYPE LOUDSPEAKER

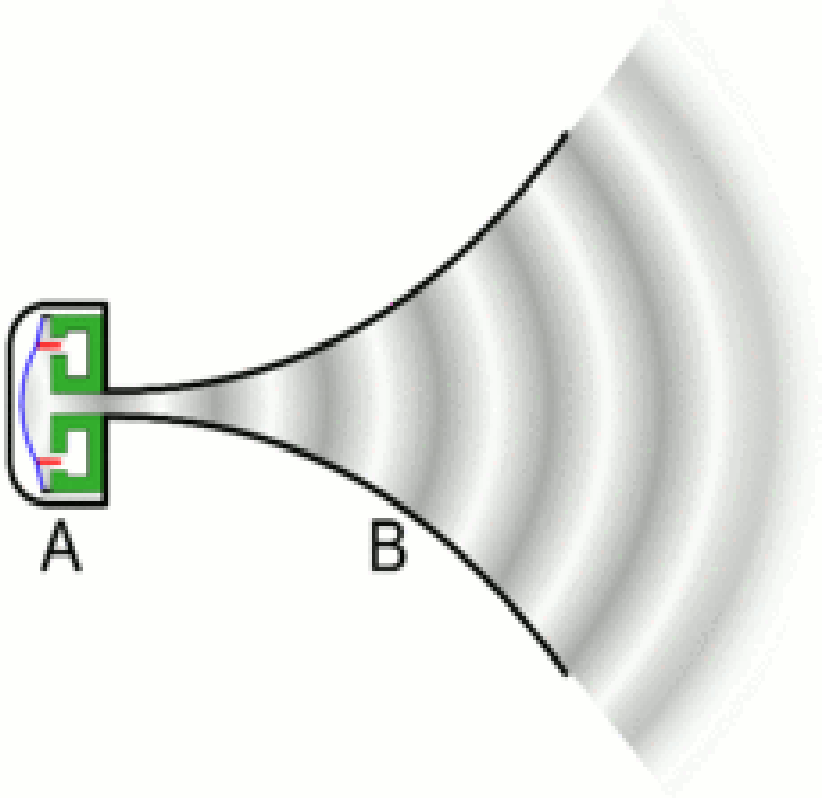
- A horn loudspeaker is a loudspeaker or loudspeaker element which uses an acoustic horn to increase the overall efficiency of the driving element(s).
- It consists of a compression driver which produces sound waves with a small metal diaphragm vibrated by an electromagnet, attached to a horn to produce sound waves to the open air.

Some characteristics is given below:

- EFFICIENCY – 30 to 50 %
- SNR – 40 db
- FREQUENCY RESPONSE – 30-10000Hz
- DISTORTION – 5%

Diagram





Construction

- The horn is tapered enclosure whose diameter increases from the throat to the mouth
- There is an air chamber trapped between throat and diaphragm.
- The horn acts as a high pass filter.

Working

- Horn type loudspeaker use moving coil place in magnetic field but instead of radiating acoustic and sound power direct to the open space of listener area.

- The power is first deliver to air chamber and than tapped to the horn and from their to the listener area.

Loudspeaker-system manufacturers

Manufacturer	Headquarters country
Acapella Audio Arts	Germany
ADAM Audio	Germany
ADRaudio	Slovenia
Advance Acoustic	France
Advent	United States
Alesis	United States
Altec Lansing	China and United States
Amphion Loudspeakers	Finland
Apertura	France
Audison	Italy
Audiovox	United States
AVI Sound International	Canada
Bang & Olufsen	Denmark

THANK YOU

Compact Disc (CD)

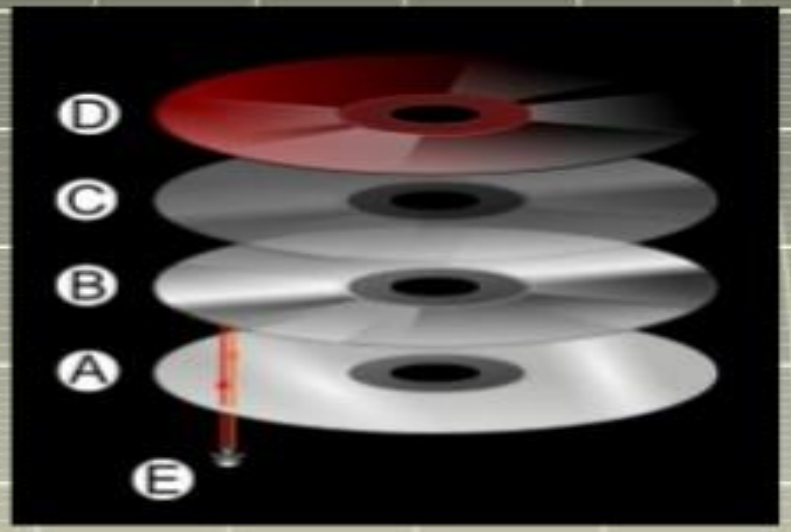
What is Compact Disc (CD)?

- *It is an optical disc used to store digital data.*
- *'SONY' first publicly demonstrated an Optical Digital Audio Disc in September 1976.*
- *It was originally developed to store & playback sound recordings exclusively, but later expanded to encompass-*

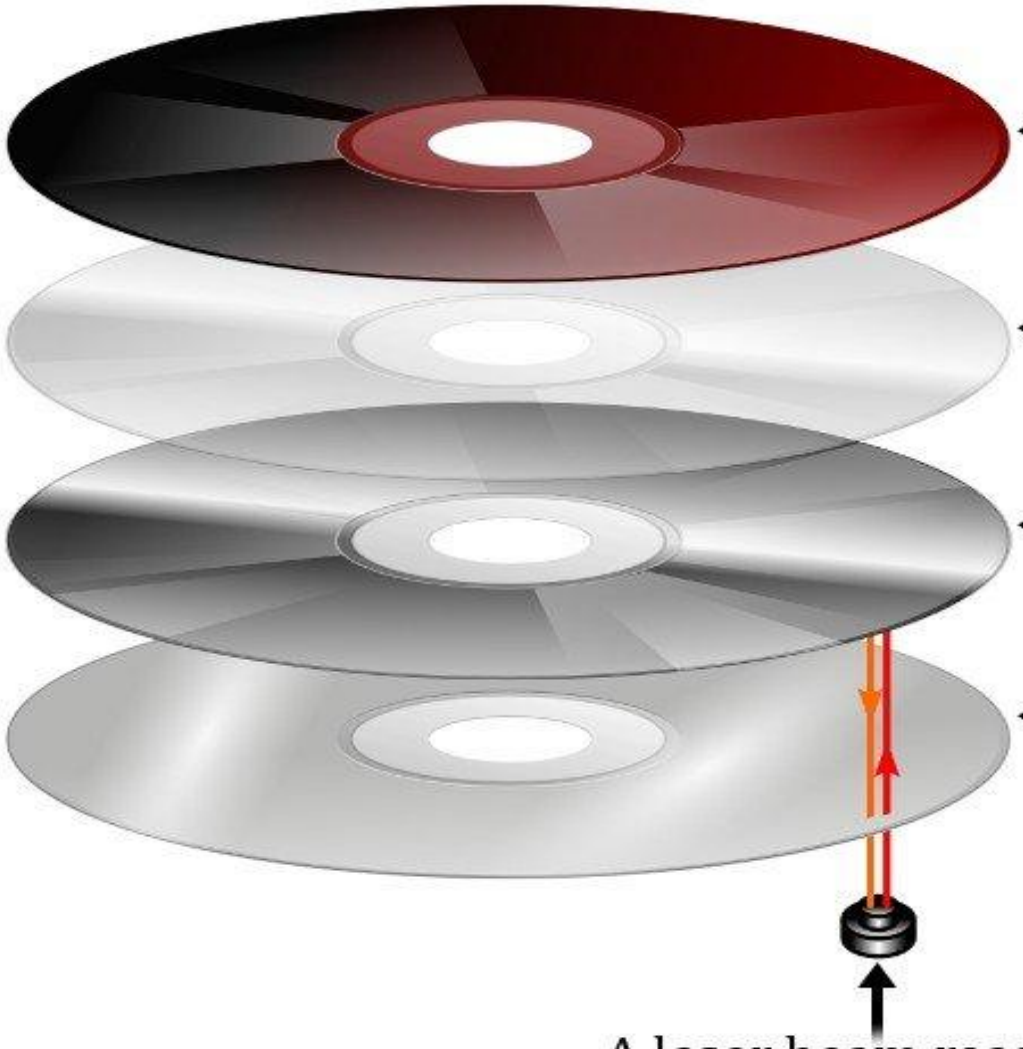
CD later expanded to encompass:-

- Data storage (CD-ROM)
- Write once audio & data storage (CD-R)
- Rewritable Media (CD-RW)
- Video compact Discs (VCD)
- Super Video Compact Discs (SVCD)
- Photo CD
- CD-i
- Enhanced CD

Physical details of COMPACT DISCS:-



A. *A polycarbonate disc layer has the data encoded by using bumps.*
B. *A shiny layer reflects the laser.*
C. *A layer of lacquer protects the shiny layer.*
D. *Artwork is screen printed on the top of the disc.*
E. *A laser beam reads the CD & is reflected back to sensor, which converts it into electronic data.*



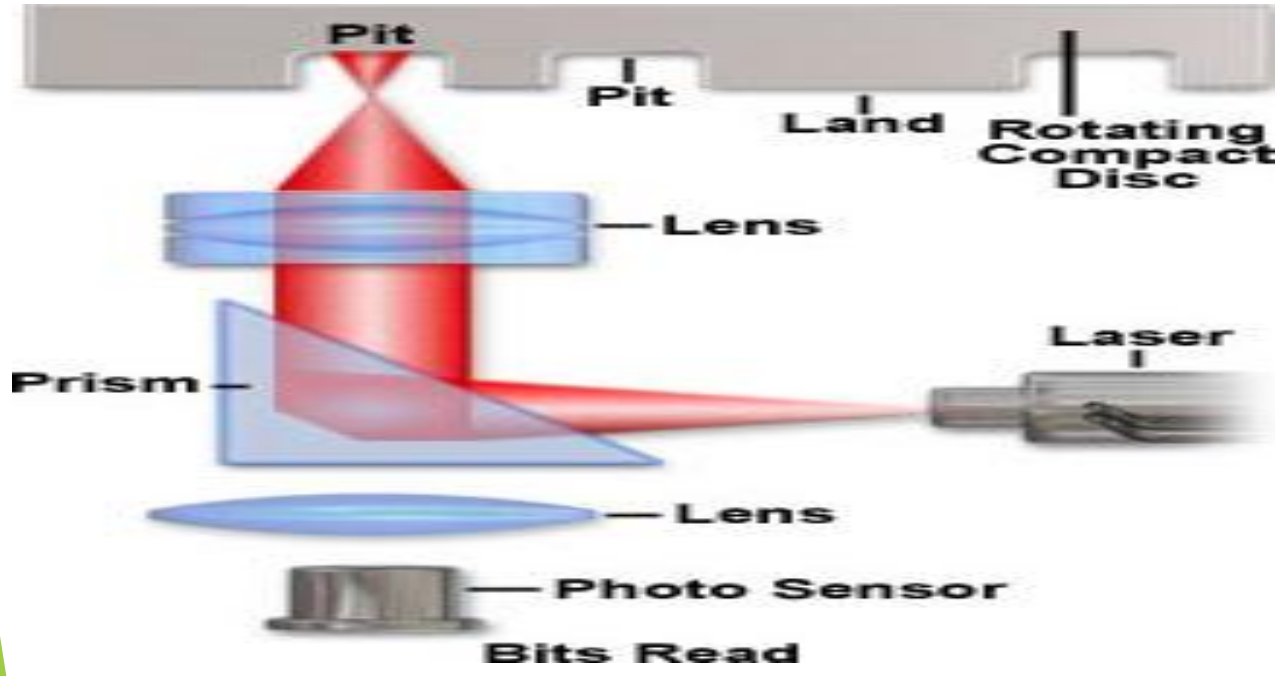
Artwork is screen printed on the top of the disc

A lacquer layer is used to prevent oxidation

A reflective layer reflects the laser back

A polycarbonate disc layer has the data encoded by using lands and pits.

A laser beam reads the polycarbonate disc


Pit
Pit
Land
Rotating
Compact
Disc
Lens
Laser
Prism
Lens
Photo Sensor
Bits Read

Disc Size and Capacity

Physical Size	Audio Capacity	CD-ROM data Capacity	Note
120mm	*74-99 min*	*650-870 MB*	*Standard size*
80mm	*21-24 min*	*185-210 MB*	*Mini-CD size*
85x54mm-86x64mm	*~ 6 min*	*140-65 MB*	*"Business Card" size*

Digital Versatile/Video Discs (DVD)

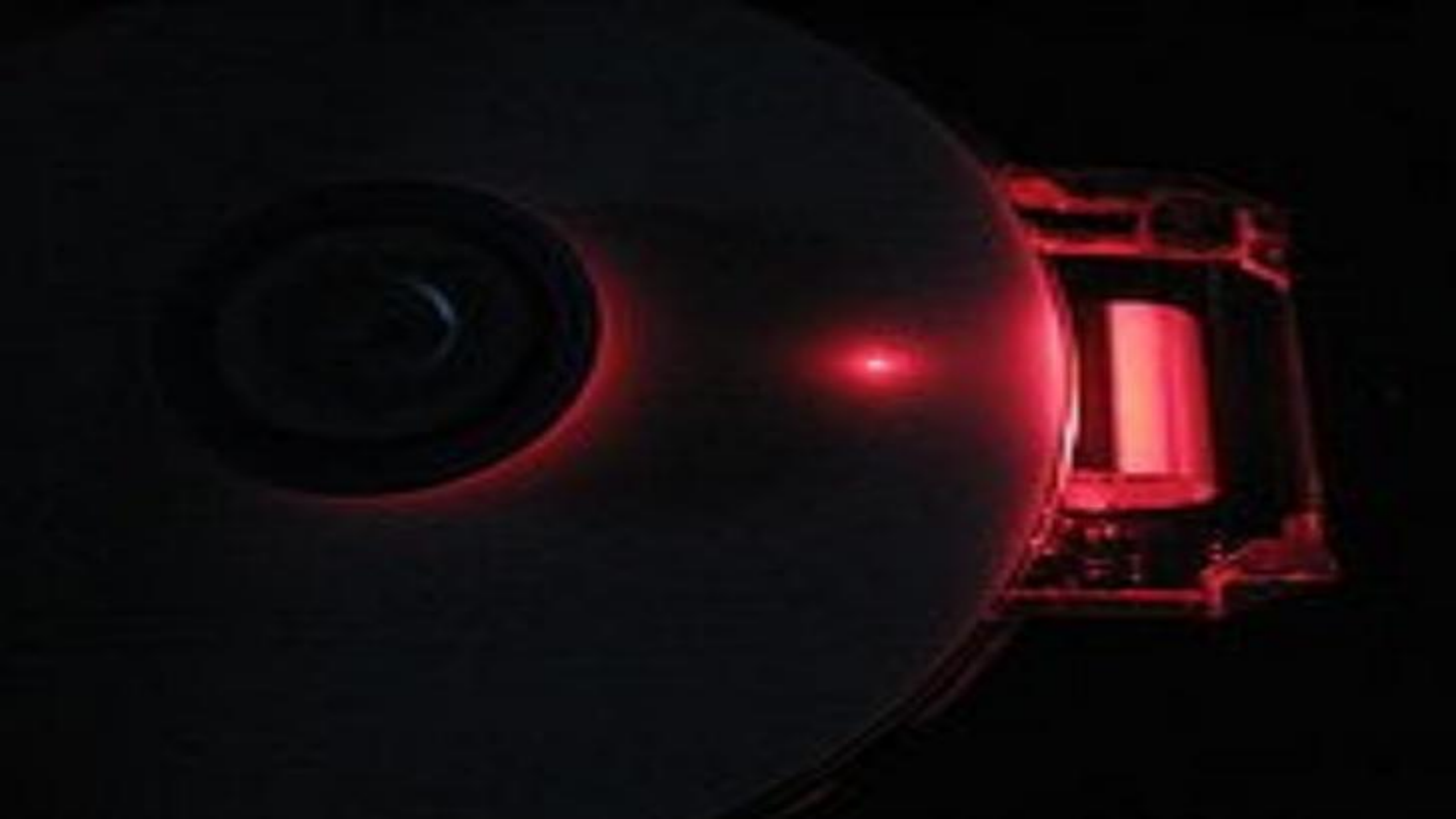
What is DVD?

- *DVD stands for Digital Versatile/Video Disc.*
- *It is an optical disc storage media format.*
- *Invented & Developed by Philips, Sony, Toshiba and Panasonic in 1995.*
- *It offers higher storage capacity than CD's while having the same dimensions.*

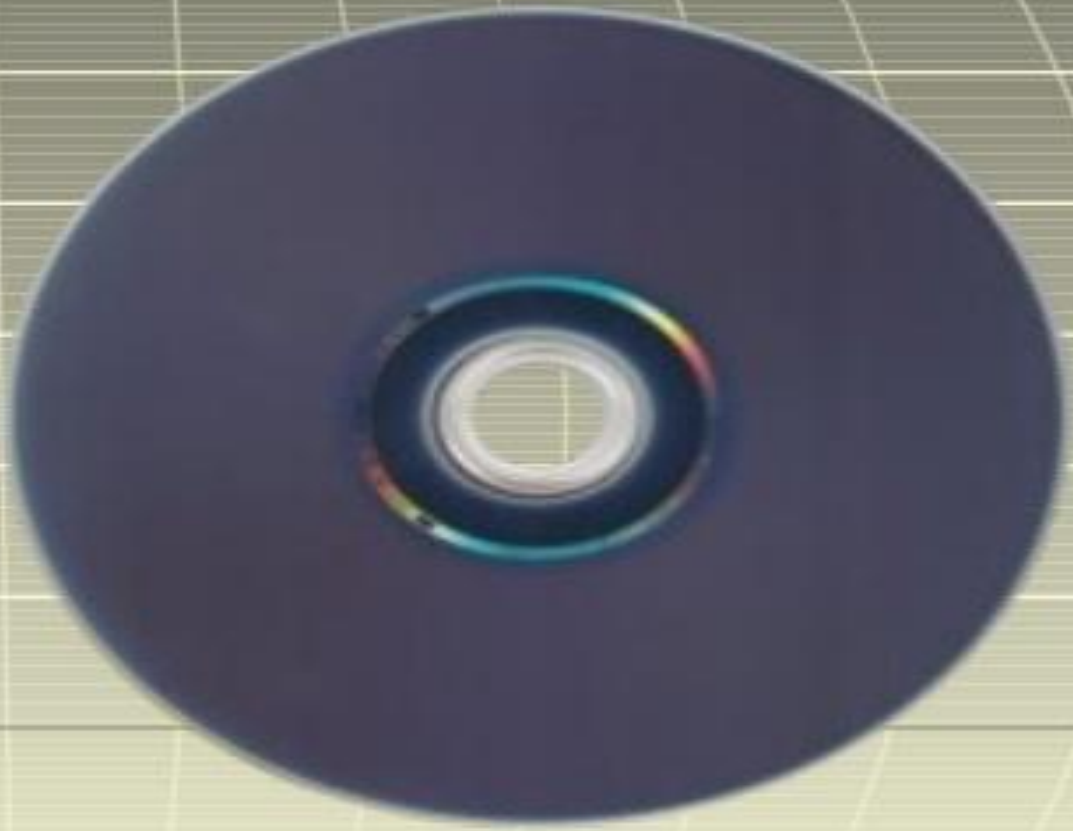
DVD sizes

- *There are basically 4 different DVD sizes.*

DVD size (name)	DVD-5	DVD-9	DVD-10	DVD-18
Storage capacity	4.7 GB	7.95 GB	8.75 GB	15.9 GB



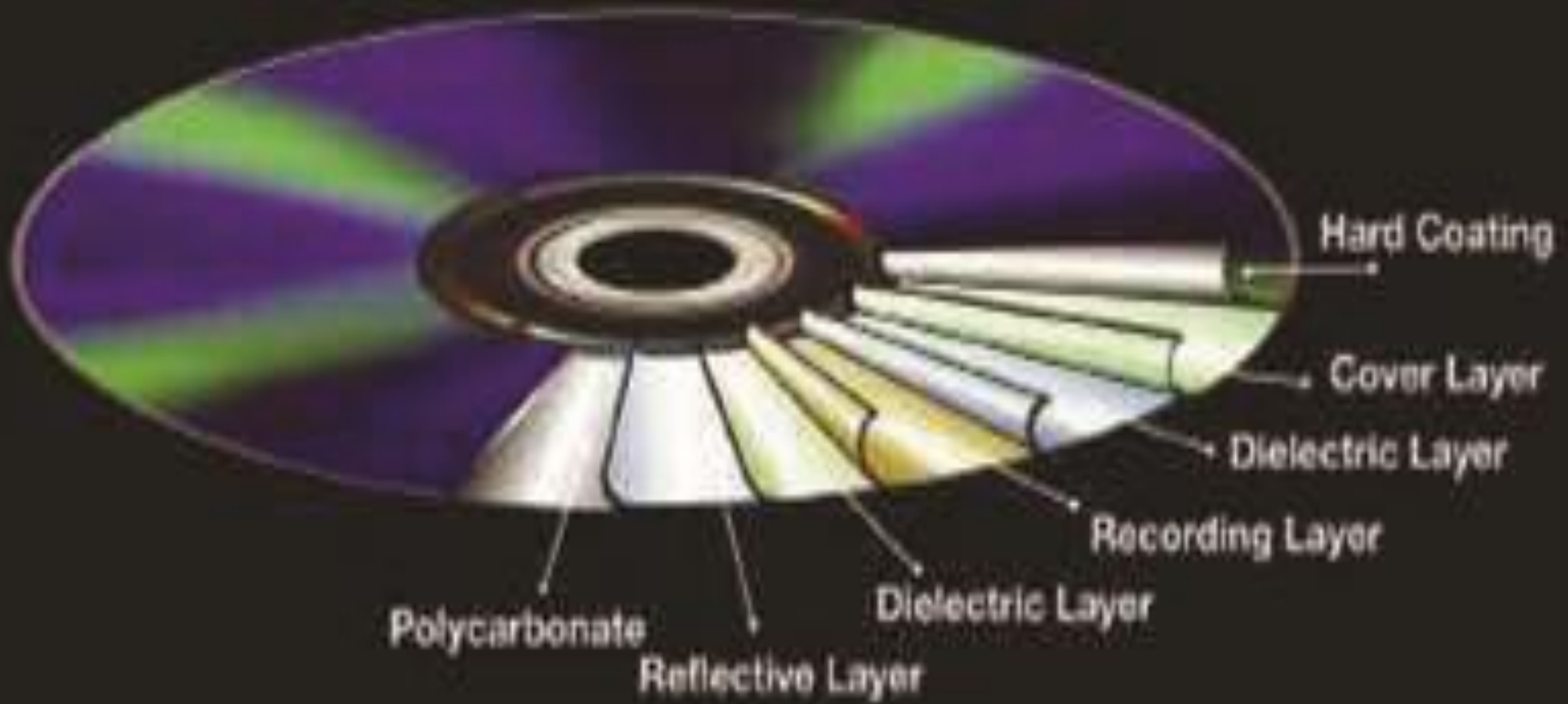
BLU-RAY DISC



What is Blu-ray Disc?

- It is a next-generation optical disc format meant for storage of high definition video & high density data.
- Jointly developed by a group of consumer electronics & PC companies called Blu-Ray disc Association (BDA) .

STRUCTURE OF A BLU-RAY DISC

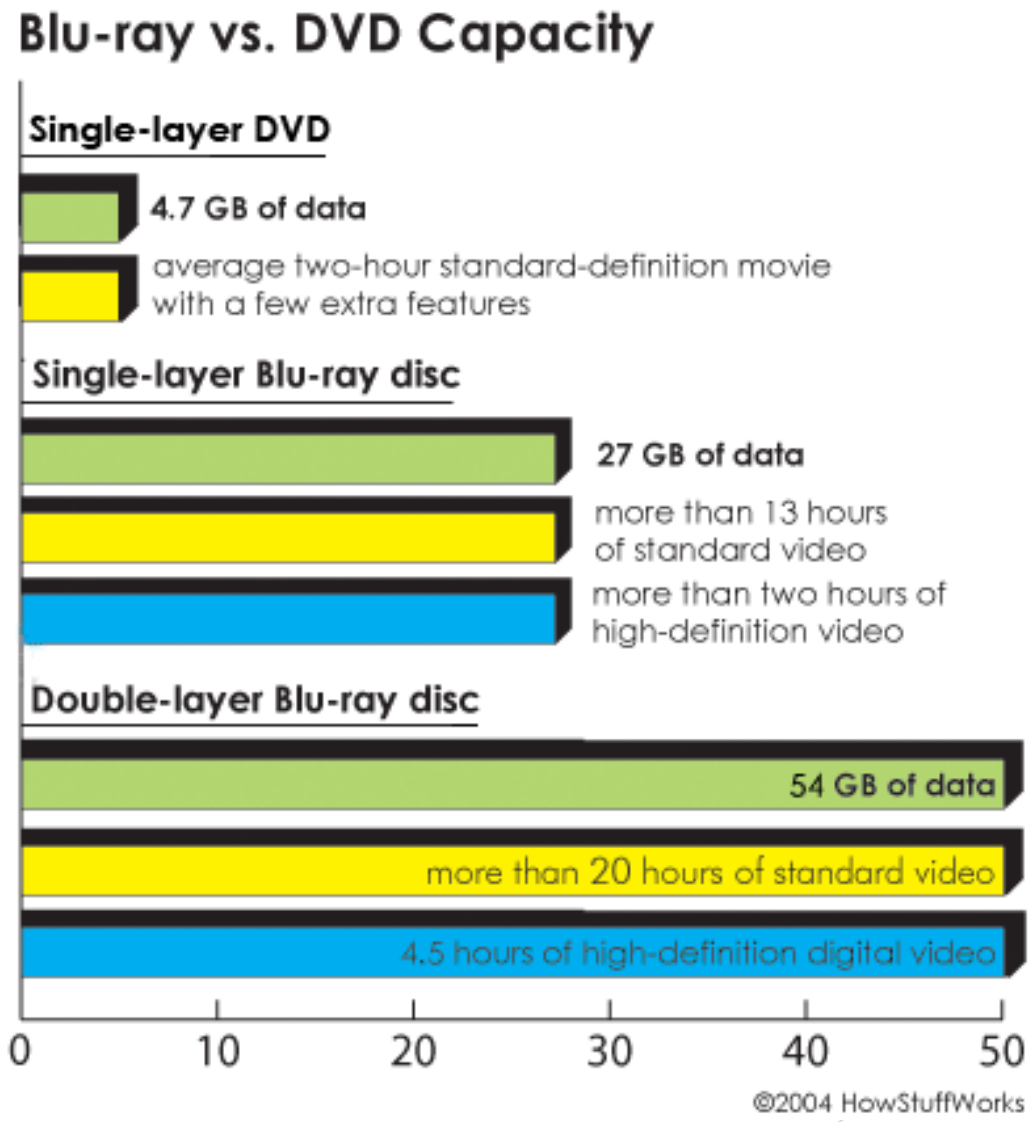


How it works

- While current optical disc technologies such as DVD rely on a red laser to read and write data, the new format uses a blue-violet laser instead, hence it's name Blu-ray
- The discs come in single or double layer. Single layer can hold 25GB and double can hold 50GB of data compared to DVDs holding 4.7GB of data


Laser wavelength: Blu-ray & DVD
shorter
longer
Lasers in blue on the visible spectrum can read more bits of data over a given area.
DVDs: because wavelengths of red light are longer, less data can be read over a given area.

Blu-ray vs. DVD capacity



How it works

- The benefit of using a blue-violet laser is that it has a shorter wavelength than a red laser, which makes it possible to focus the laser spot with even greater precision. This allows data to be packed more tightly and stored in less space, so it's possible to fit more data on the disc even though it's the same size as a CD/DVD.

Capacity & Usage :-

- **Capacity** = 25 GB (single-layer)
  50 GB (dual-layer)
  100/128 GB (BDXL)
- **Usage** :-

1. Data Storage
2. High definition Video
3. High definition Audio
4. Stereoscopic 3D
5. Playstation Games

Size & Capacity:-

Type	Diameter (cm)	Layers	Capacity GB
Standard disc size, single layer	12	1	25.0
Standard disc size, dual layer	12	2	50.1
Mini disc size, single layer	8	1	7.8
Mini disc size, dual layer	8	2	15.6

THANK YOU