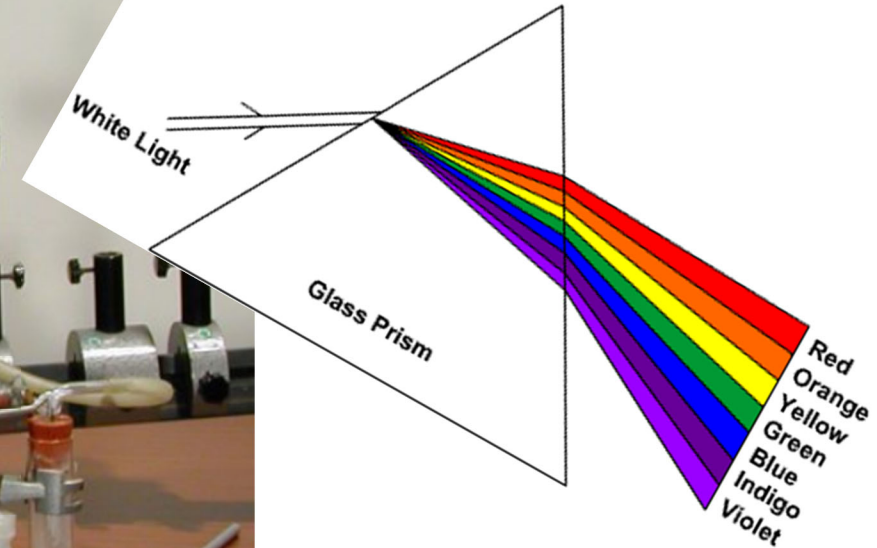
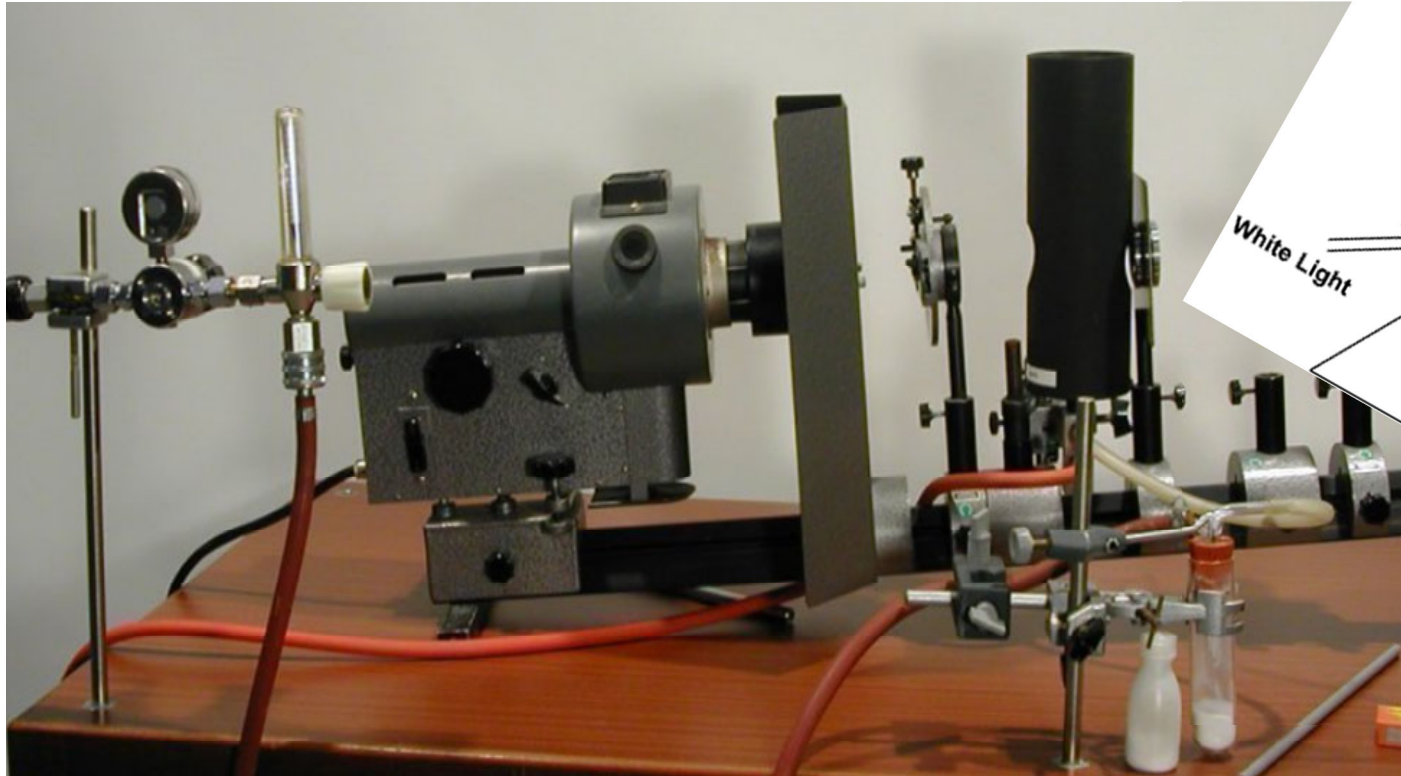


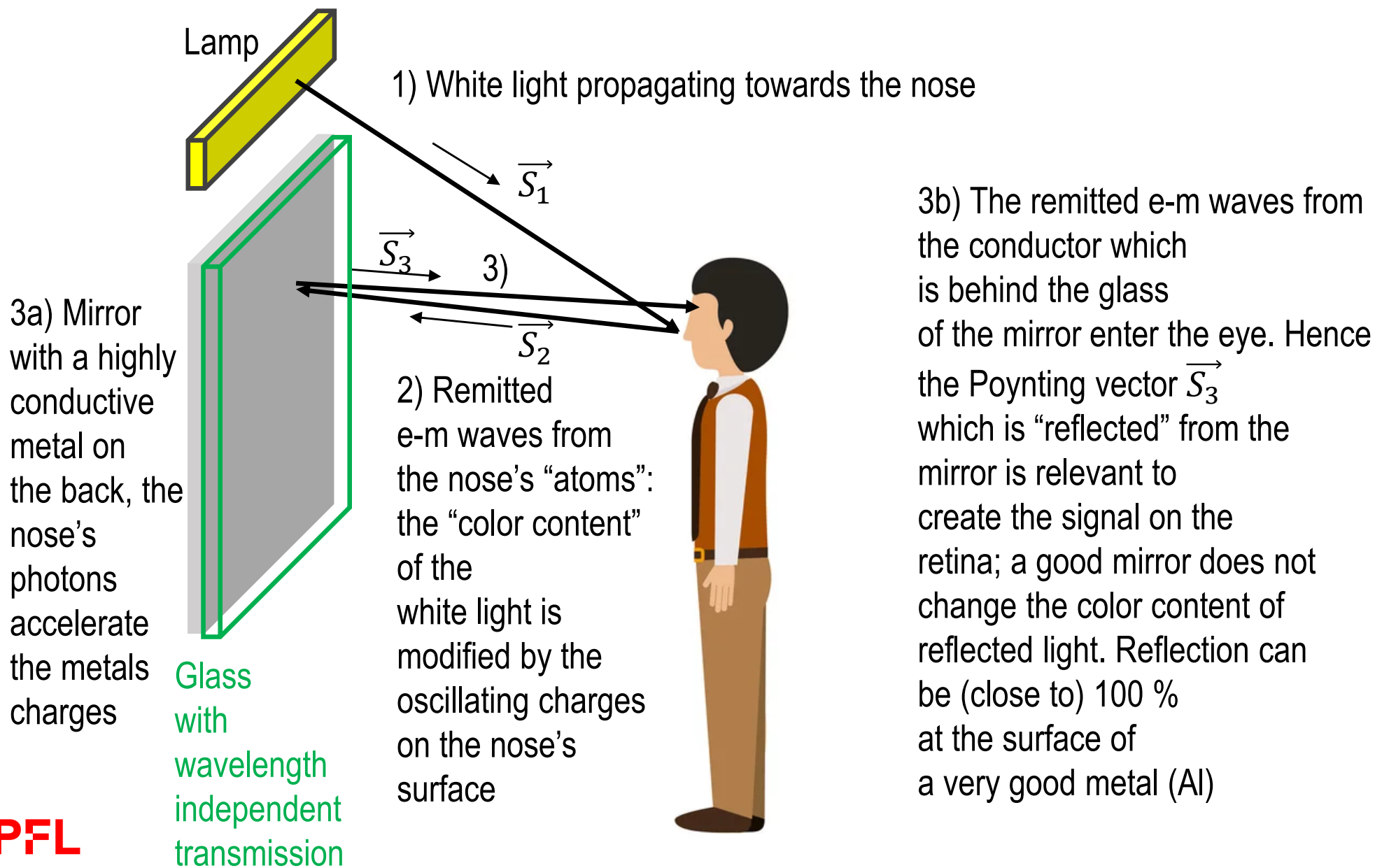
# Experiment: White light interacting with atoms provided by sodium chlorid (salt) in a flame



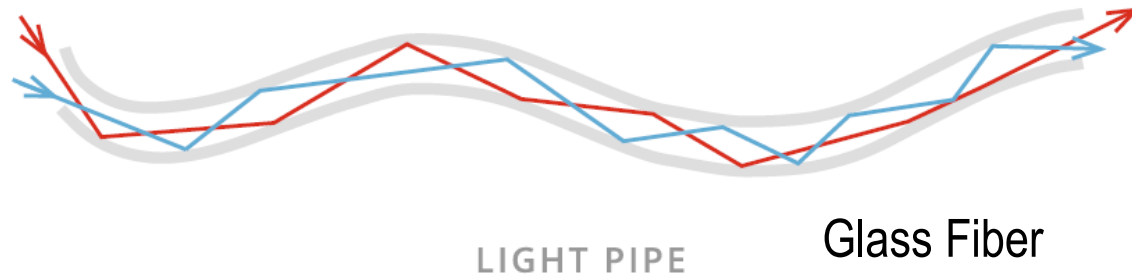
A surprising results is found when there is a second light source (a flame) in which sodiumchlorid is burning: a dark stripe (“shadow”) develops in the spectrum induced initially by the strong white-light lamp. Reason: The photons of “yellow” wavelength of the white-light lamp accelerate very well (“resonantly”) the charges (electrons) of the sodium atoms, they re-emit the same wavelength but they are microscopic dipoles and hence distribute the energy into a circle around them => less energy reaches the wall where the spectrum is shown.

# How do we see our “colored” nose in the bathroom window?

Via “colorful” reflection of electromagnetic waves offered as white light by a lamp:

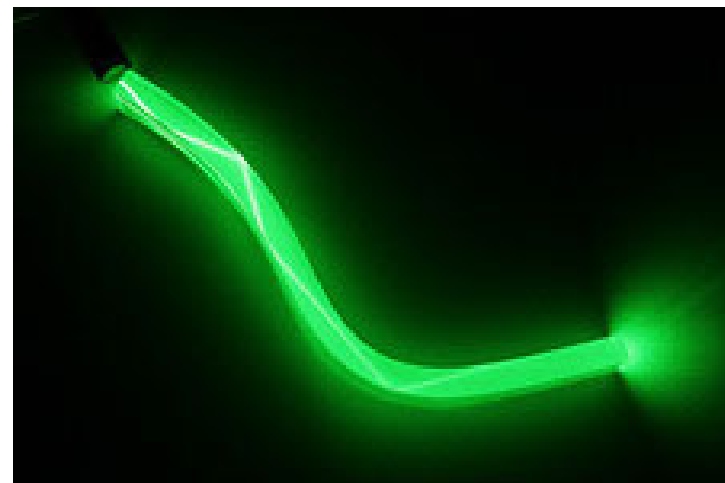


# Experiment: glass fibers for guiding light



glass:  
 $n \cong 1.5$   
 $\theta_{crit} = \arcsin\left(\frac{1}{1.5}\right) \cong 42^\circ$

Fig. 4.15 Light can be “piped” through solid plastic or glass rods using total internal reflection



# The darkest versus whitest material



"Vertically Aligned NanoTube Arrays"

## Darkest Black

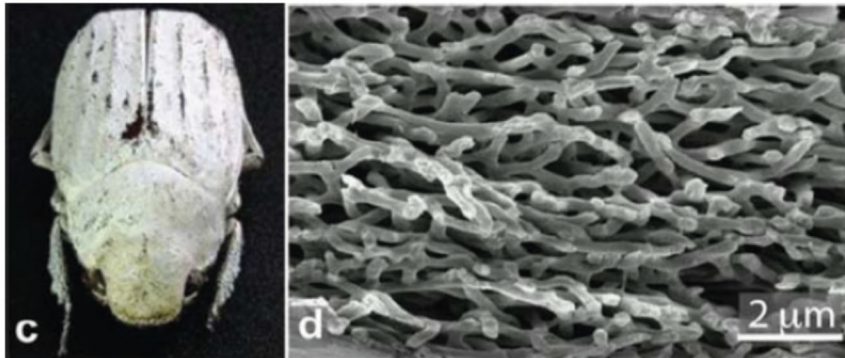
Vantablack is made of carbon nanotubes and is the blackest substance known,

A maximum of 99.965% of radiation in the visible spectrum remains in the structure

<http://mentalfloss.com/article/77190/6-facts-about-vantablack-darkest-material-ever-made>

- The light falling on VANTA-black is “trapped” inside the surface consisting of a “forest” of nanotubes.
- **We do not “see” VANTA-black, we see the material around.**
- Light converted into e.g. heat

## Whitest White



(Photo : Scientific Reports/Vignolini et al) Researchers have recently determined that two types of beetles have shells that reflect light so well, they appear whiter than the whitest paper. Pictured is Lepidiota stigma.

From <<http://www.designntrend.com/articles/18038/20140815/scientists-find-the-purest-whitest-white-in-beetles.htm>>

Scientists Find The Purest, Whitest White In Beetles  
Mary Nichols , Design & Trend Contributor  
Aug, 15, 2014

- **All wavelengths of the sunlight** “come back to the eye” (reflected)
- The bug’s material does not absorb energy at specific wavelengths in the visible regime