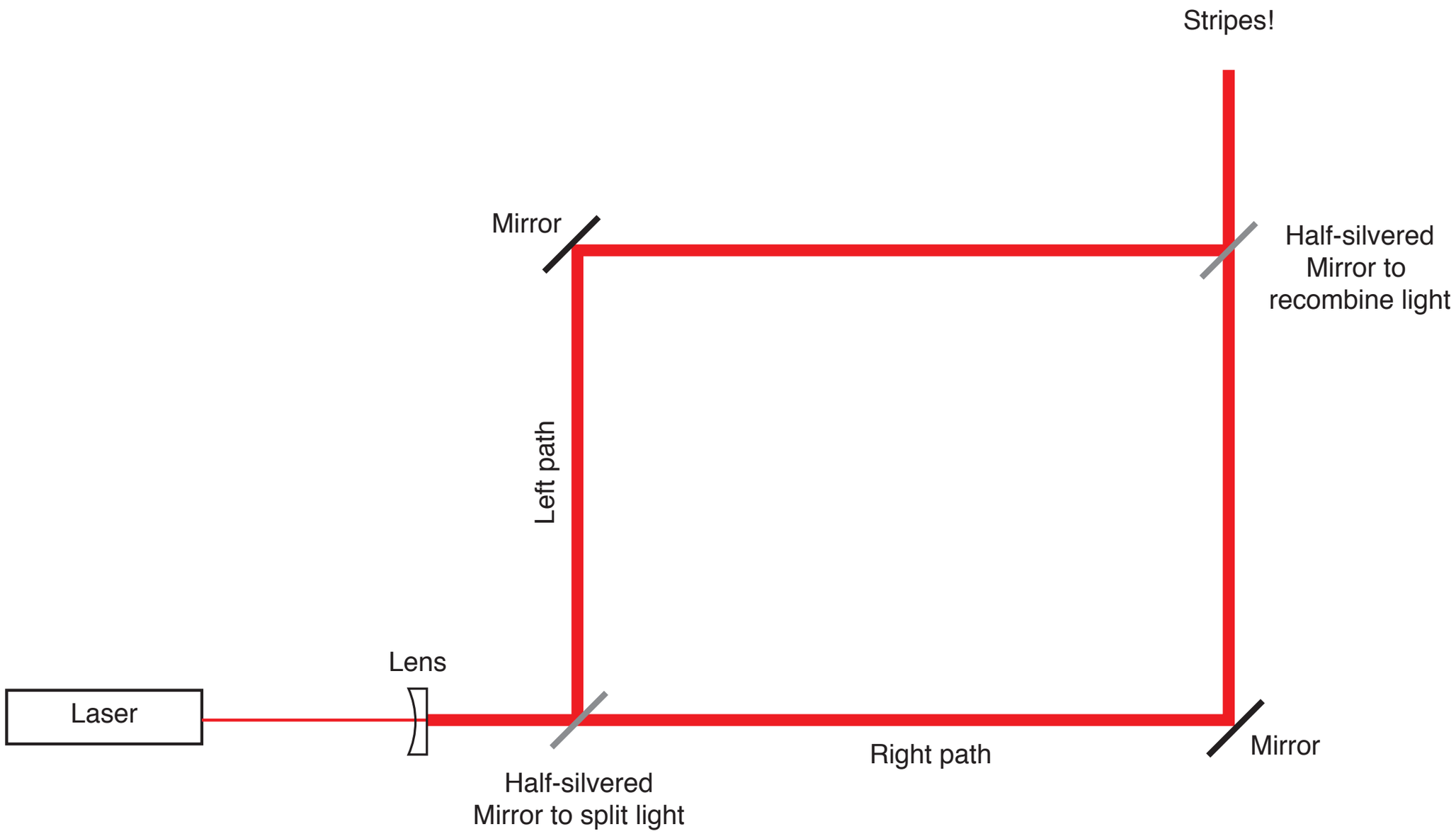
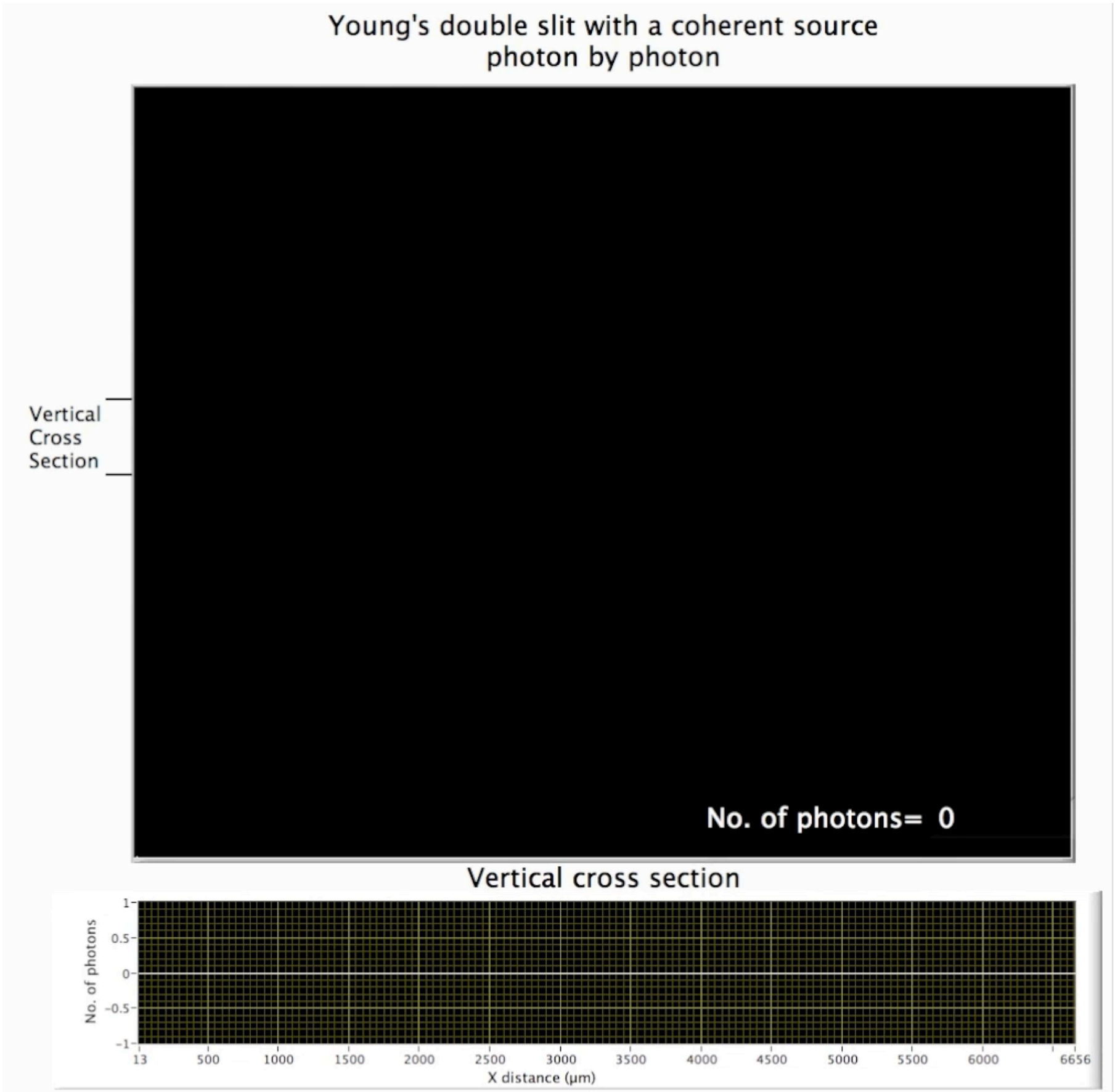
The world is made of notes

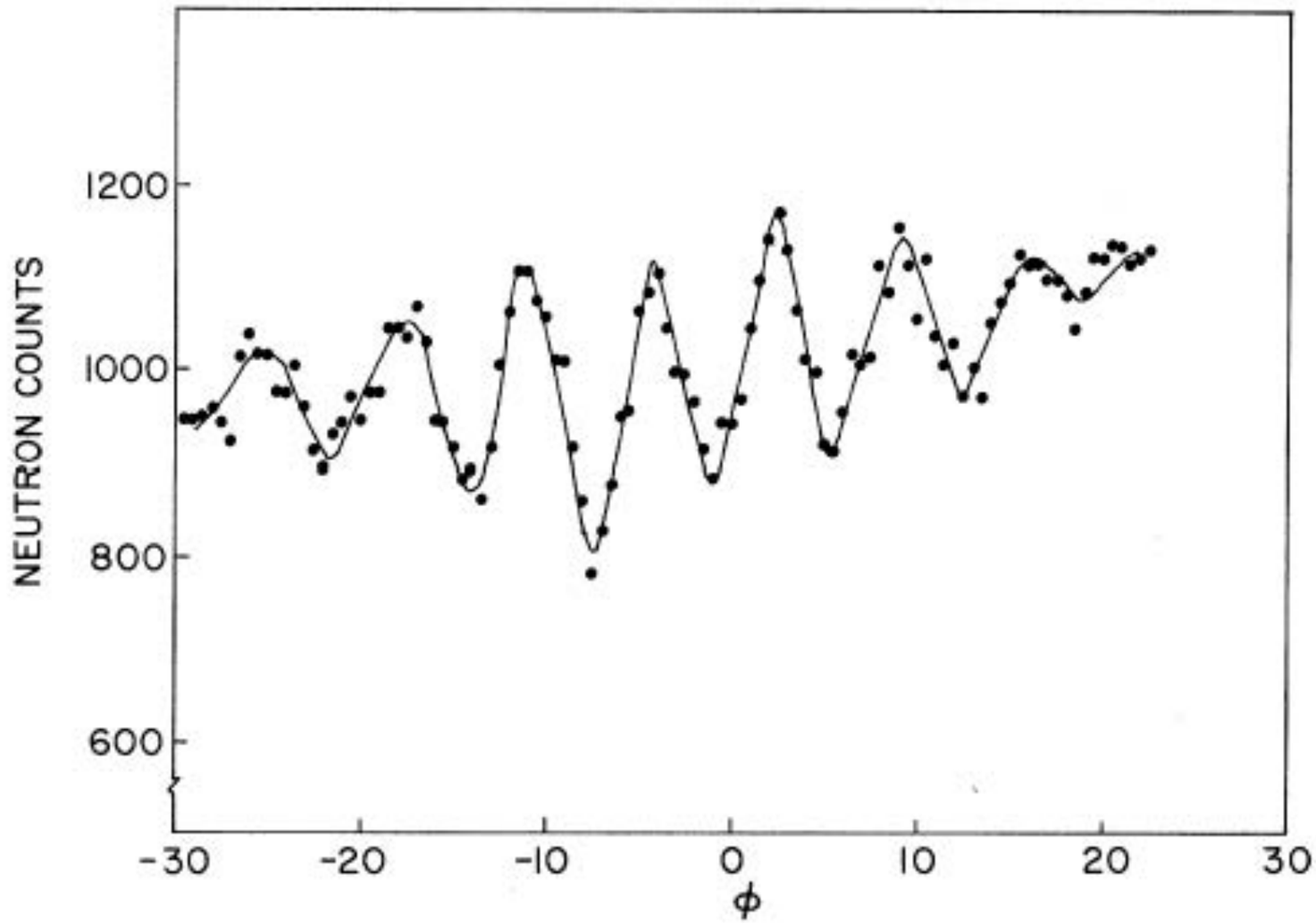
Which path did the photon take?





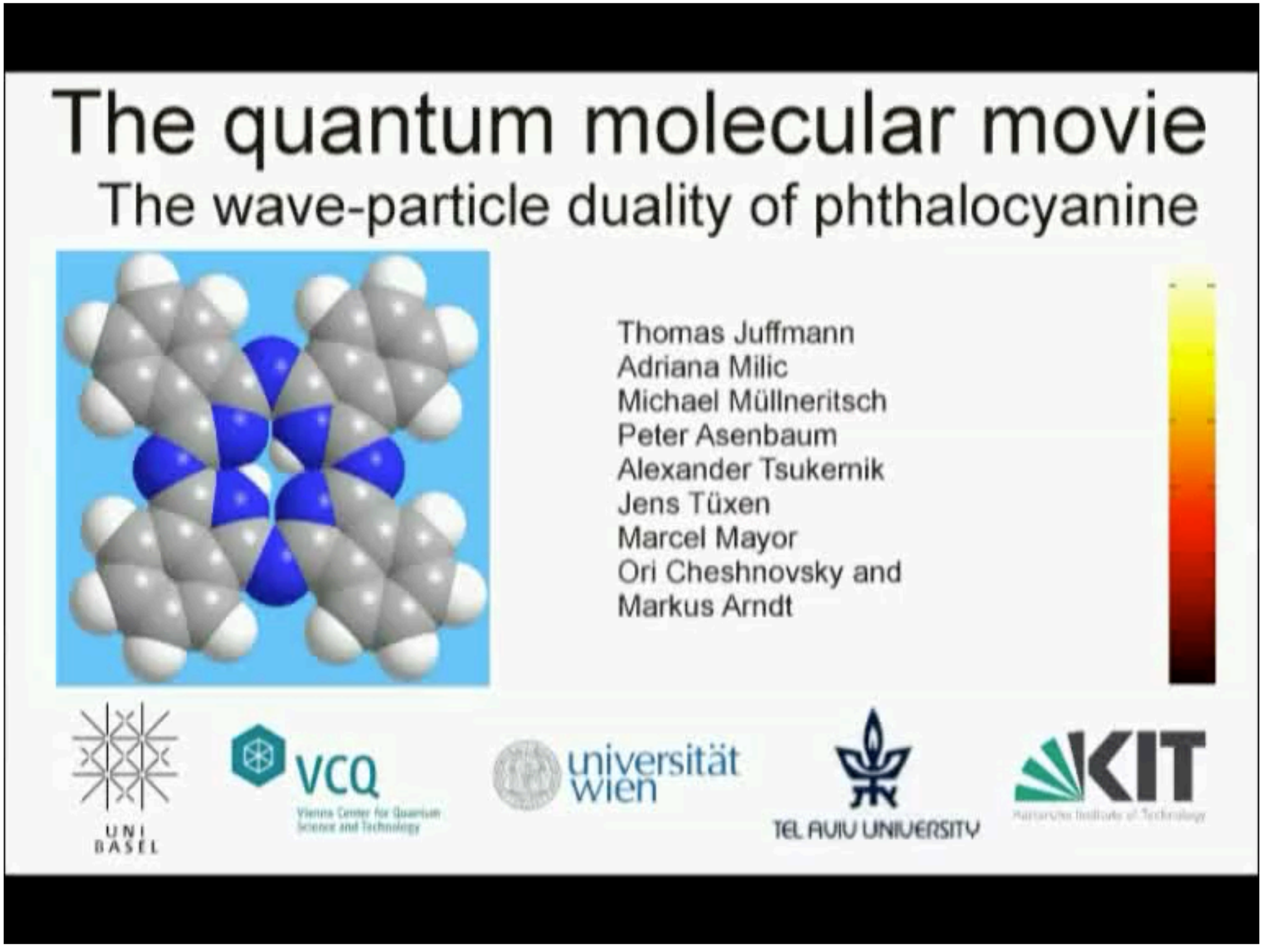
https://doi.org/10.1119/1.4955173

Neutrons



Colella, Overhauser, & Werner

$C_{32}H_{18}N_8$ (~3000 particles)



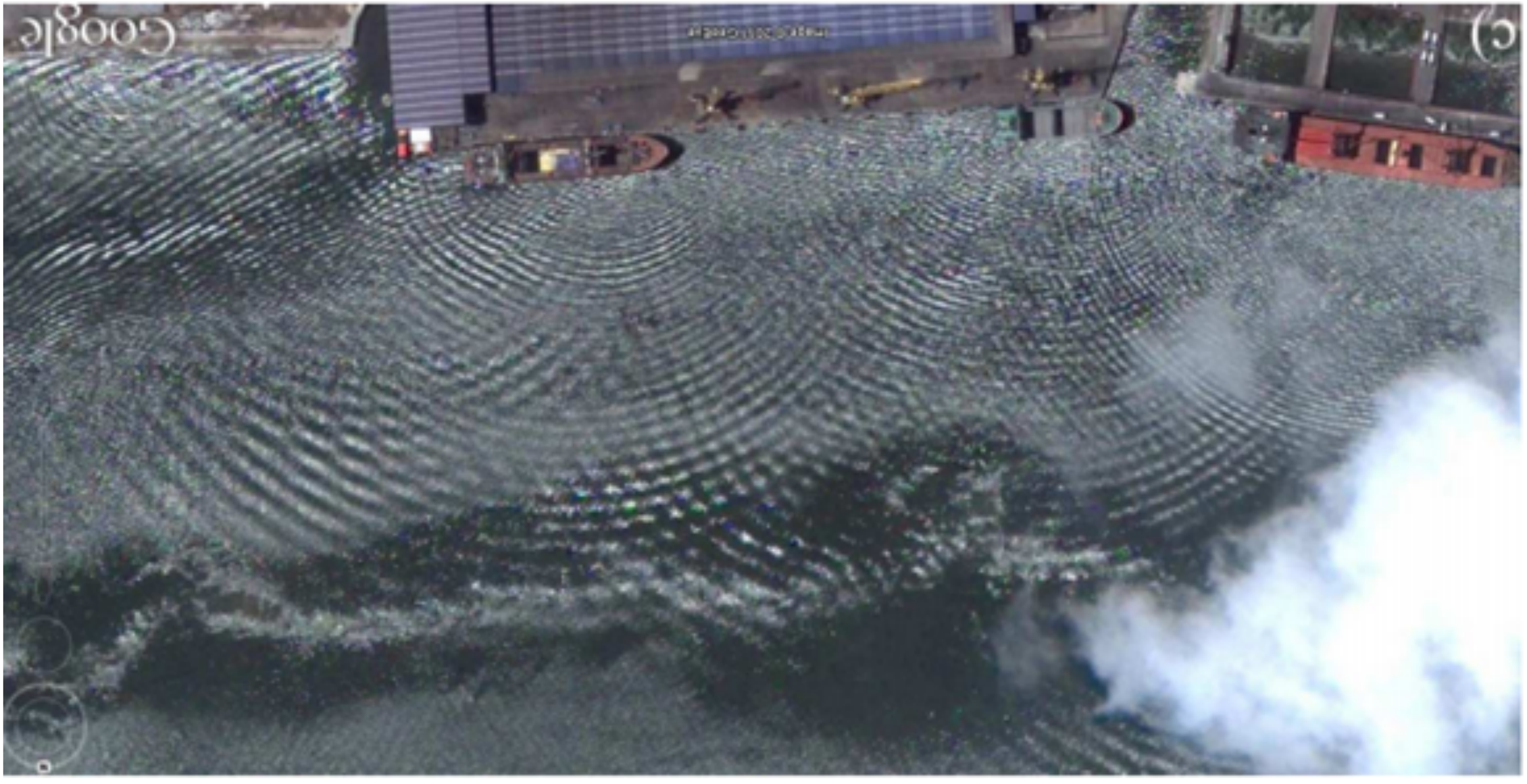
All particles **move** like waves and **hit** like particles

- From photons, to electrons, to neutrons, to molecules, they **all** move like waves and hit like particles

- Color is related to both wavelength and energy

Fundamental feature of how our universe works

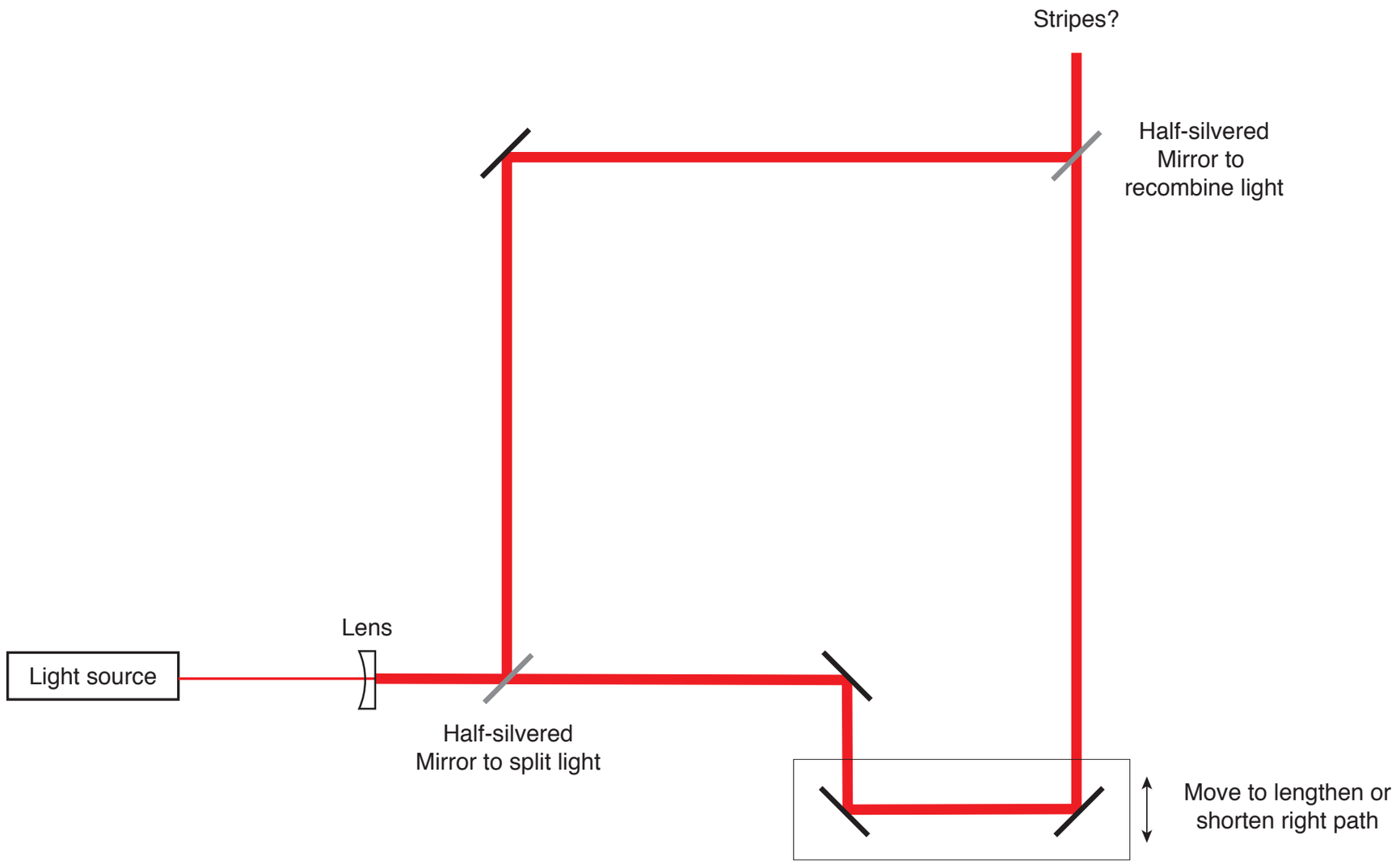
Ripples


Google

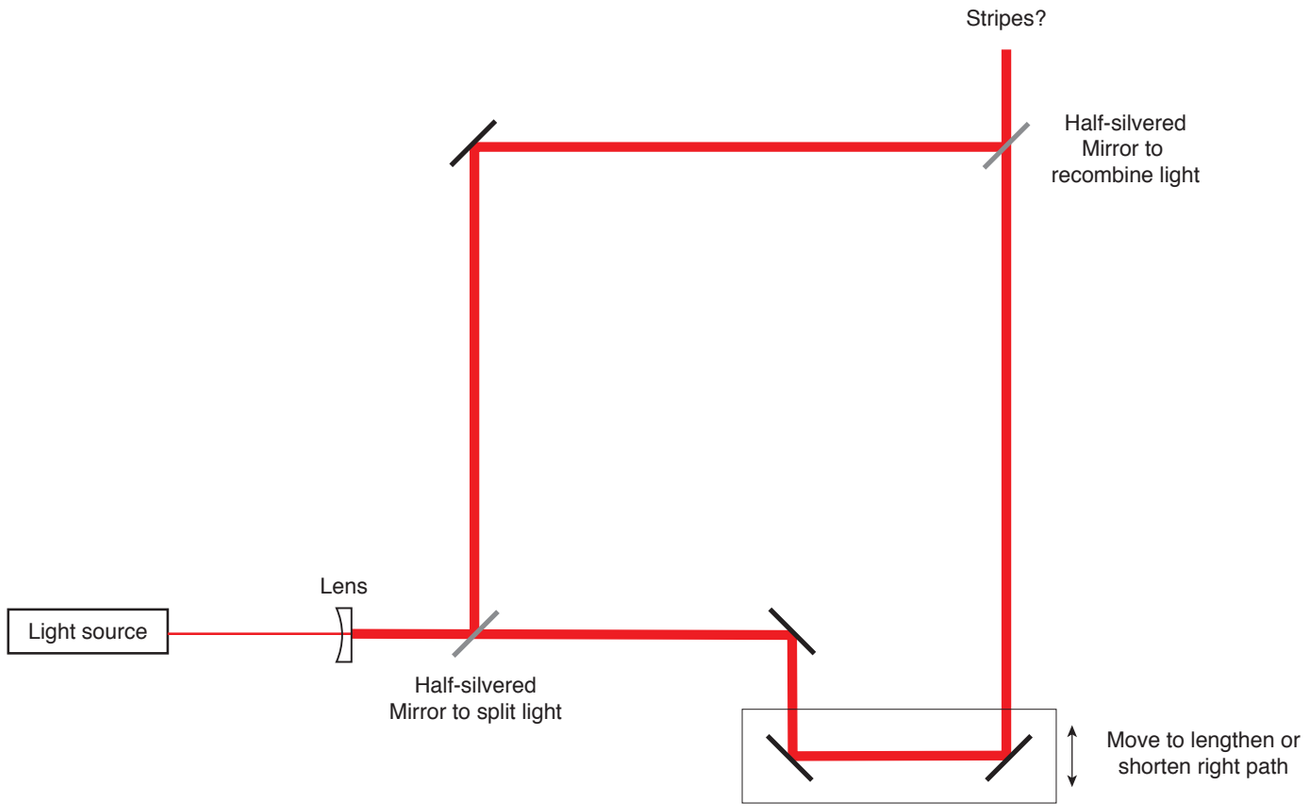
If all particles move like waves: two key questions

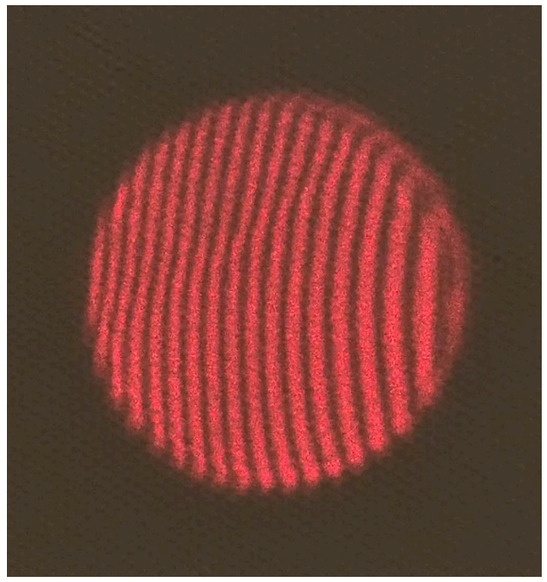
- How long is a particle ripple?
- How wide is a particle ripple?

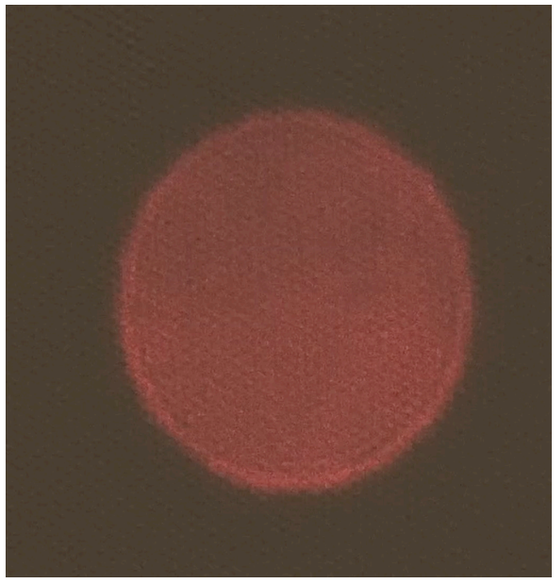
Fancier interferometer



Fancier interferometer

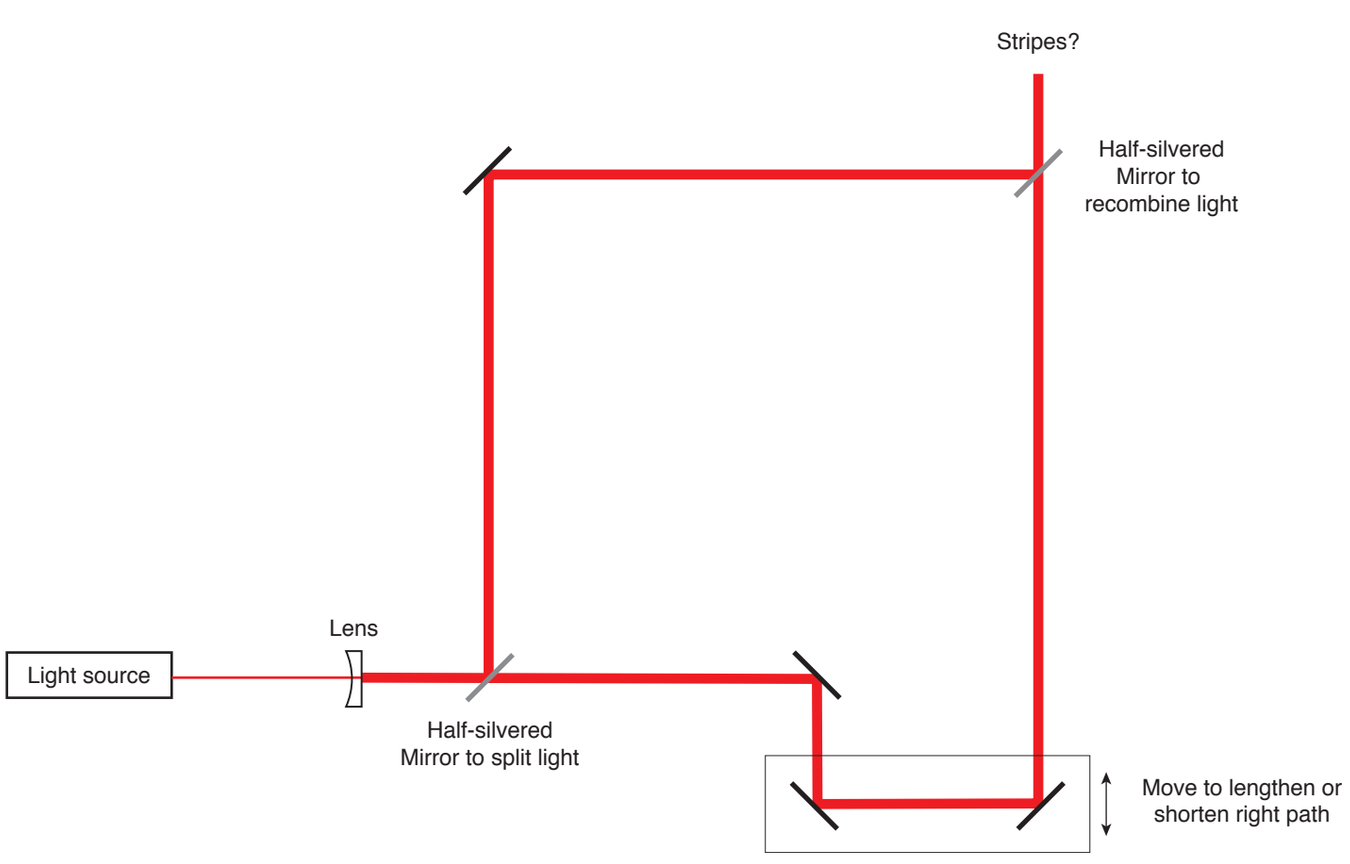


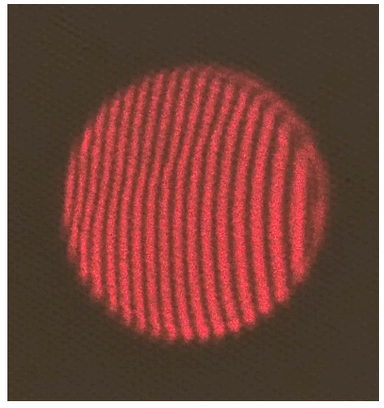


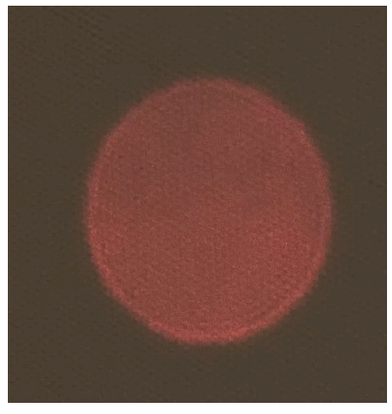


Stripes fade

- Sometimes very quickly (white light; microns)
- Sometimes very slowly (fancy lasers; km)



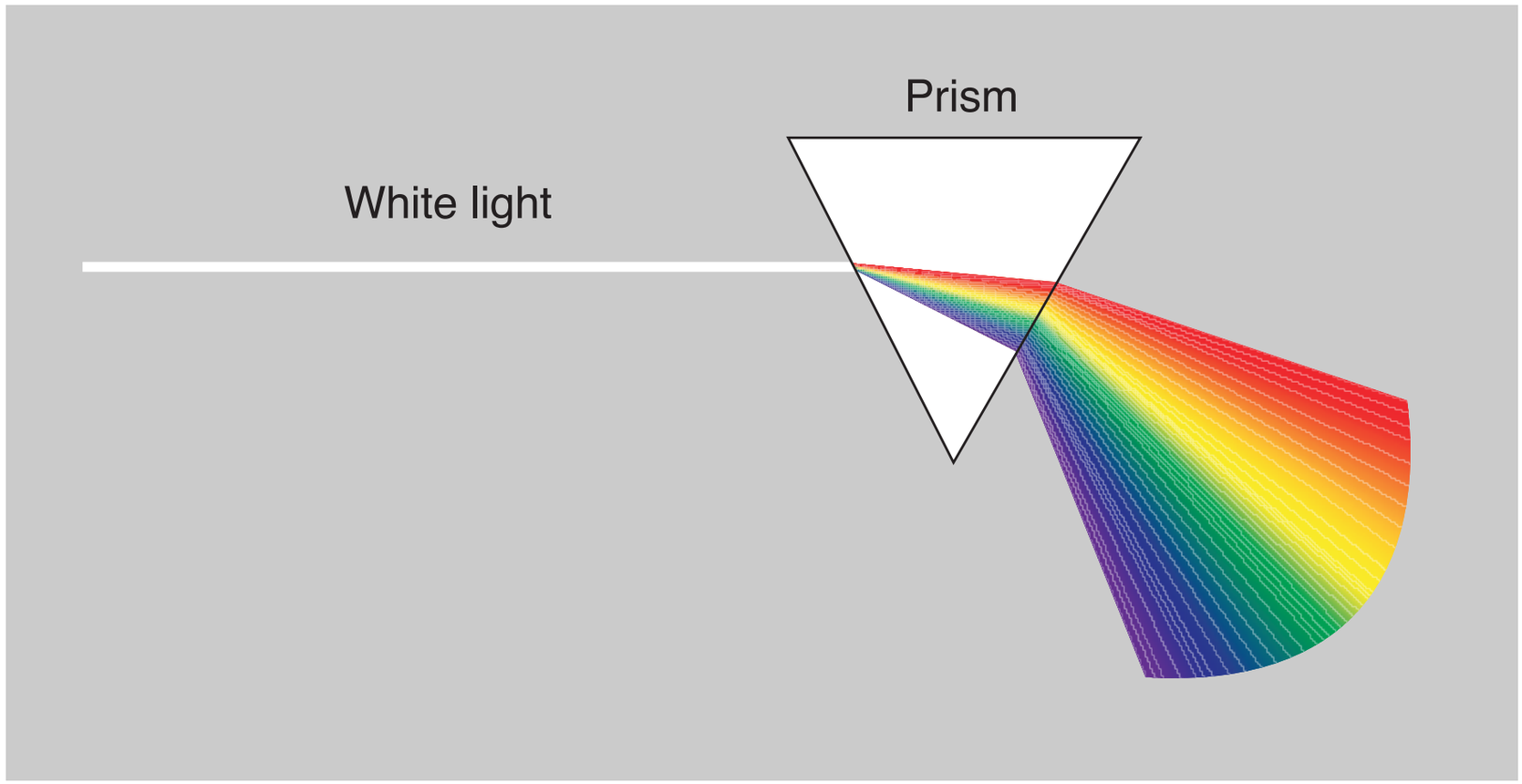




Going through the bulb drawer

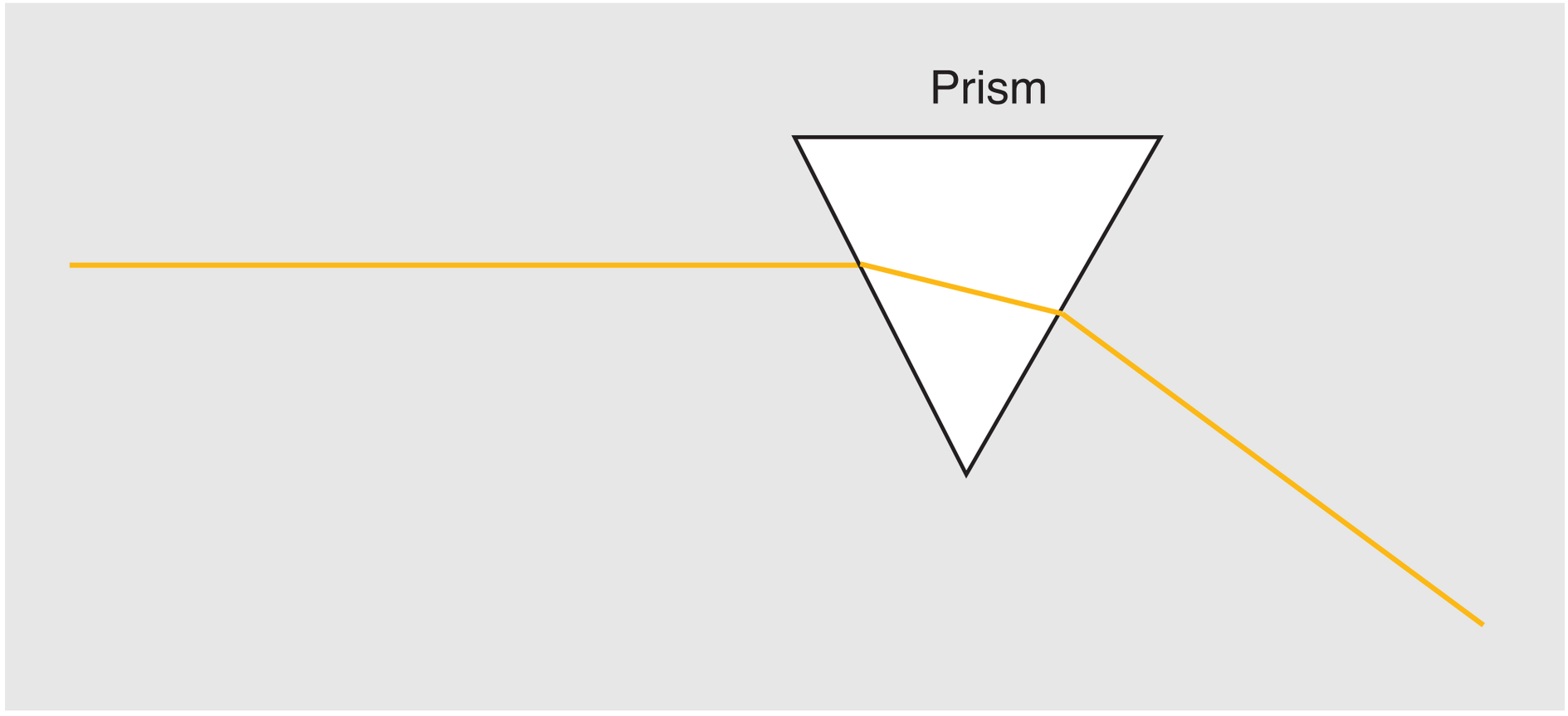
Sunlight, starlight, incandescent light bulb

- Wide range of color
- *Very* short ripple



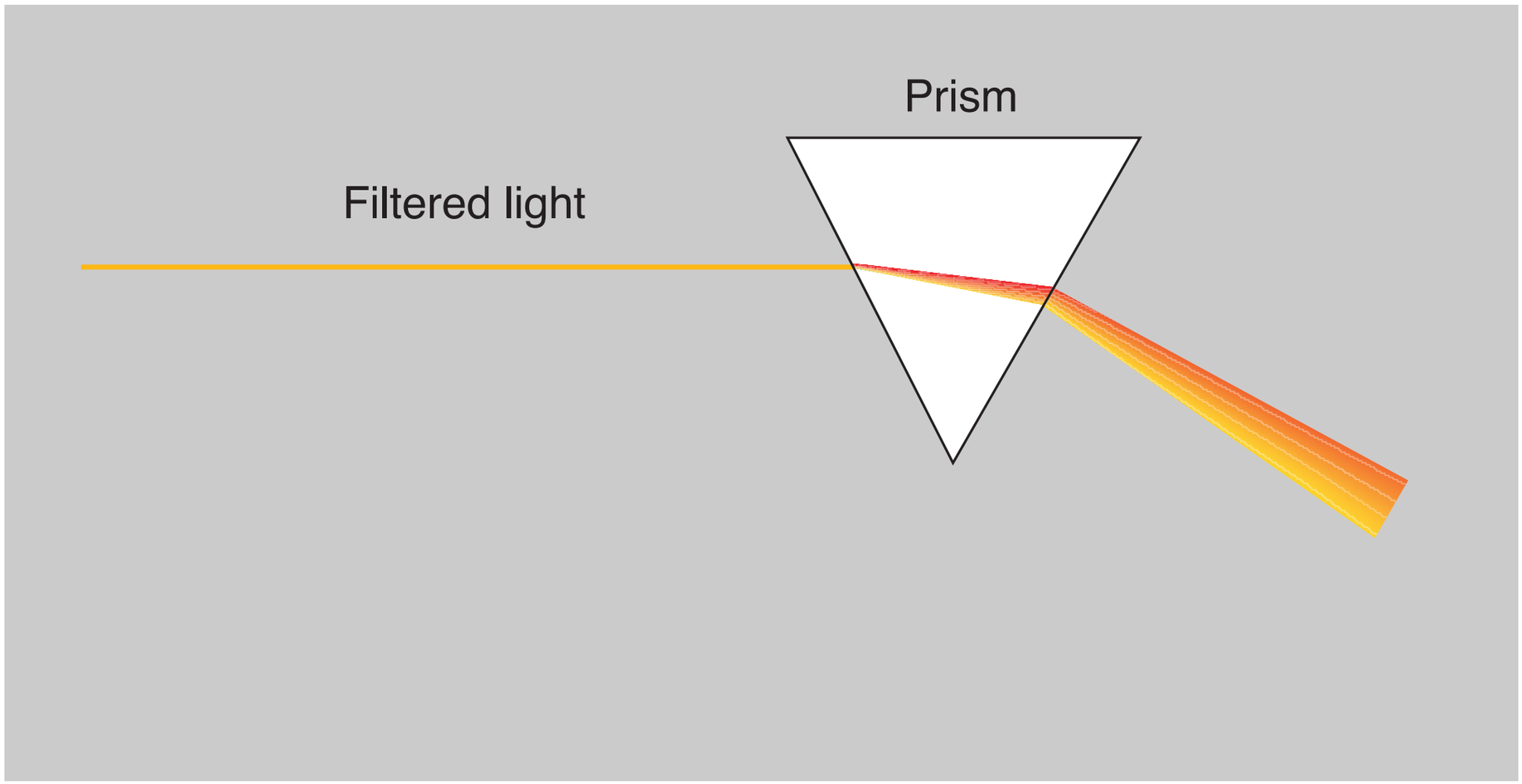
Lasers, neon lamp, sodium streetlight

- narrow range of color
- Long ripple



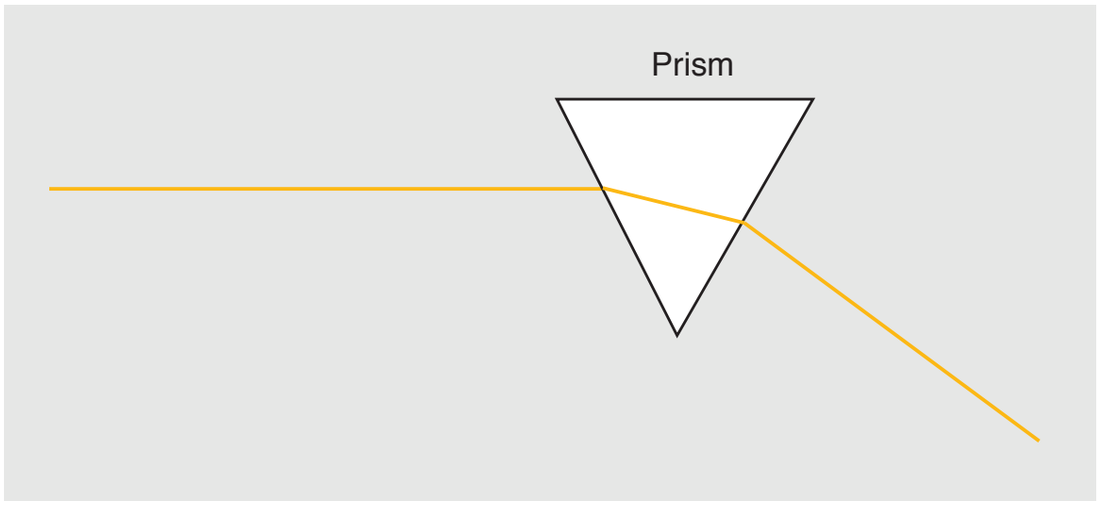
Filtered starlight, light reflected off of paint

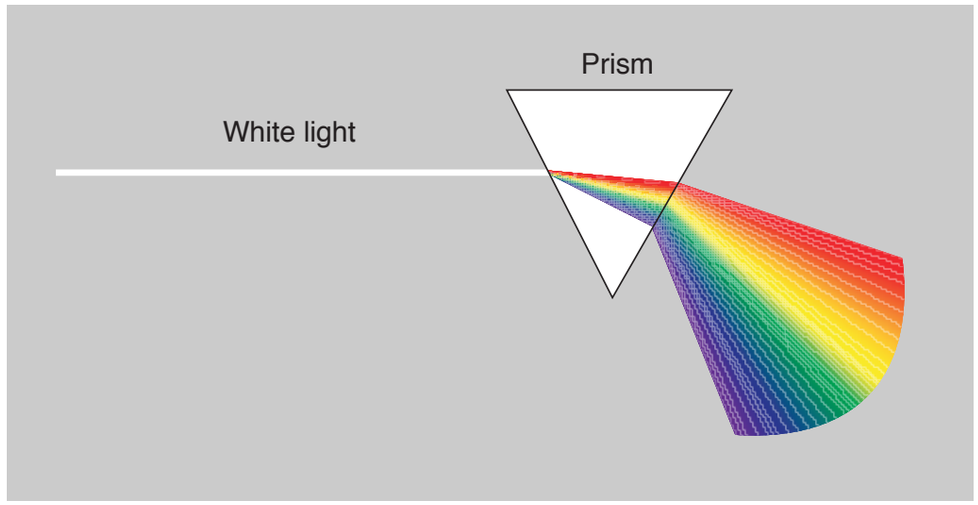
- Intermediate range of color
- Intermediate ripple



Hints

- Long ripple is a narrow range of color
- Short ripple is wide range of color





Ripples