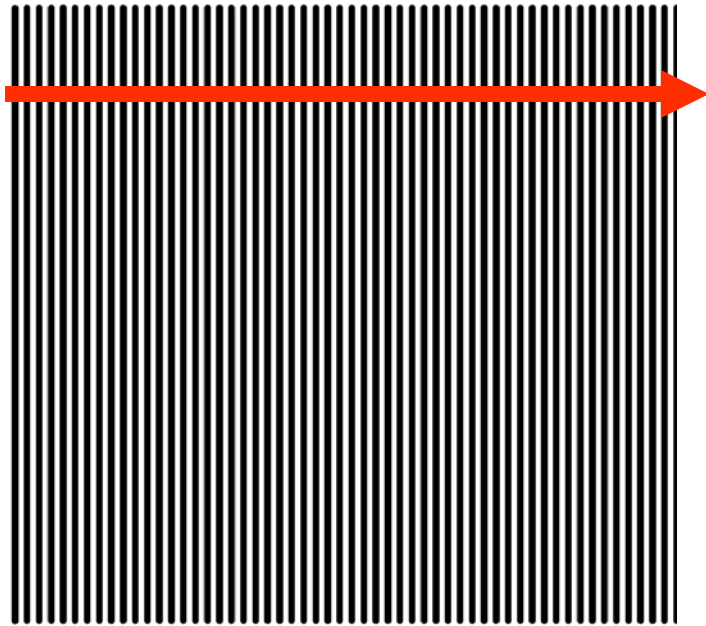


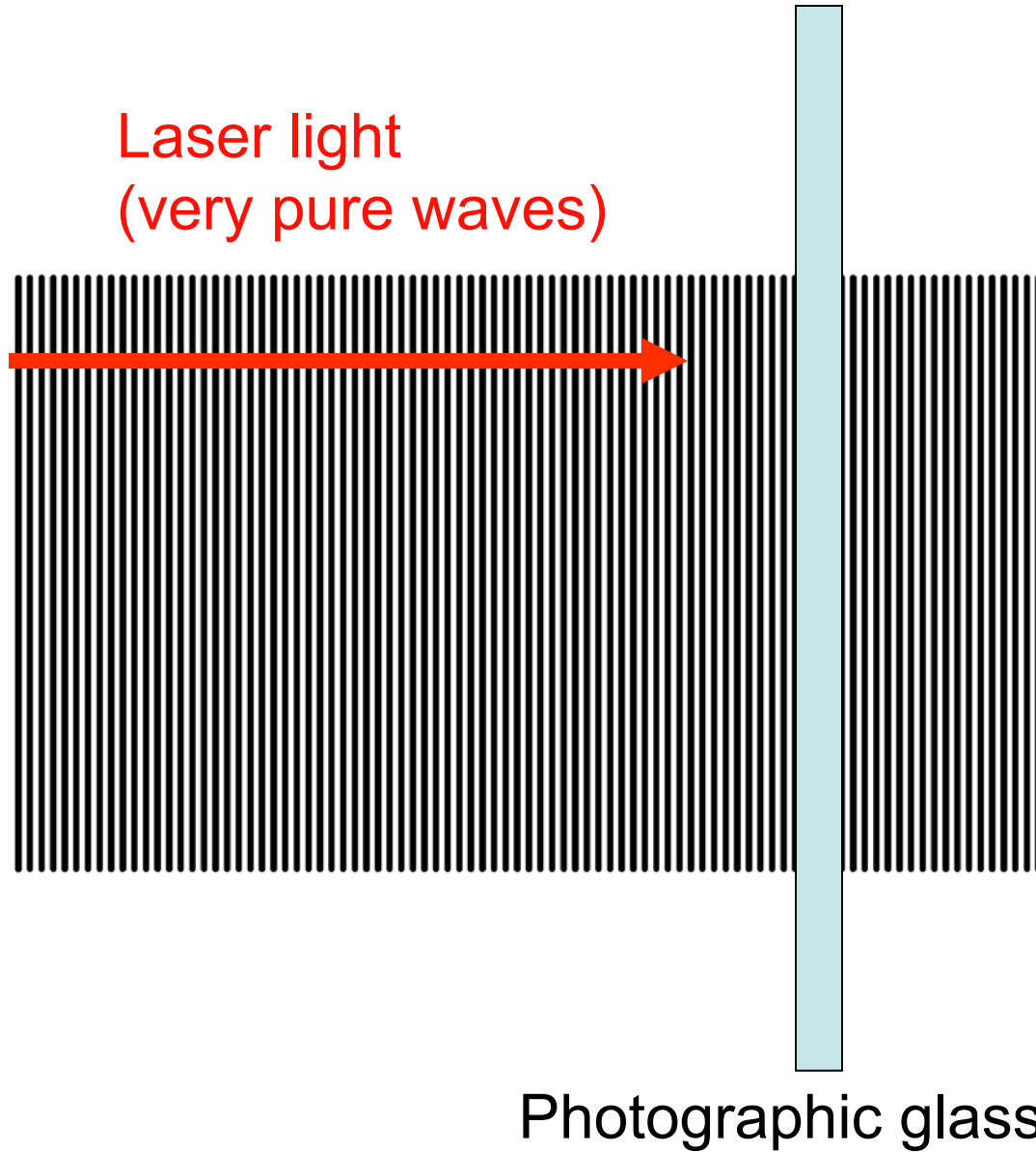
Lab #2 Holography

Making a Hologram!

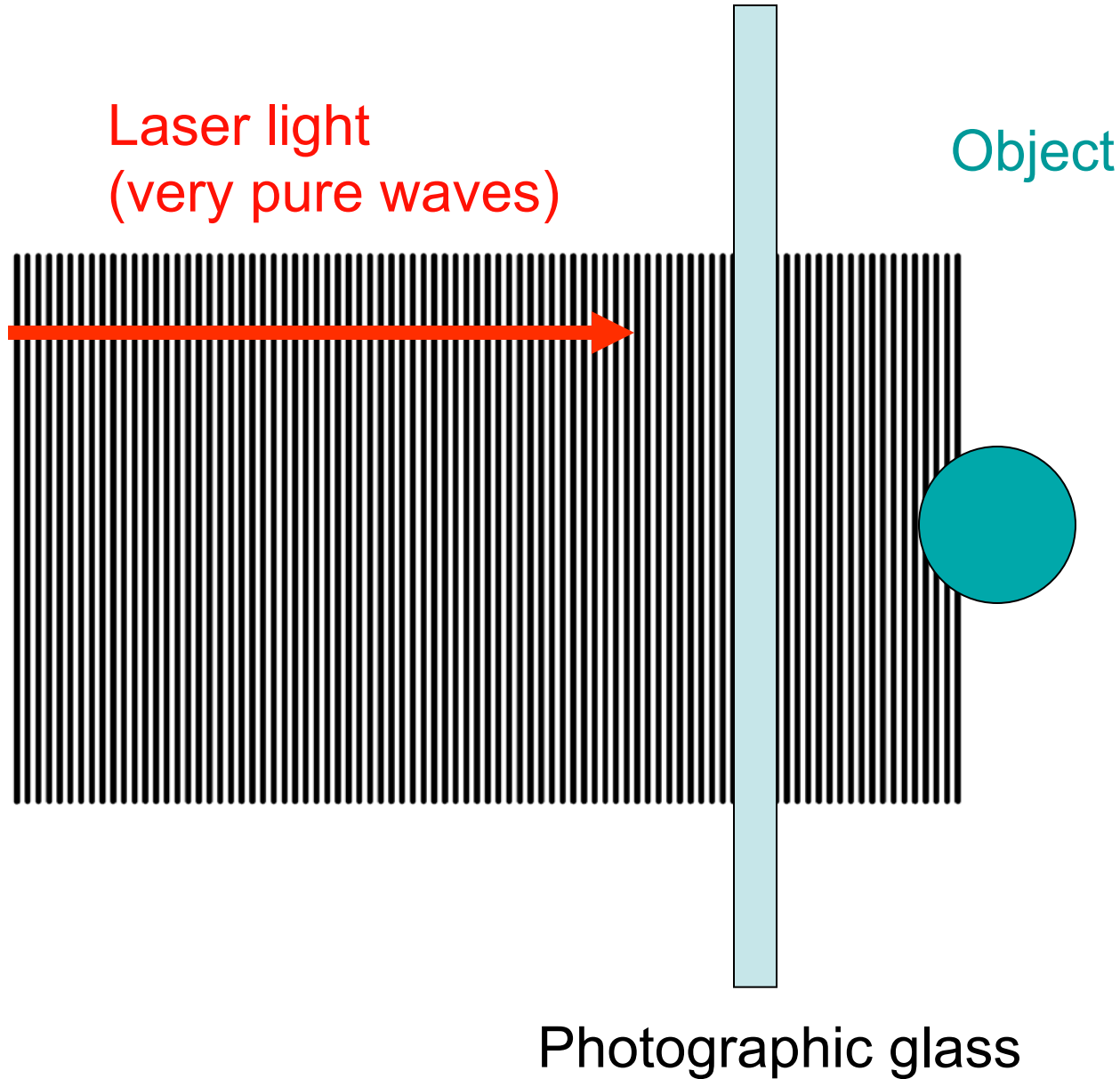
Laser light
(very pure waves)



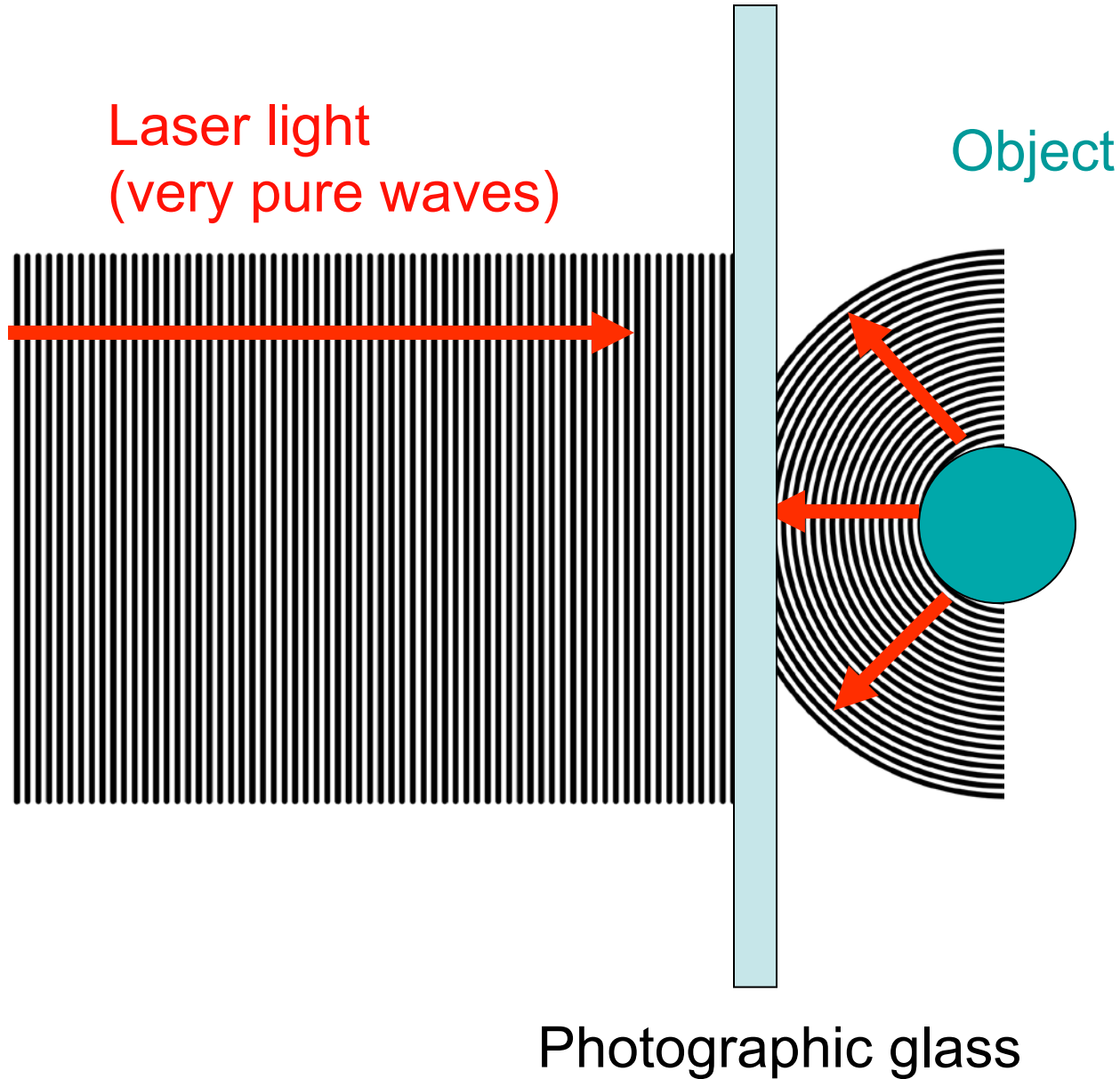
Making a Hologram!



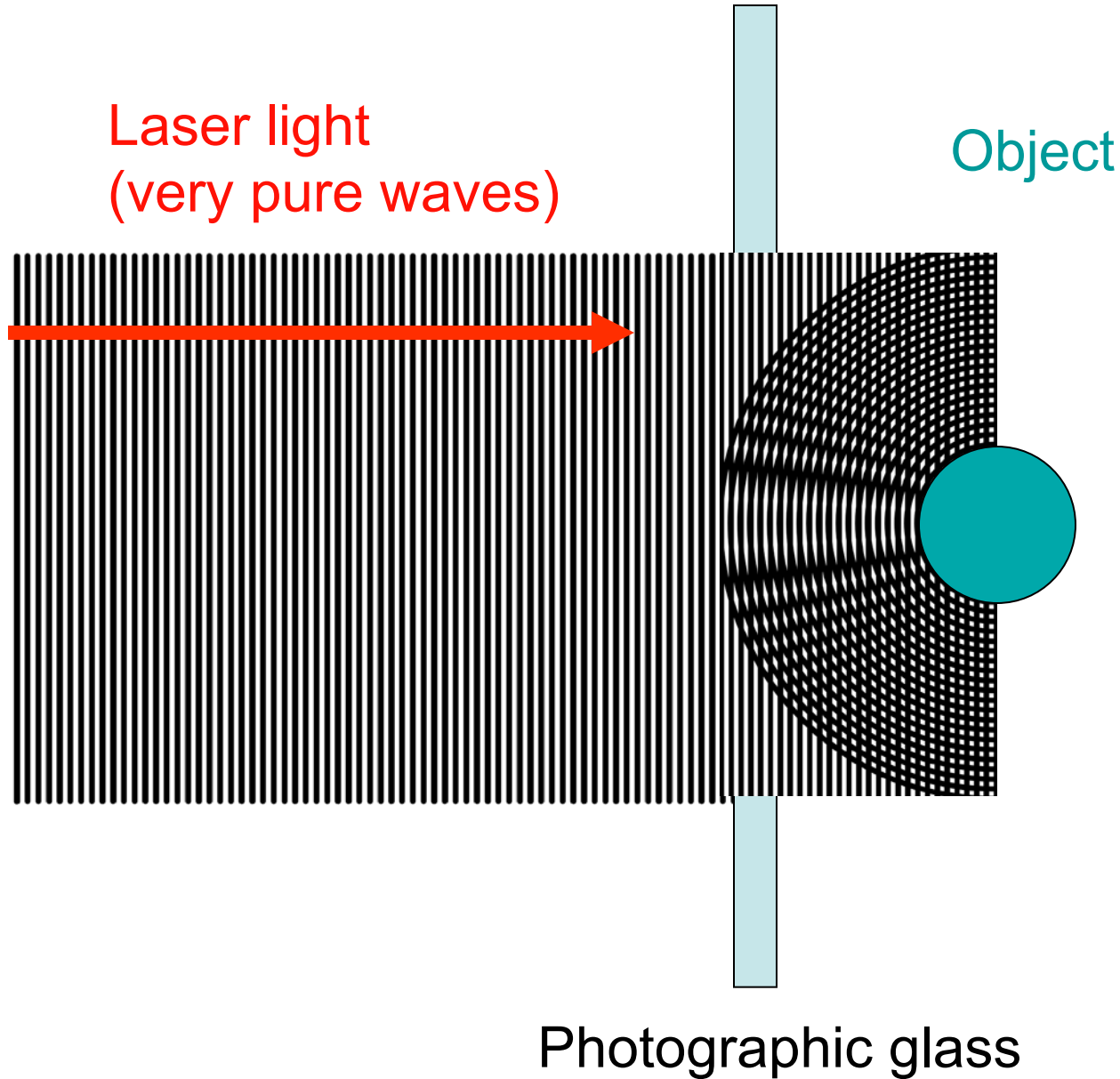
Making a Hologram!



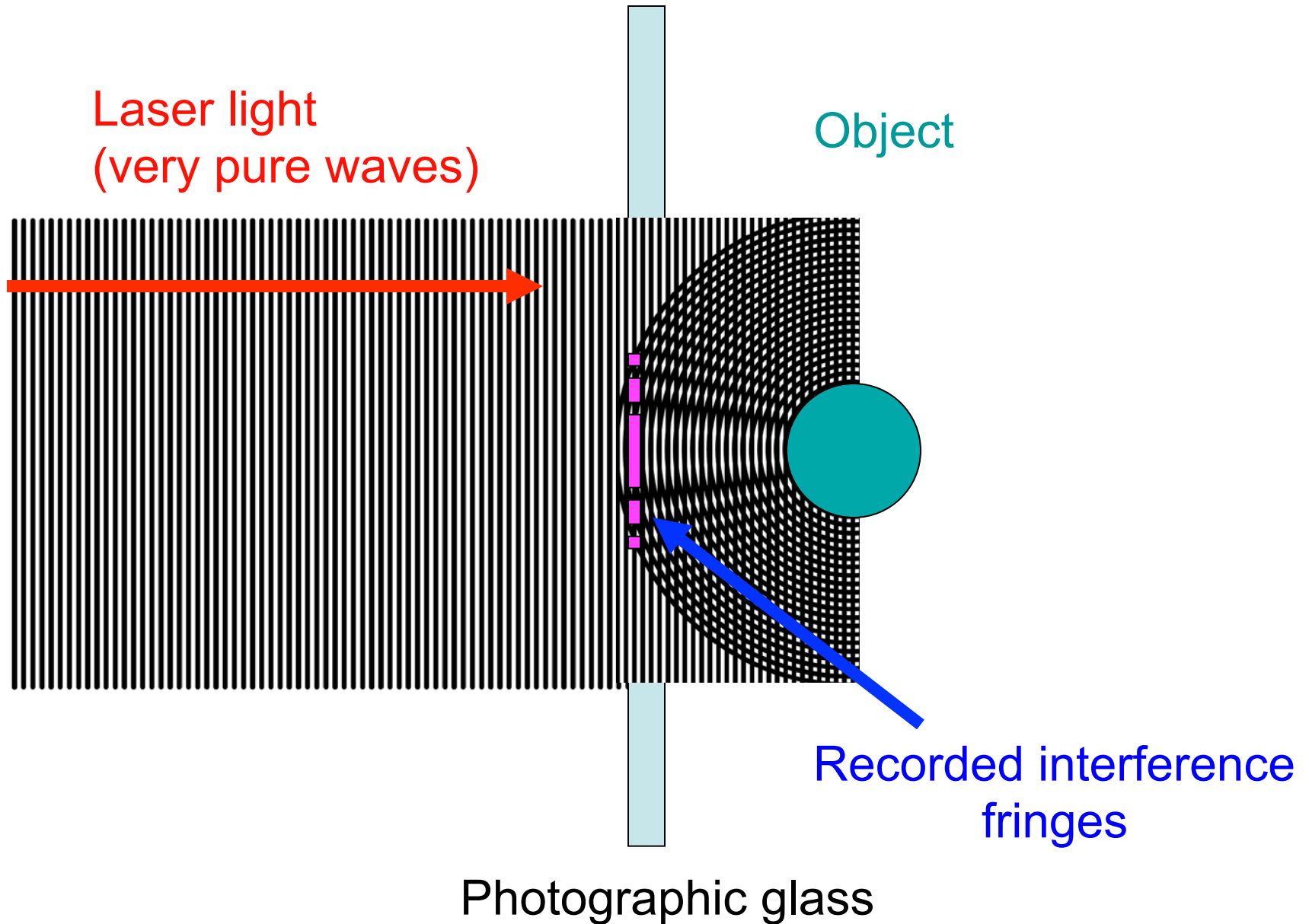
Making a Hologram!



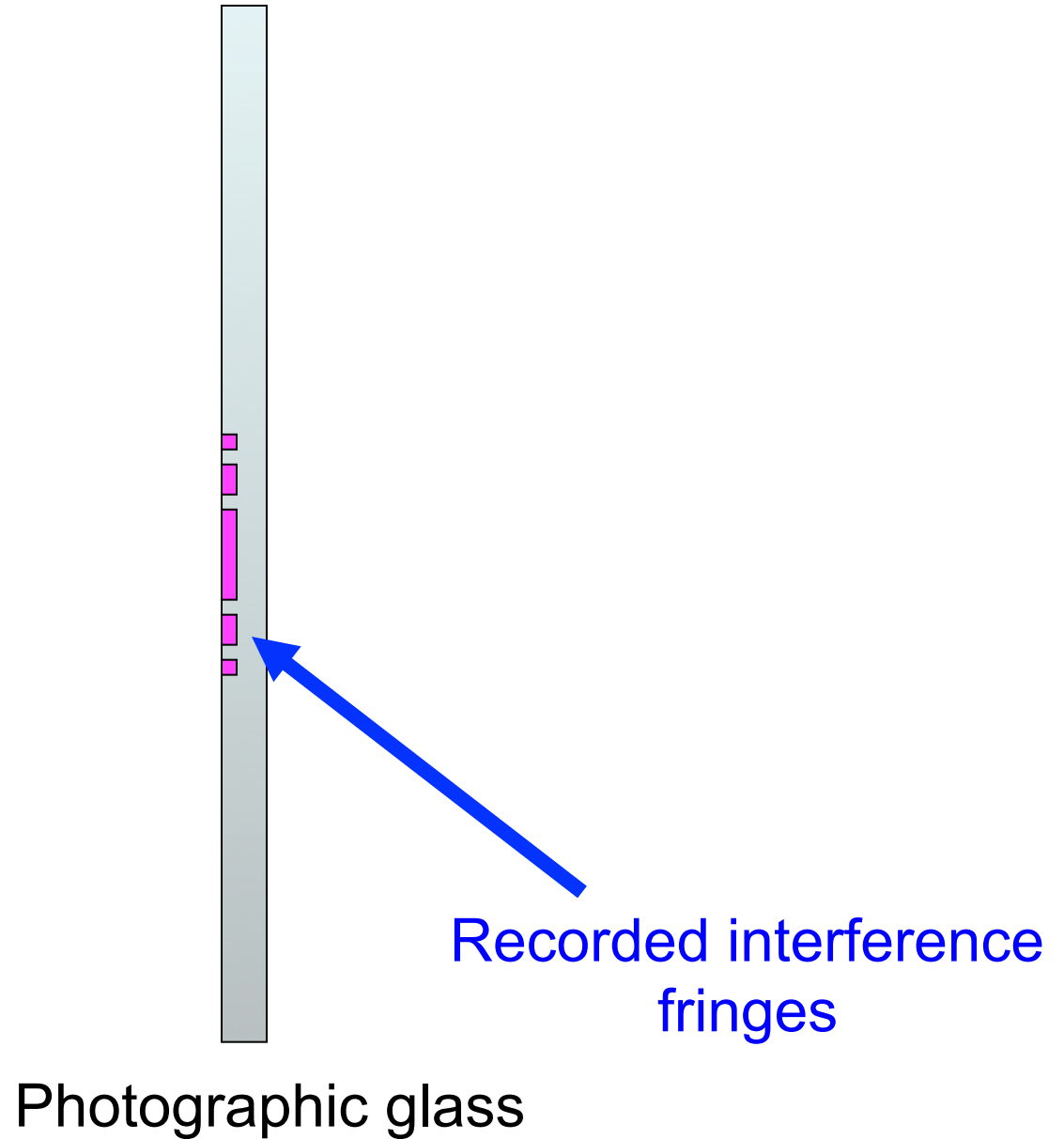
Making a Hologram!



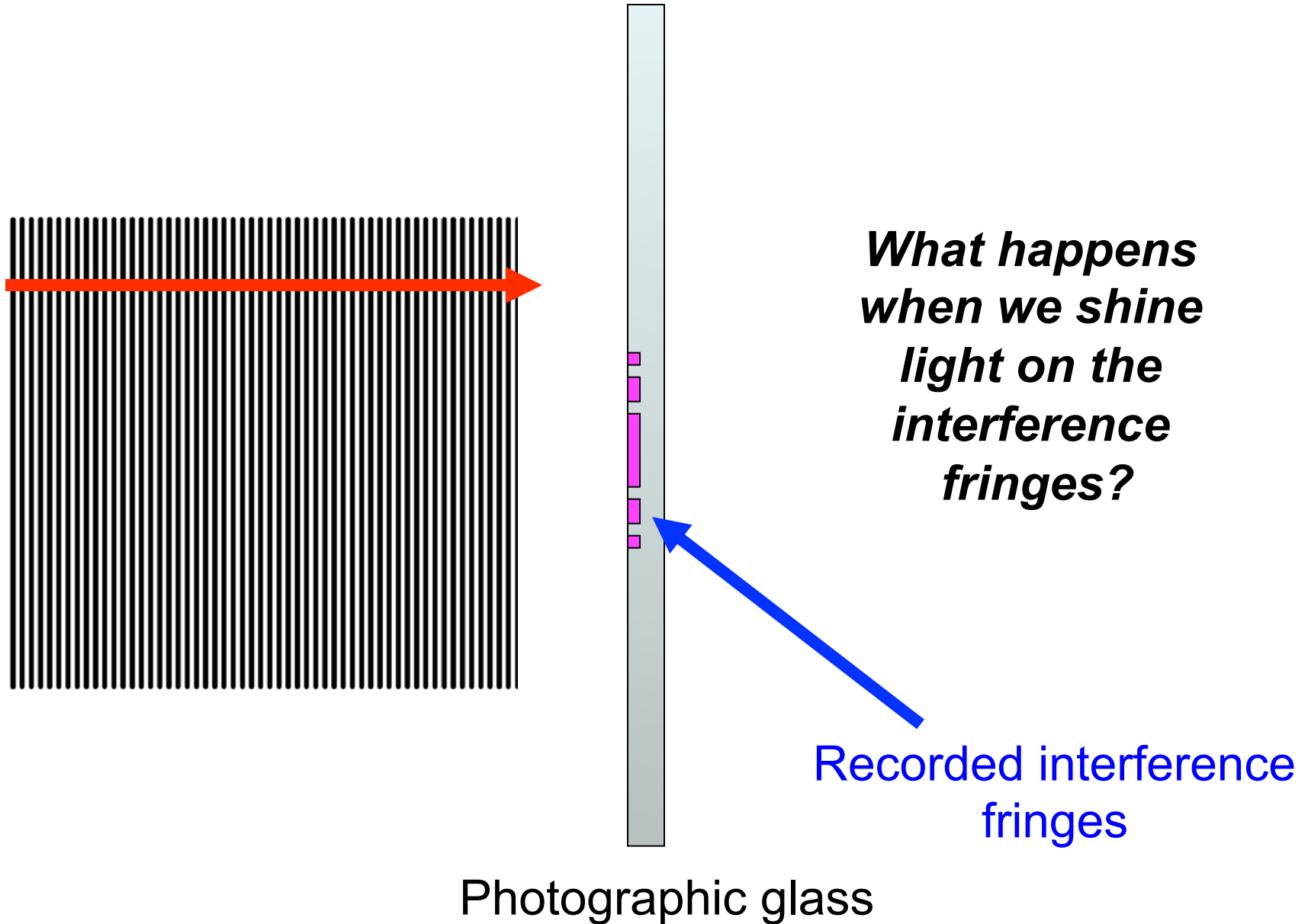
Making a Hologram!



Making a Hologram!

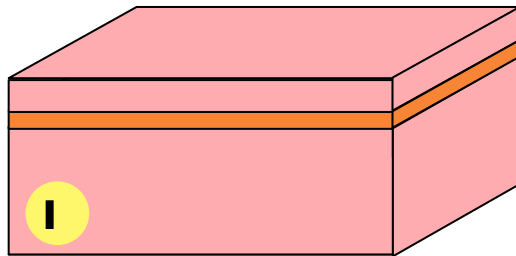


Making a Hologram!

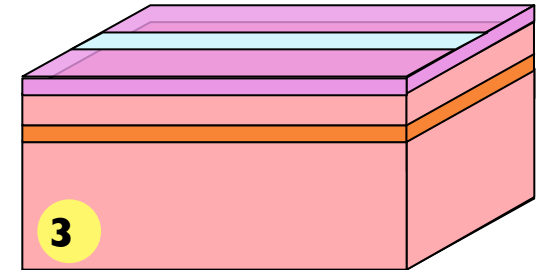
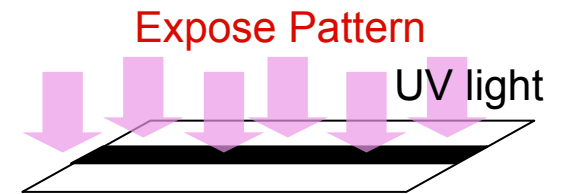
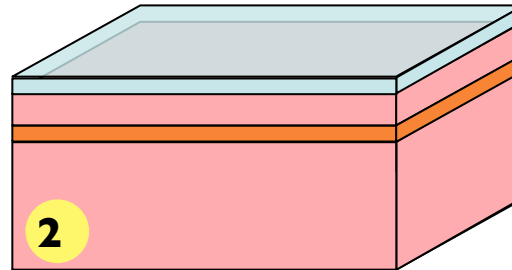


Photolithography

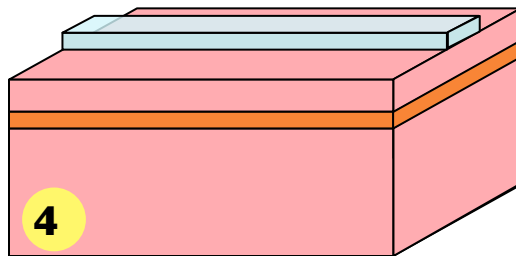
Semiconductor
Wafer Substrate



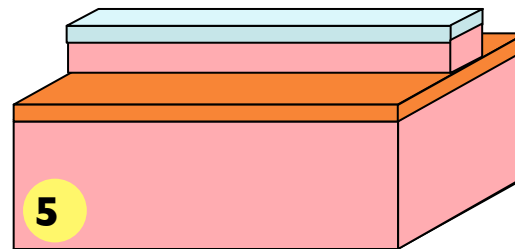
Apply
Photosensitive Film



Develop Pattern



Chemically etch (acid)



Remove film



Resolution is limited by the resolution of the optics:
-the wavelength of light
-numerical aperture of the imaging lenses

Fabrication Process

Exposure

- Laser: 5mW at 670 nm
- Silver halide emulsion

Developer

- Metol
- Ascorbic acid
- Sodium Carbonate
- Sodium Hydroxide

Bleach

- Copper Sulfate
- Potassium Bromide
- Sodium Bisulfate

Wetting Solution

- Linear Alcohol Alkoxylates

To create a latent image by recording interference fringes

During developing silver bromide microcrystals in the emulsion layer of a plate turn into tangles of metallic silver.

Unexposed silver bromide are dissolved and removed from the emulsion layer.

To reduces the likelihood of water spots

Fabrication Process

1. Exposure

- Position the laser until the object is fully illuminated and place a shutter in front of it
- Turn off the light and place the holographic plate on the top of the object
- Remove the shutter for **20 seconds**

2. Developer

- Submerge the plate into the developer so that all parts get wet evenly. Slush it around for **20 seconds** until the plate turns uniformly black

3. Rinse (DI Water)

- Rinse it with water for **30 seconds** up to 3 minutes

4. Bleach

- Place the rinsed hologram into the bleaching solution. Agitate it until the plate is completely clear. It takes up to **1 minute**

5. Rinse (Water)

- Rinse it with water for **30 seconds** up to 3 minutes

6. Wetting Solution

- Place the finished hologram in the wetting solution for **20-60 seconds**.

7. Drying

- Remove the hologram to dry. Stand it against a vertical surface with the bottom edge resting on a paper towel. Or use two clothespins to hold the edge of the plate.

4. Viewing

- View the hologram with incandescent light such as a projector, flashlight, spotlight. Or LED white light and the sun.

MIT OpenCourseWare
<http://ocw.mit.edu>

6.S079 Nanomaker
Spring 2013

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.