HOLOGRAPHY

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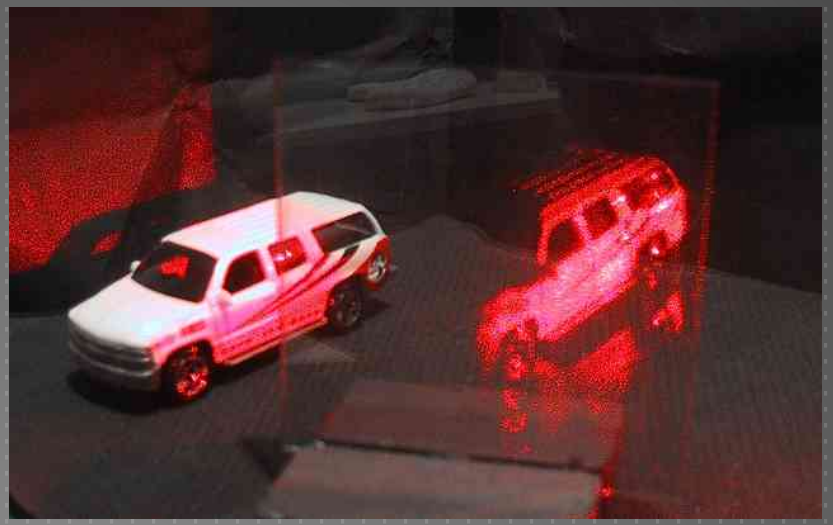
WHAT IS HOLOGRAPHY?

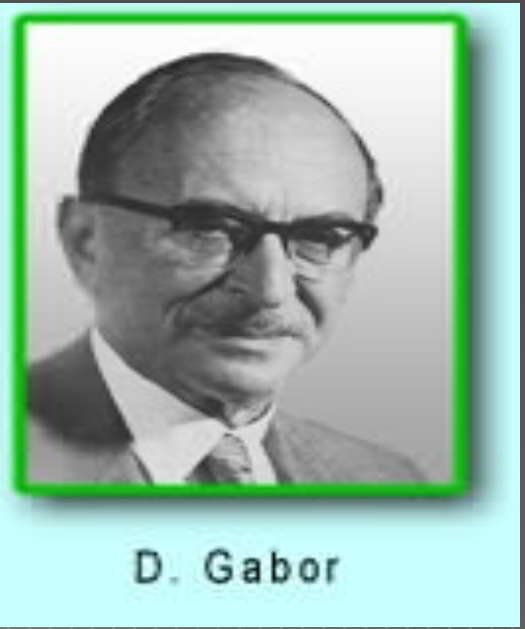
A technique that creates three-dimensional images using lasers, interference patterns, and diffraction.



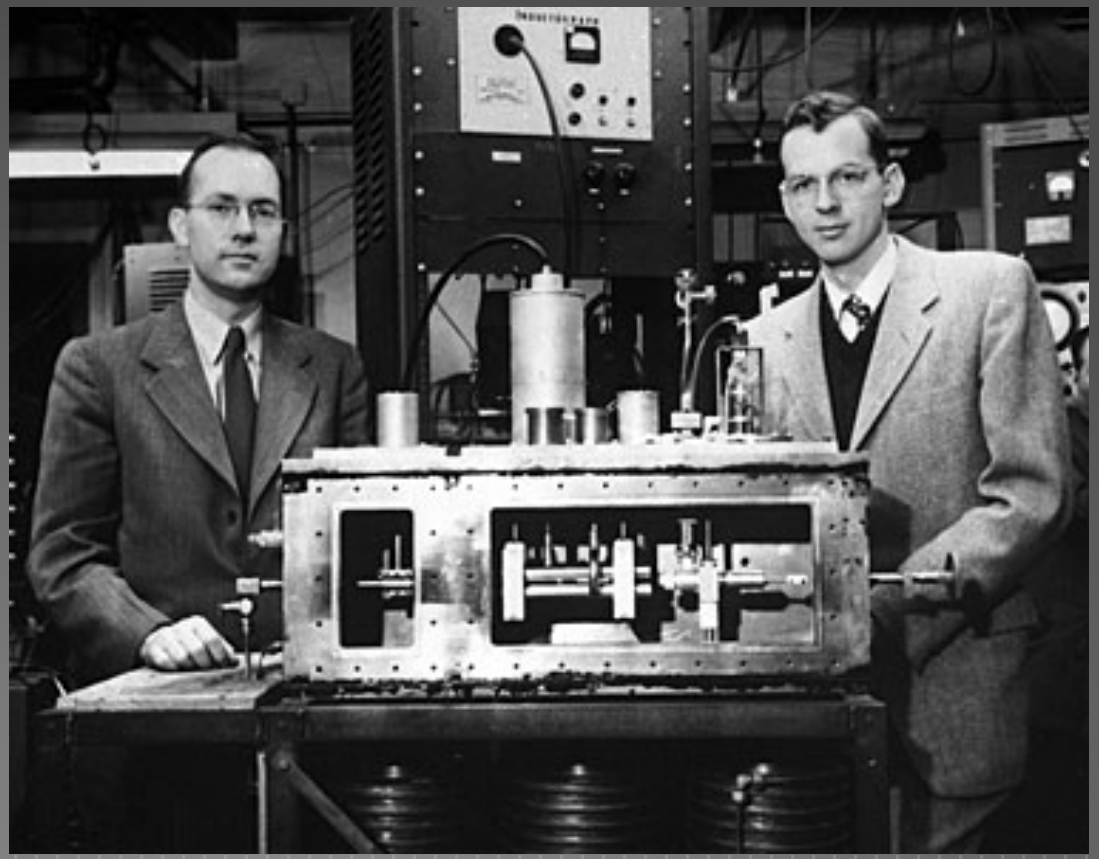
HISTORY OF THE HOLOGRAM

DENNIS GABOR INVENTED HOLOGRAPHY IN THE LATE 1940'S.

- Created with electron microscopes
- Patent filed in December 1947
- Created in Rugby, England



THE INVENTION OF THE LASER IN 1960 LED TO OPTICAL HOLOGRAPHY.



YURI DENISYUK CREATED THE FIRST REFLECTION HOLOGRAM IN 1962 IN THE SOVIET UNION.

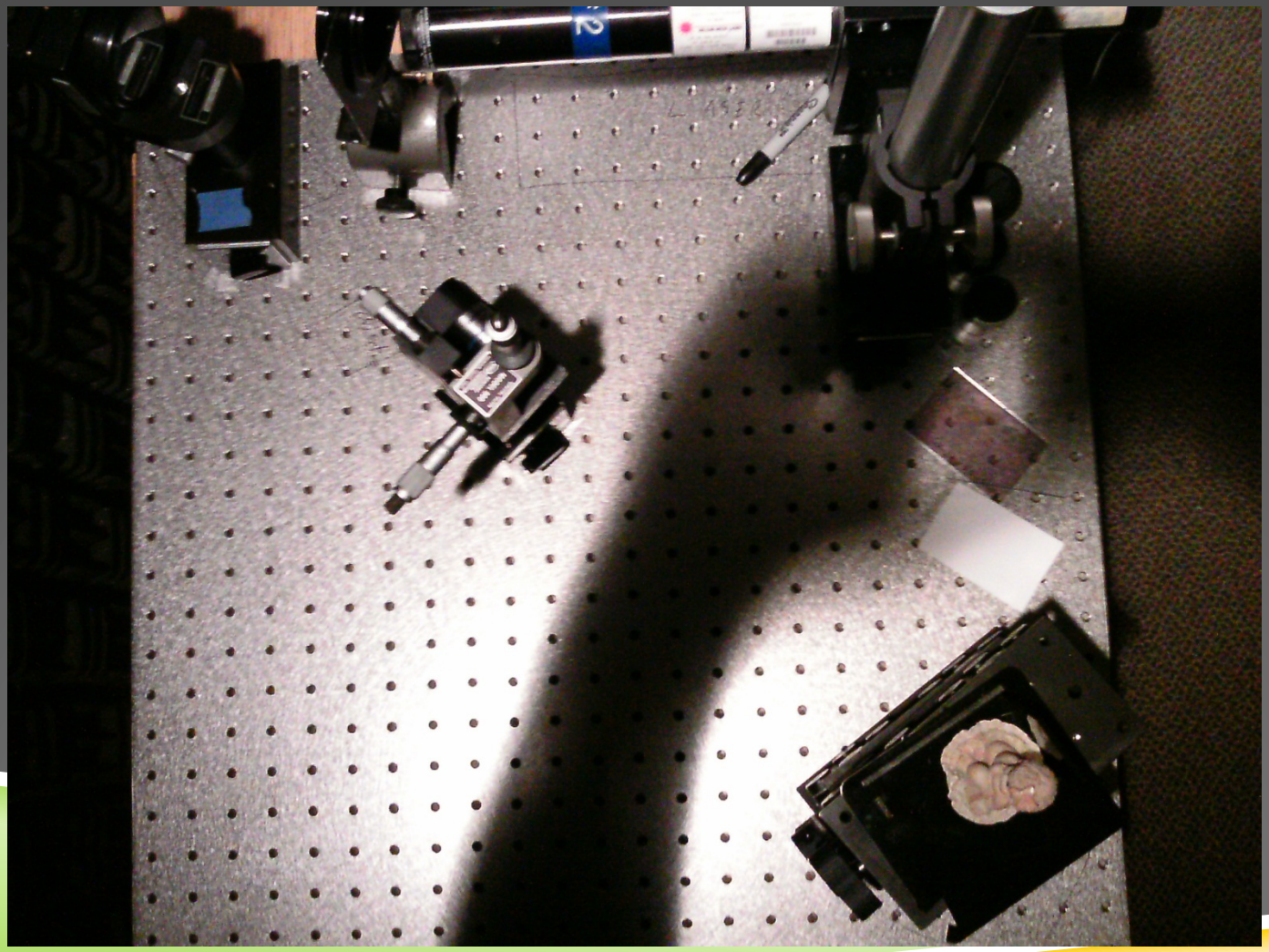
TRANSMISSION HOLOGRAMS WERE INVENTED BY EMMETT LEITH AND JURIS UPATNIEKS IN 1962.

HOW HOLOGRAMS WORK

ELEMENTS TO MAKE A HOLOGRAM

- Reference beam – beam that directly hits the film
- Object beam – beam that bounces off the object to hit the film
- Film – substance used to record the hologram; we used photopolymers
- Laser – light source with a single coherent wavelength
- Objective lens – expands the beam; 60x worked the best for our experiment

EXPERIMENTAL SET UP

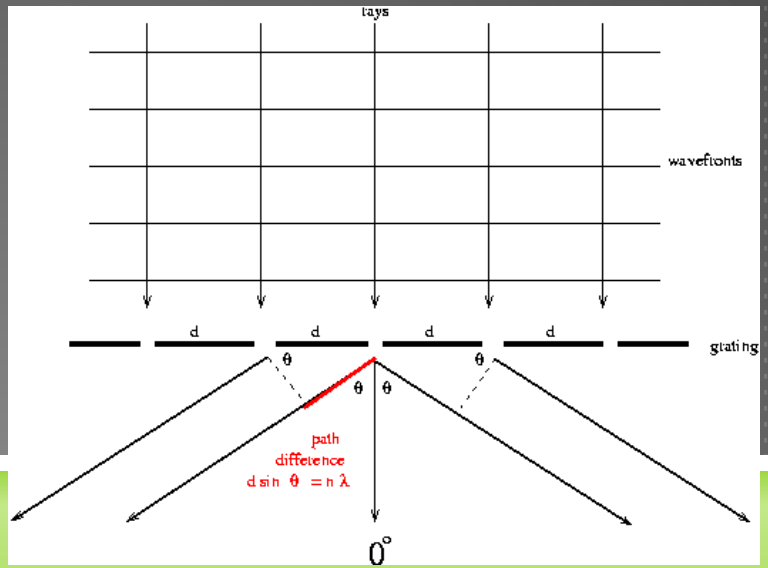


THINGS TO KEEP IN MIND WHEN MAKING A HOLOGRAM

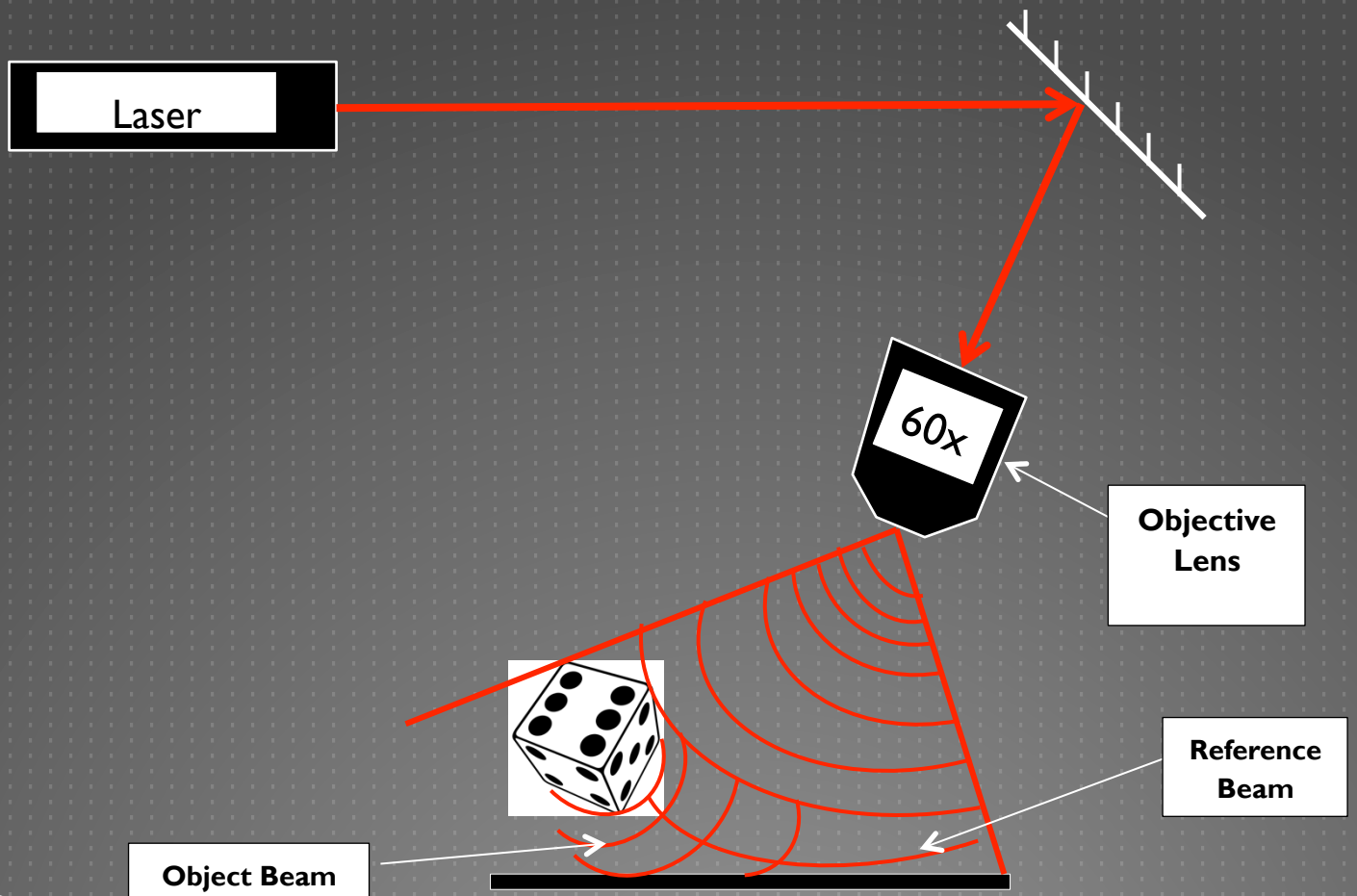
- Be quiet! The sound vibrations can move the equipment and mess up the process.
- Make sure the laser is parallel to the table and the objective lens to create a better angle for expanding the beam.
- Take one minute to cover the beam and stop vibrations before beginning.
- Keep the lights off while taking out the film to prevent pre-exposure.
- The exposure for the film we used takes 5 minutes of complete darkness and silence to work.
- After the hologram is recorded, it's okay to immediately put it in light to set the film.

DIFFRACTION GRATING BENDS LIGHT DEPENDING ON THE WAVELENGTH AND DISTANCE

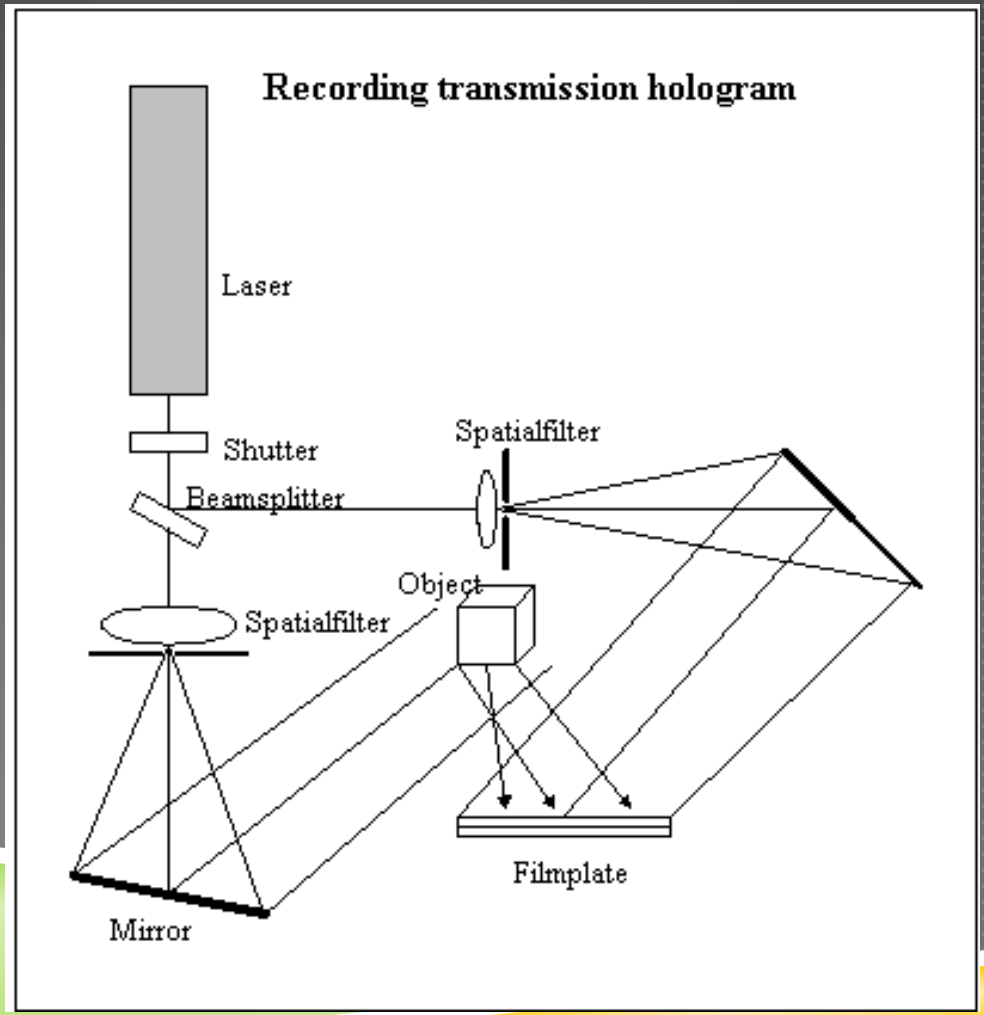
- Diffraction grating bends light using an interference pattern which results in a pattern of straight lines.
- $\sin\theta = \lambda / d$



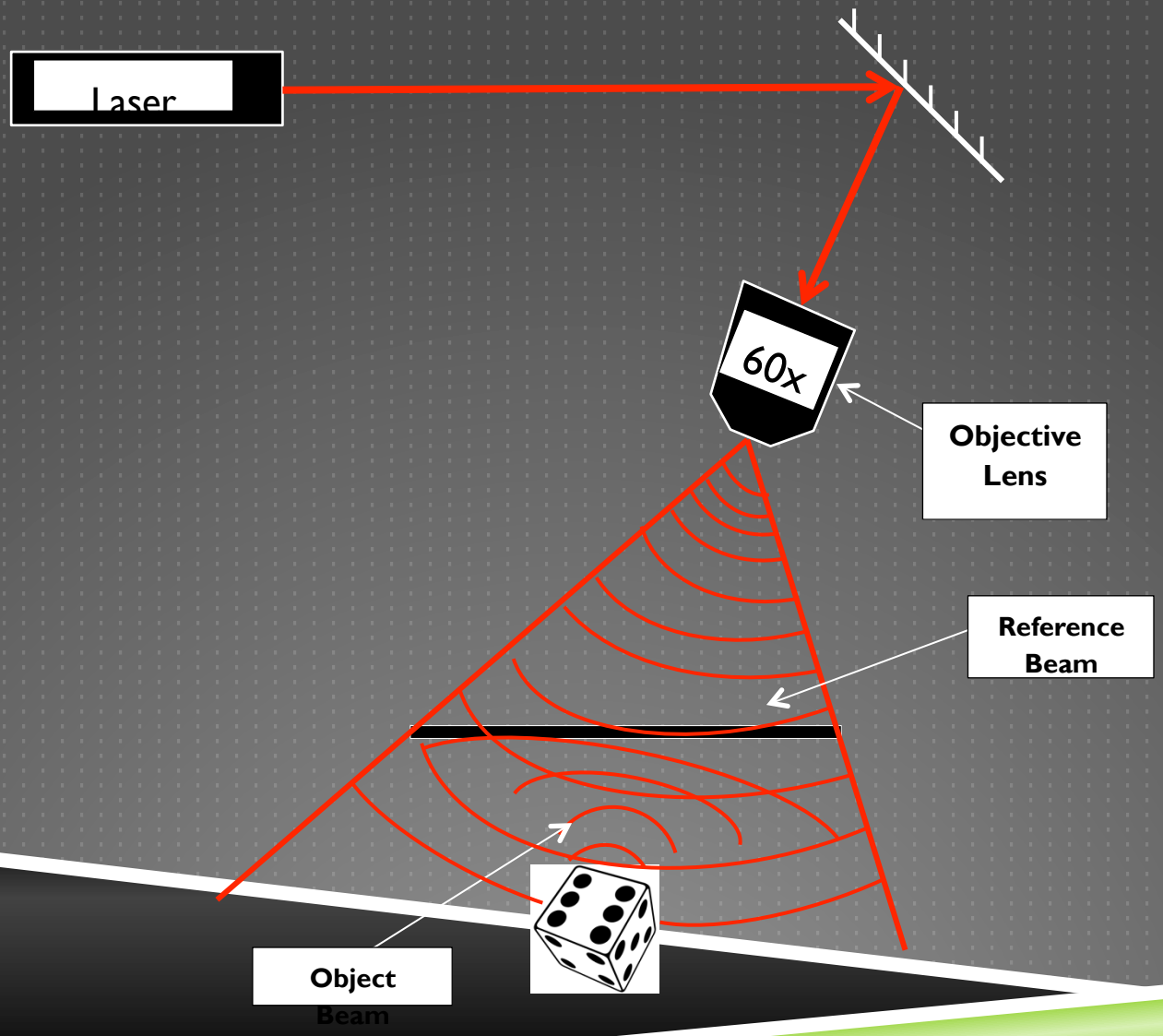
Transmission Hologram



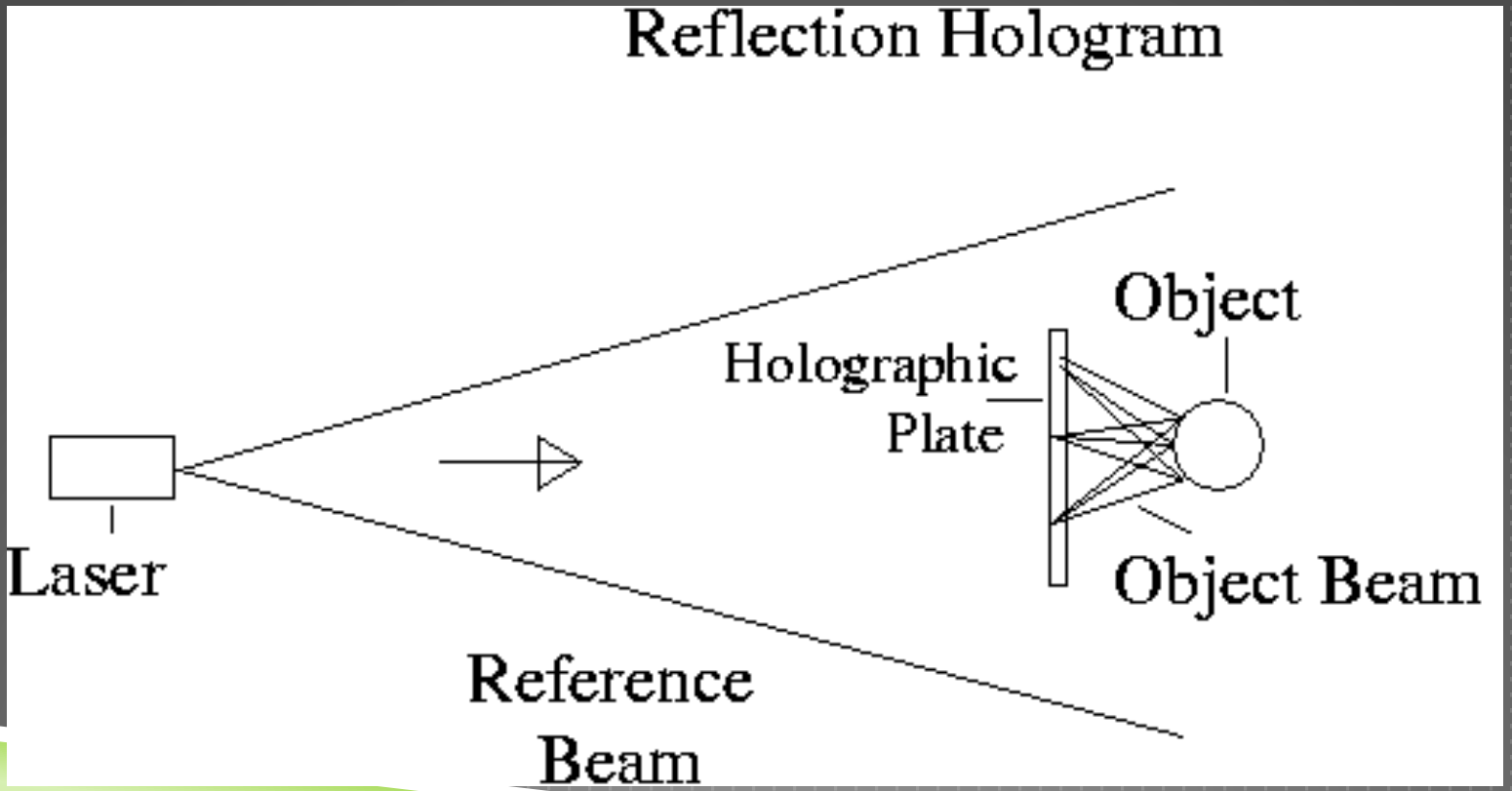
TRANSMISSION HOLOGRAMS BENDS LIGHT DIFFERENTLY AT DIFFERENT POINTS ON THE FILM.



Reflection Hologram



REFLECTION HOLOGRAMS REFLECTS LIGHT DIFFERENTLY AT DIFFERENT POINTS ON THE FILM.



THE RESULTS

Movement of the laser, any of the optics, or the objects will make the hologram not come out correctly.

The top of this Mickey Mouse figurine moved, so it didn't show up

The hologram can also be messed up with problems in the film. (eg. Air bubbles in the film, scratches on the film, or pre-exposure of the film)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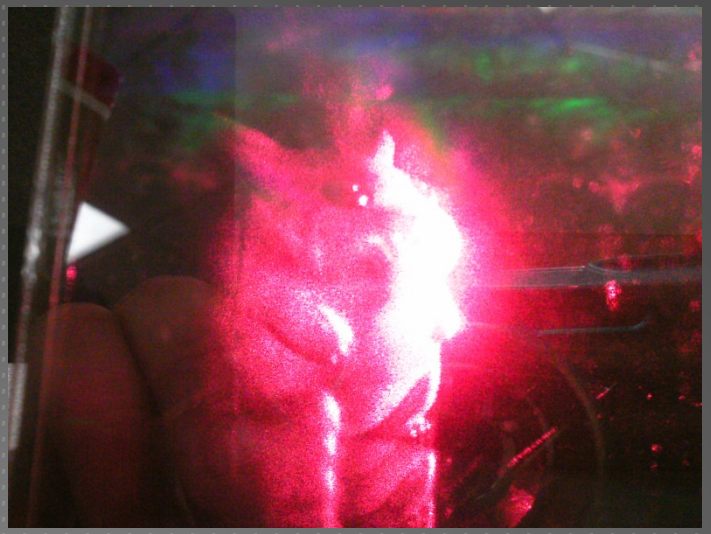

CONCLUSION

- There are many important steps to follow when making a hologram correctly.
- Learning more about holograms helps you recognize true holograms – don't be fooled by the media's perception of holograms!
- Overall, holograms are cool!