Stereoscopic Systems Part 2

Colored vs. Polarized Filters

Modern stereo 3D films use glasses with polarized filters instead of colored filters.

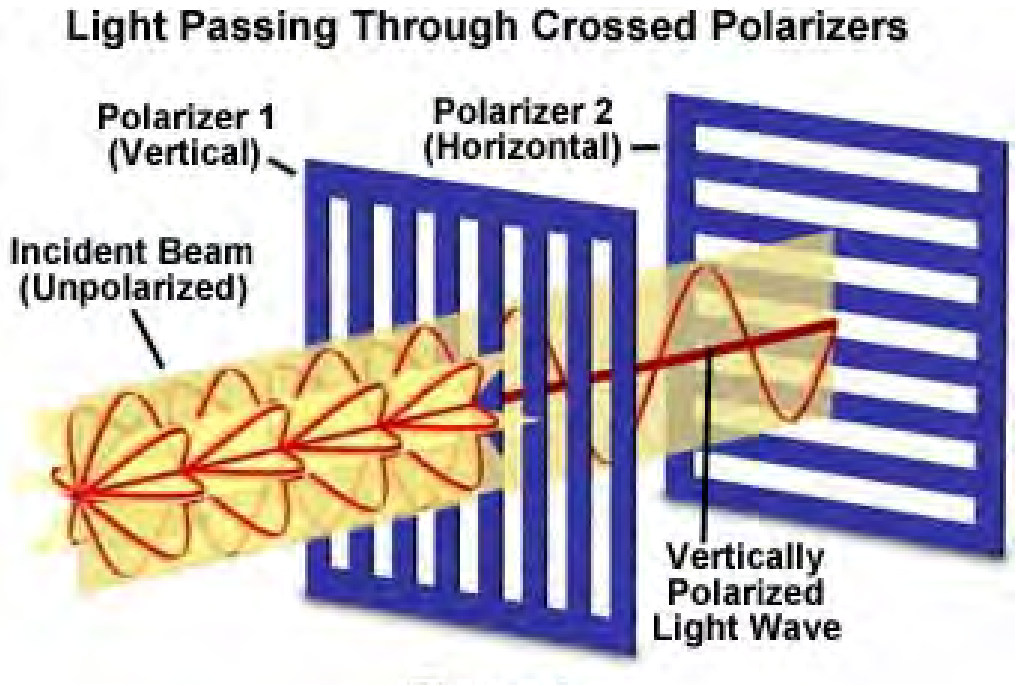
Colored Anaglyph Glasses

Polarized Glasses

Linear Polarization

Transverse waves can be polarized.

The direction of the polarization is the direction of the amplitude of the oscillations.



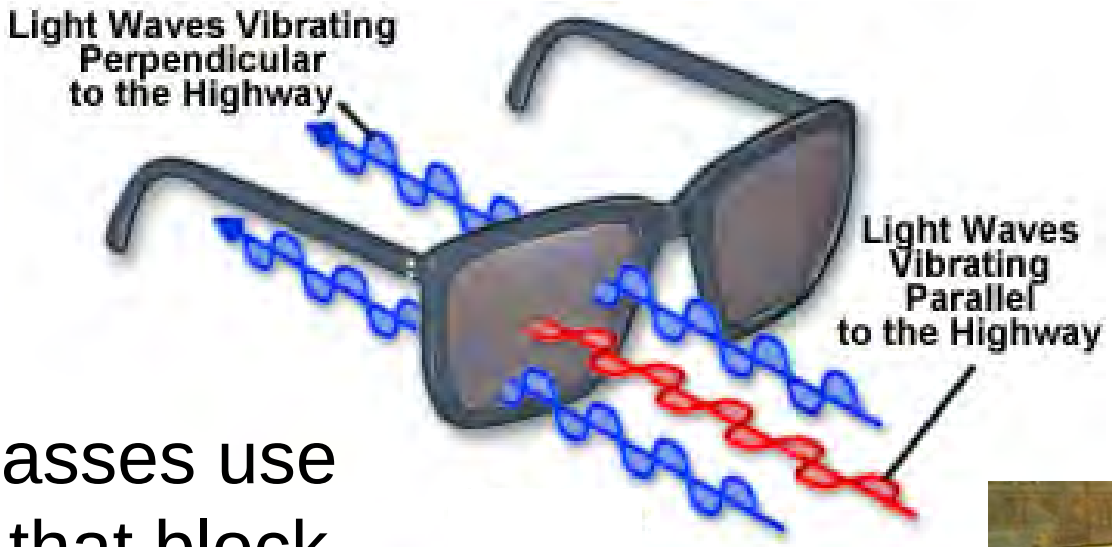
Polarizing filters take light with a random mix of polarizations and allow only one direction to pass.

Linear Polarization

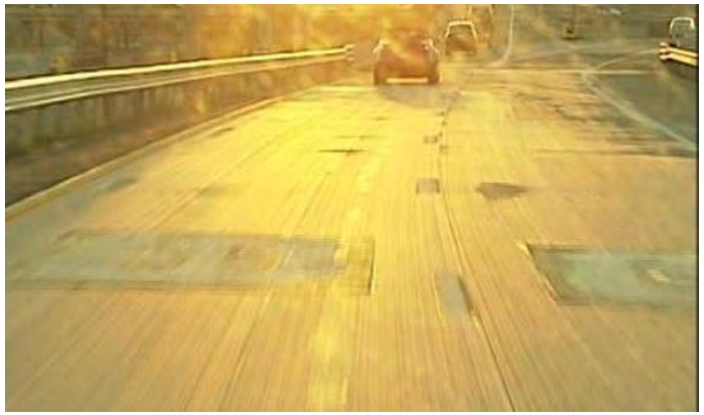
A pair of linear polarized filters that are perpendicular block out light.

Polarized Sunglasses

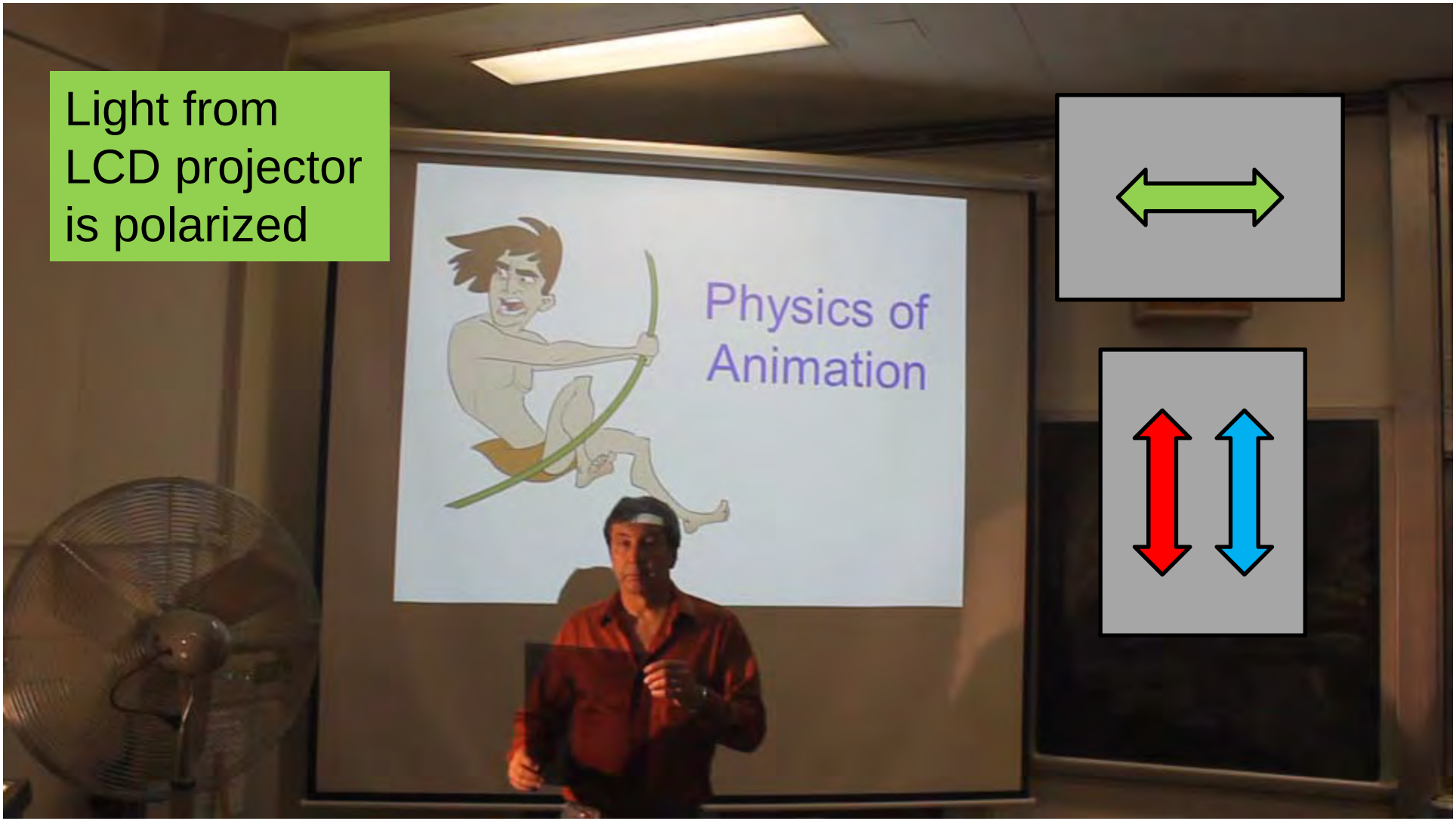
Reflected light from a horizontal surface is often polarized in the horizontal direction.



Sunglasses use filters that block horizontally polarized light.

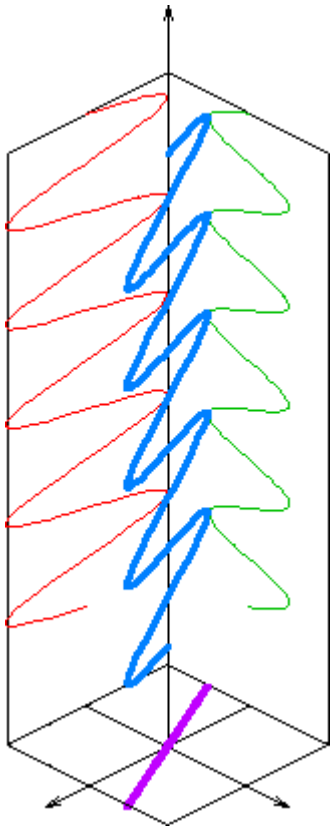


Polarization & LCD Projectors

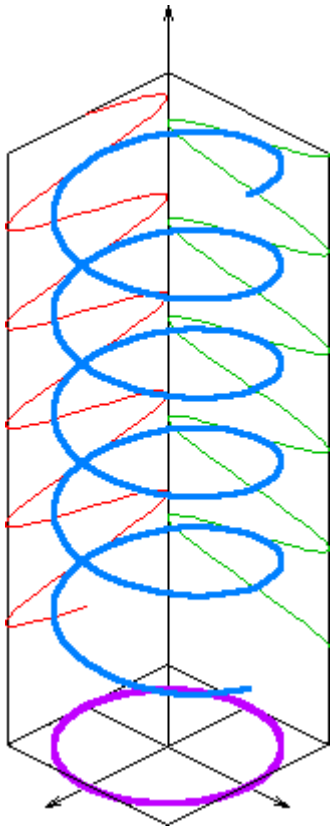


Circular Polarization

Transverse waves can also be circularly polarized.



Linear



Circular

Left Right

Circular Polarized Glasses

Reflections with 3D Glasses

Red/Cyan Anaglyph Glasses

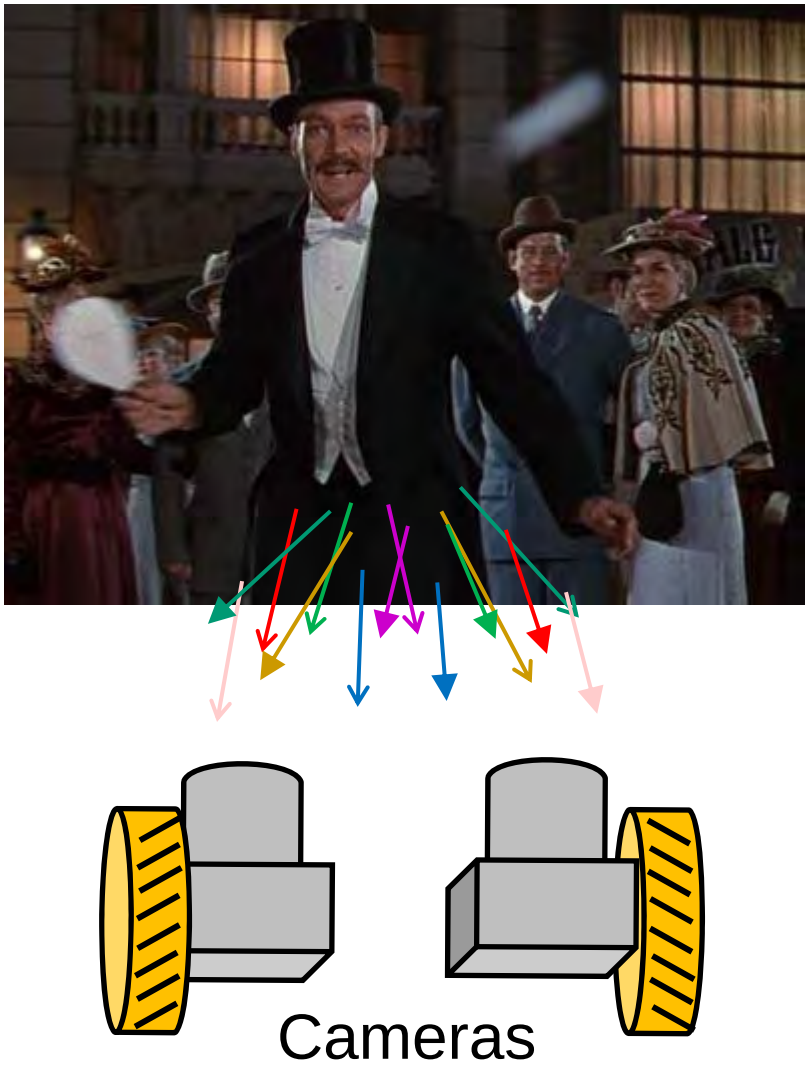
Circular Polarized Glasses

Put on stereo 3D glasses, close one eye, look in mirror.

Filming for Polarized Projection

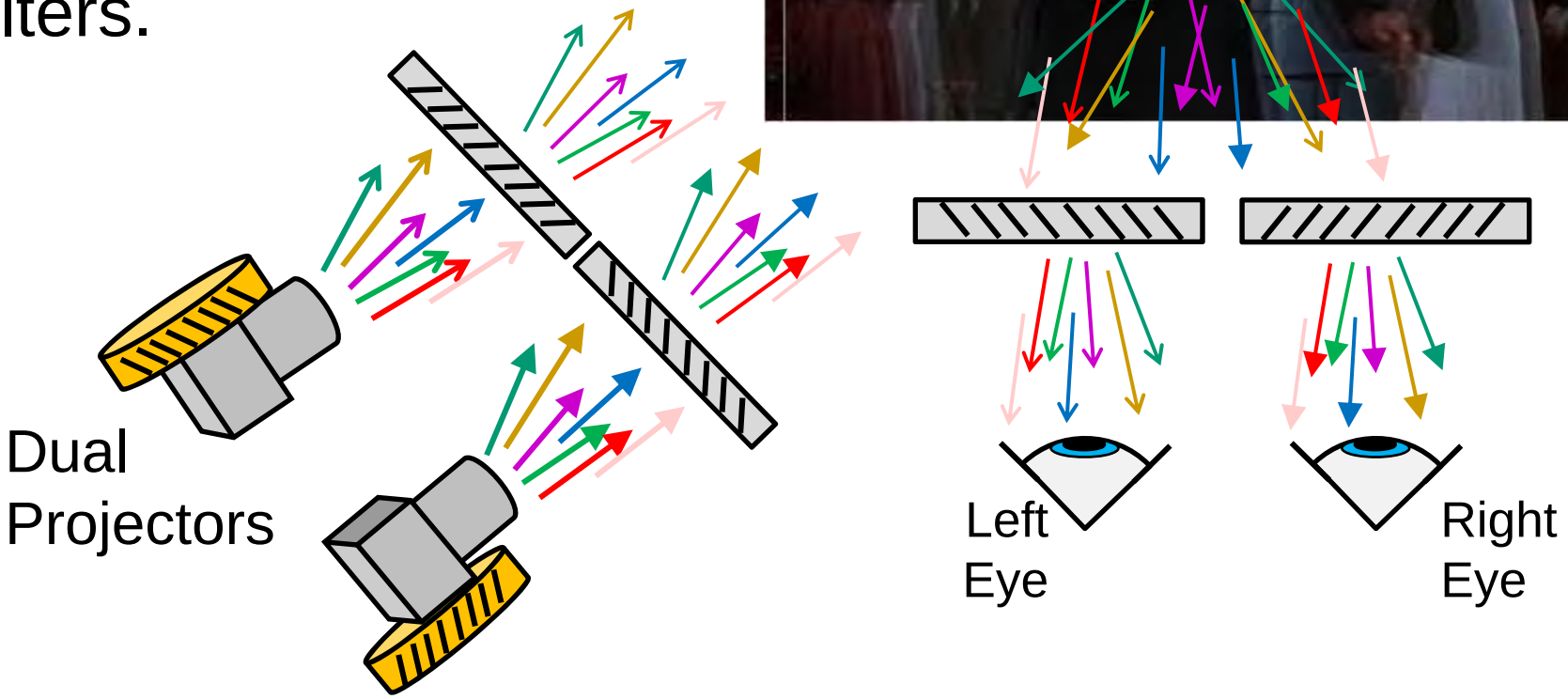
Unlike color, the polarization of light is not recorded by film (neither regular film or digital recording).

Use two cameras to record the two views but polarization only used when projecting.



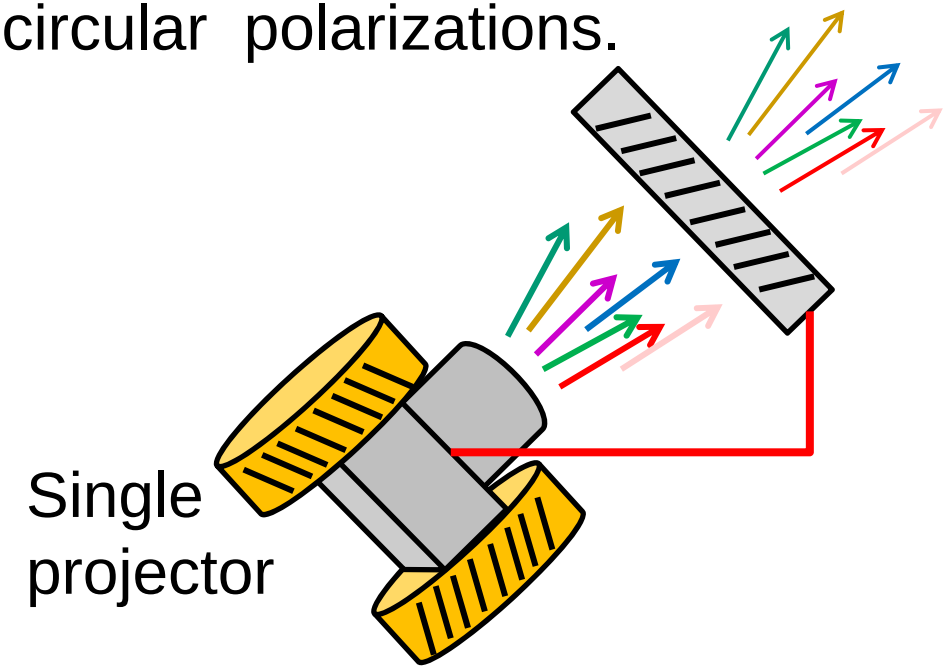
Old Polarized Projection

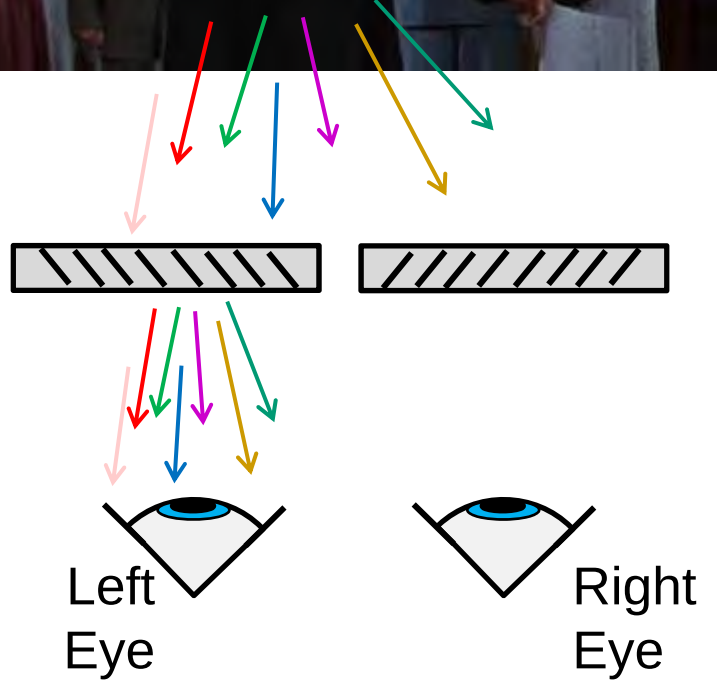
Older systems used dual projectors and linear polarizing filters.



New Polarized Projection

Digital projector is synchronized to an electronic polarizer. Interleave frames with alternating left and right circular polarizations.

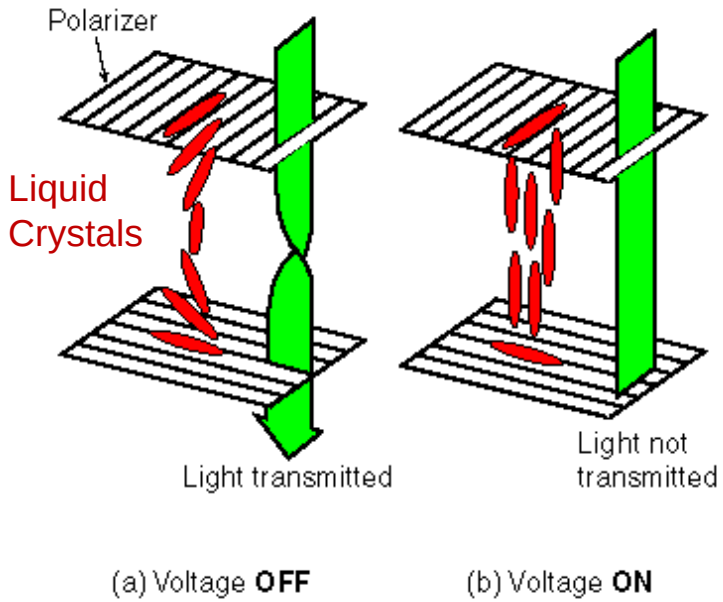




Next frame seen by right eye.

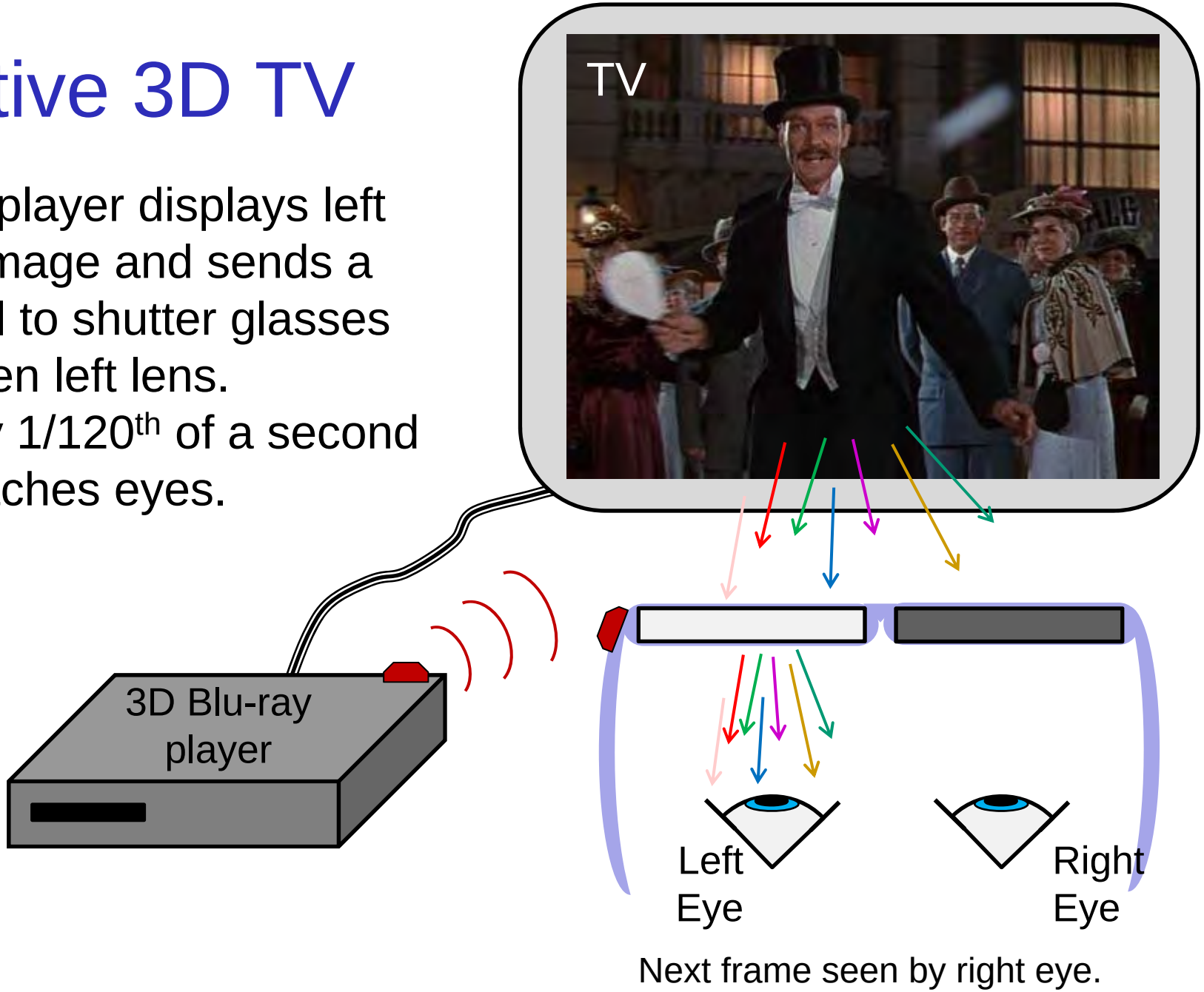
Shutter Glasses

Lenses of shutter glasses are active liquid crystal displays that electrically switch from clear to dark.



Active 3D TV

DVD player displays left eye image and sends a signal to shutter glasses to open left lens.
Every 1/120th of a second it switches eyes.

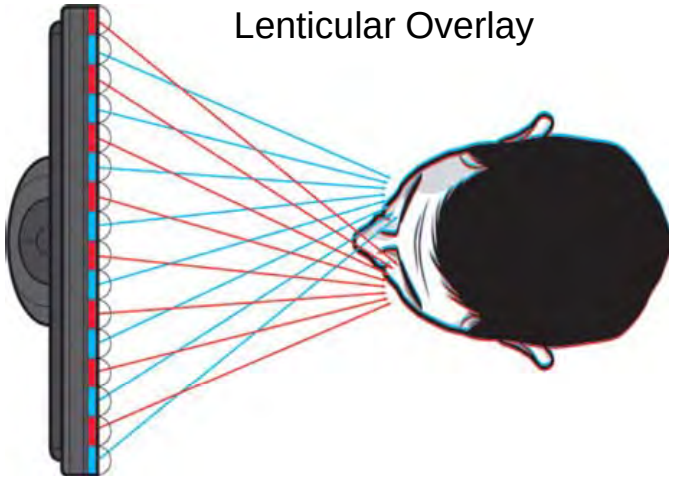


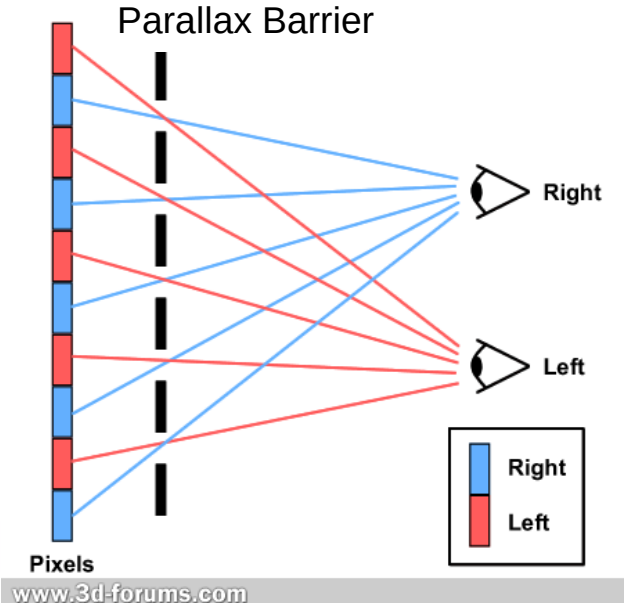
Next frame seen by right eye.

Autosteroscopic Displays

Stereo 3D without glasses is achieved by having each eye seeing different pixels, either by lenses or barriers.

Current technology only allows a single viewer close to the display.





Parallax using Accelerometers

Devices with an accelerometer, such as the iPhone, can detect motion and change the display to match the resulting parallax.

Icons move relative to the background when you move the device but not when you only move your head.

Holograms

True holograms are made using interference patterns from multiple laser sources.

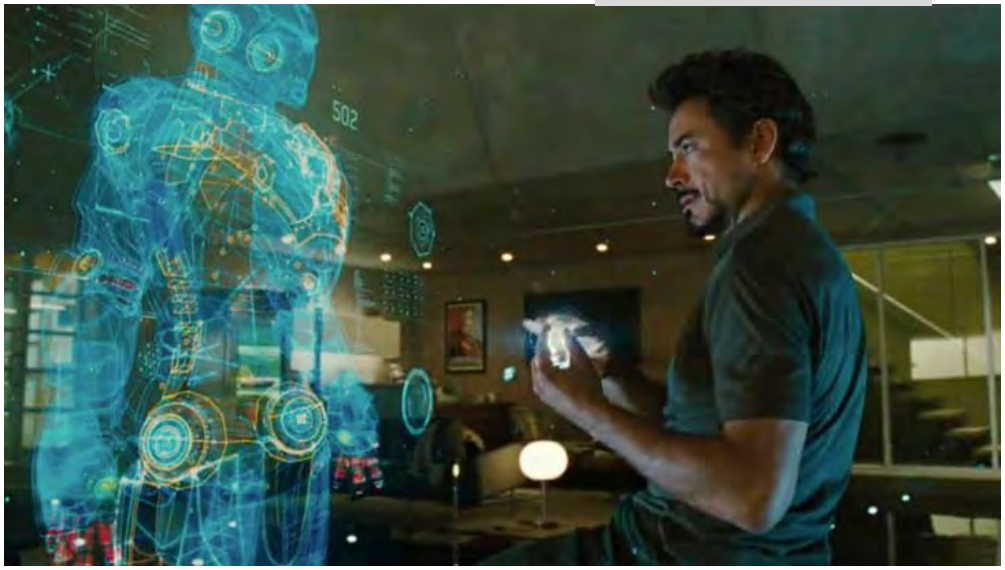
Holograms allow you to rotate your view of an image by either moving your head or by moving the hologram around.

Rainbow hologram on a credit card

Two photos of a hologram, taken from two different angles.

Movie “Holograms”

Iron Man 3 (2013)



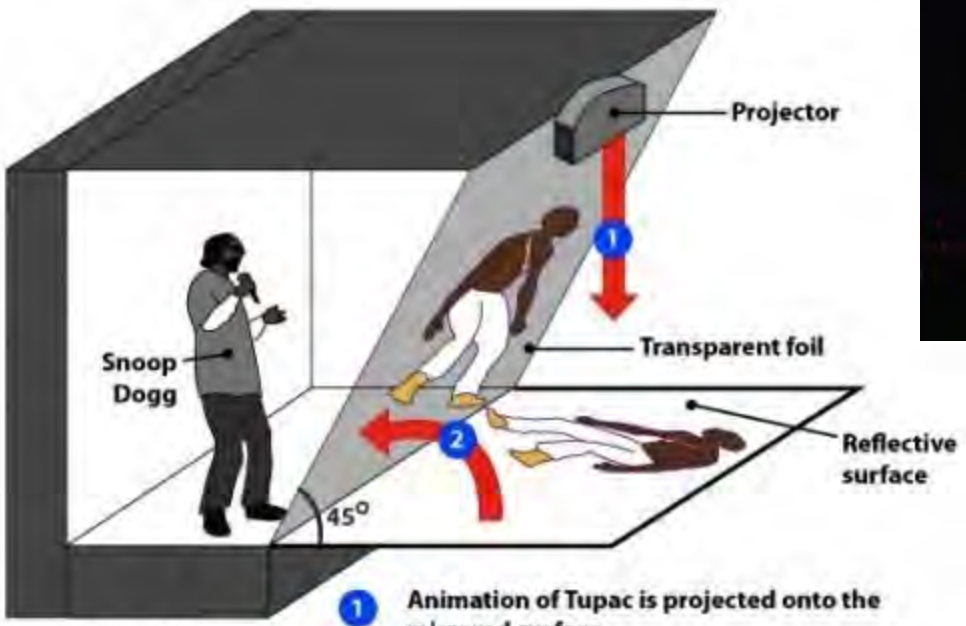
Holograms in sci-fi films are composited images, either CG or live-action.

They are transparent with a shimmering glow to make them look photonic.

Star Wars (1977)

Concert “Holograms”

Deceased rapper Tupac appeared to perform at Coachella as a hologram



1 Animation of Tupac is projected onto the mirrored surface

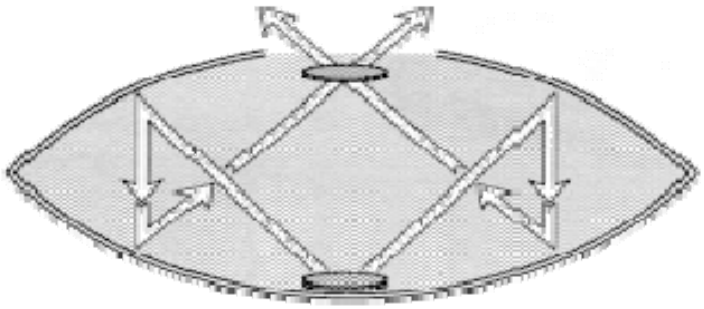
2 Image is reflected onto the transparent screen, which is angled such that the audience sees Tupac but not the foil.

Source: Musion Eyeliner system patent (U.S. Patent No. 5,865,519, “Device For Displaying Moving Images In The Background Of A Stage”); Musion Systems Ltd.

Actually a CG animation projected onto a clear screen (Pepper’s Ghost)

Mirror “Holograms”

Pair of concave mirrors forms an image that is 3D. An object placed inside seems to float over the hole.



Mirror “Hologram”

Summary

- Modern stereo 3D films use polarized glasses.
- Horizontally polarized filters will block vertically polarized light (& vice versa).
- Clockwise circular polarized filters will block counter-clockwise polarized light (& vice versa).
- Shutter systems alternate opening the shutter on the glasses on each frame of film.
- Autostereoscopic displays use grids (parallax barriers) or lenses (lenticular overlay).
- True holograms are made using interference patterns from multiple laser light sources.