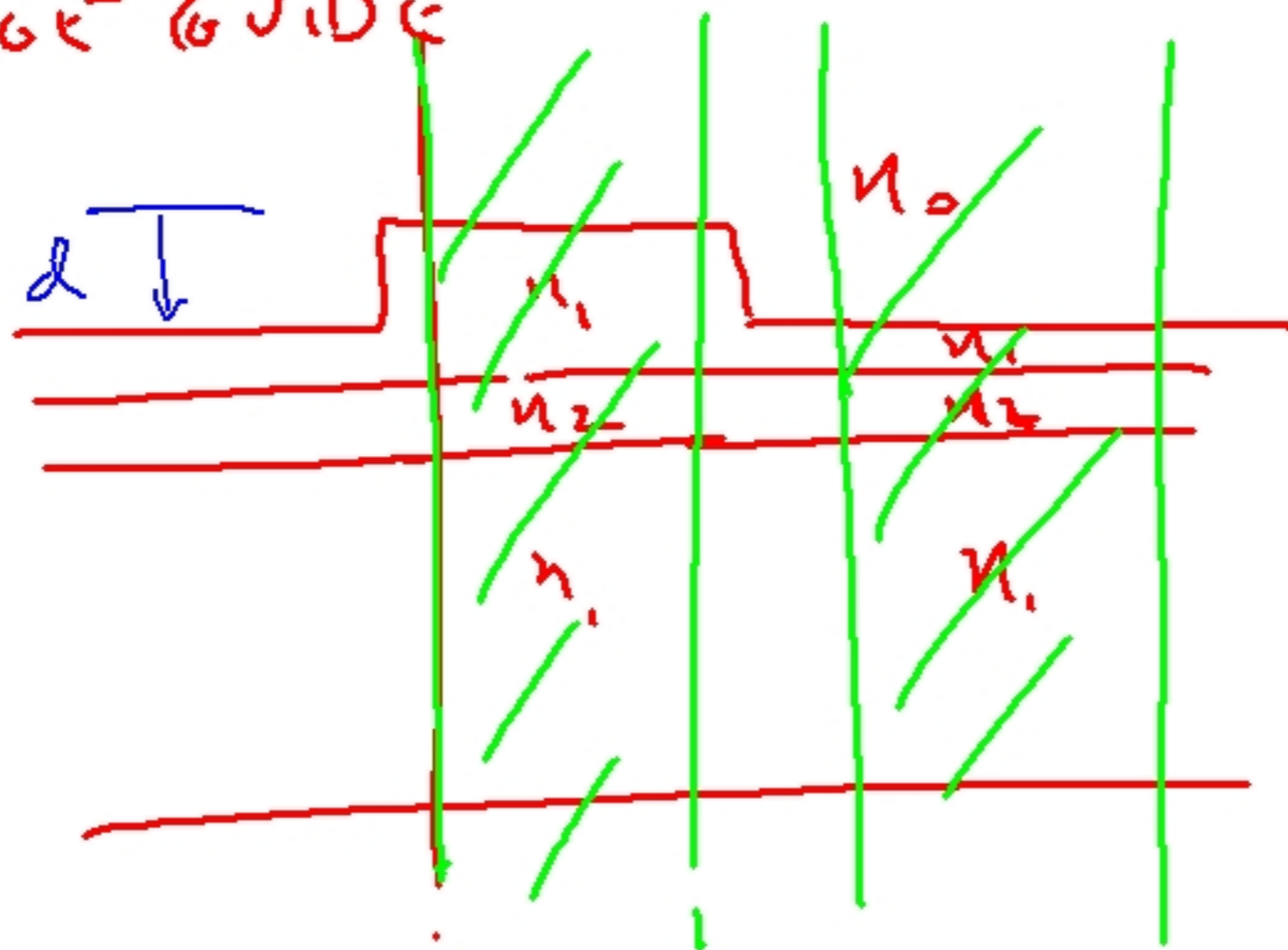
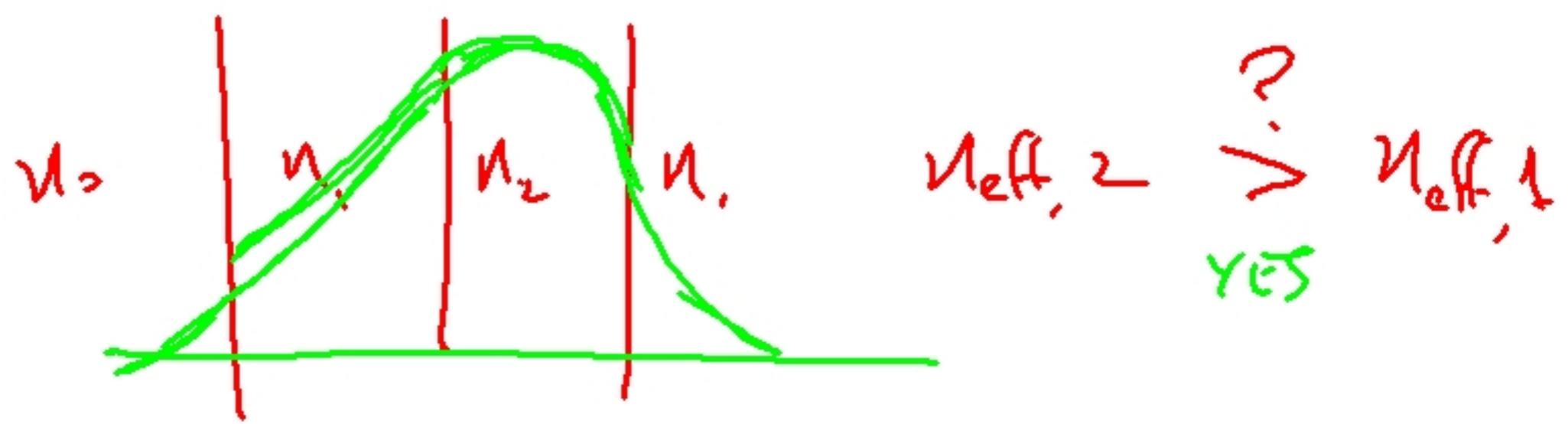
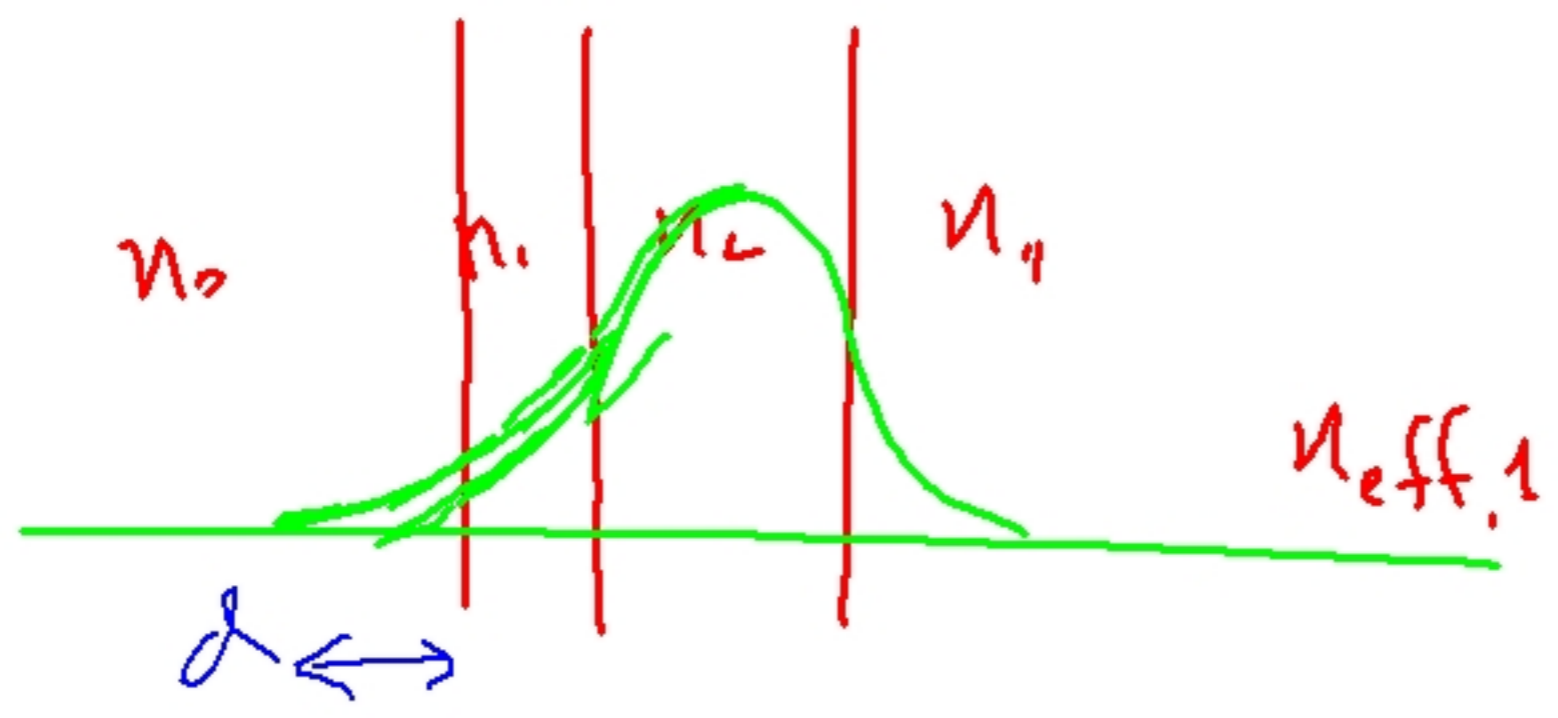


LECTURE 17 — DIELECTRIC STRUCTURES
PHOTONIC CRYSTALS
LEDs — initial discussion

RIDGE GUIDE





Lateral Δn determined by d

PHOTONIC CRYSTALS

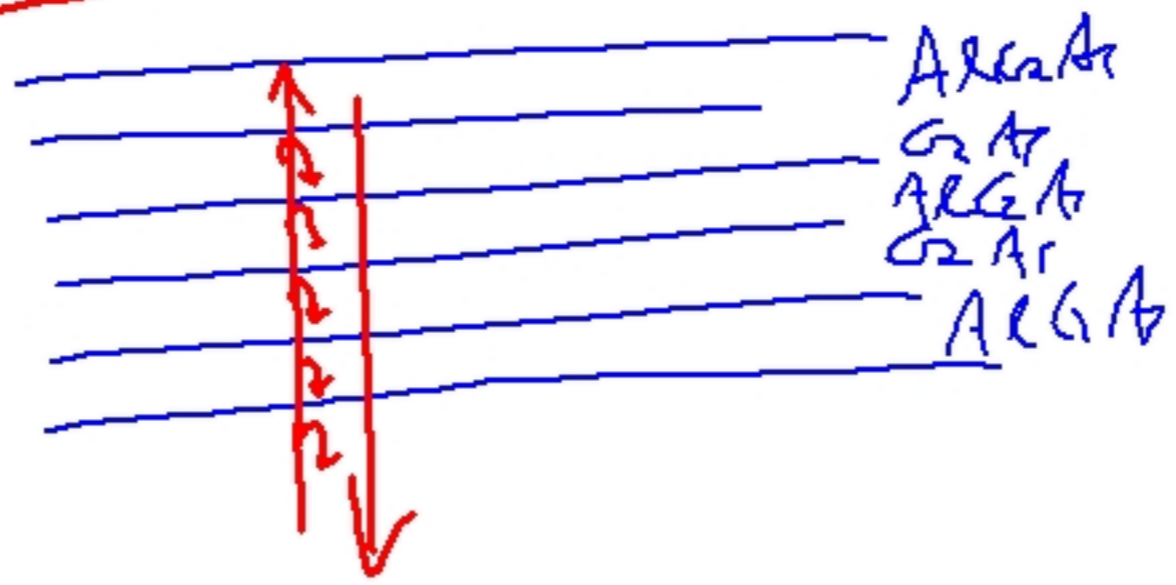
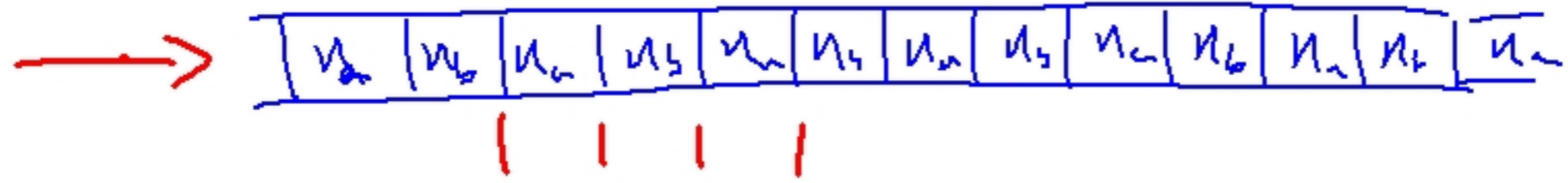
A MATERIALS WITH PERIODIC INDEX OF REFRACTION VARIATIONS

original proposal \Rightarrow 3d structure $n \approx 2$

$$1 \mu\text{m} \quad n \approx 3 \Rightarrow \lambda_{in} = 300 \text{ nm}$$

first realization \Rightarrow 1d structures

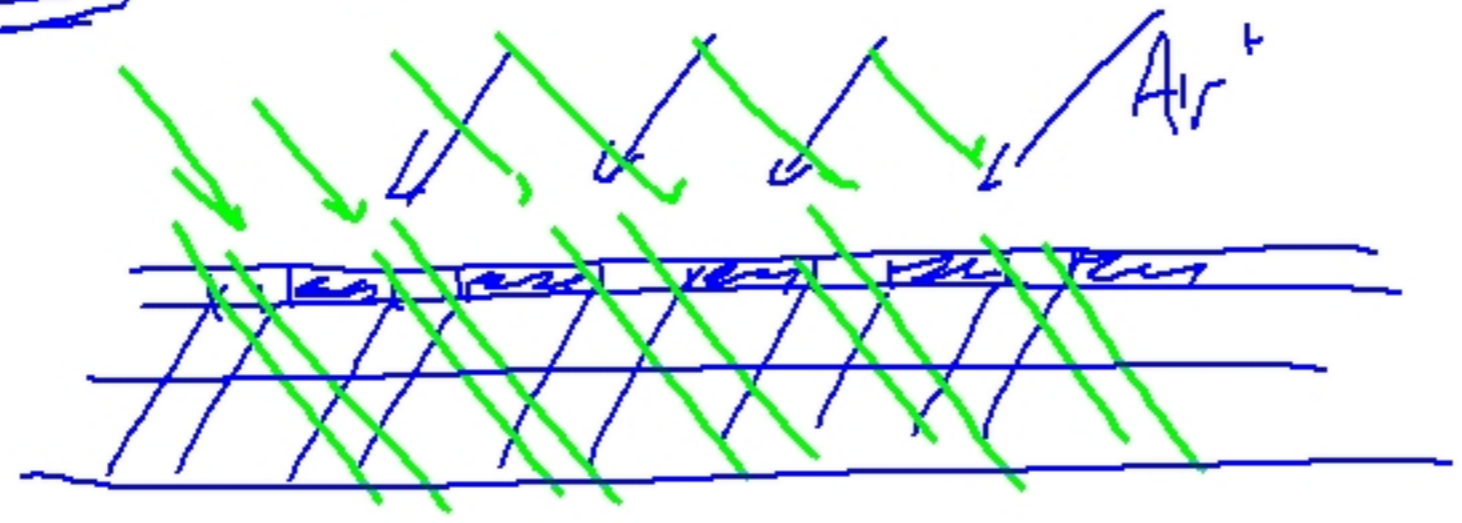
Distributed feedback
Bragg reflectors



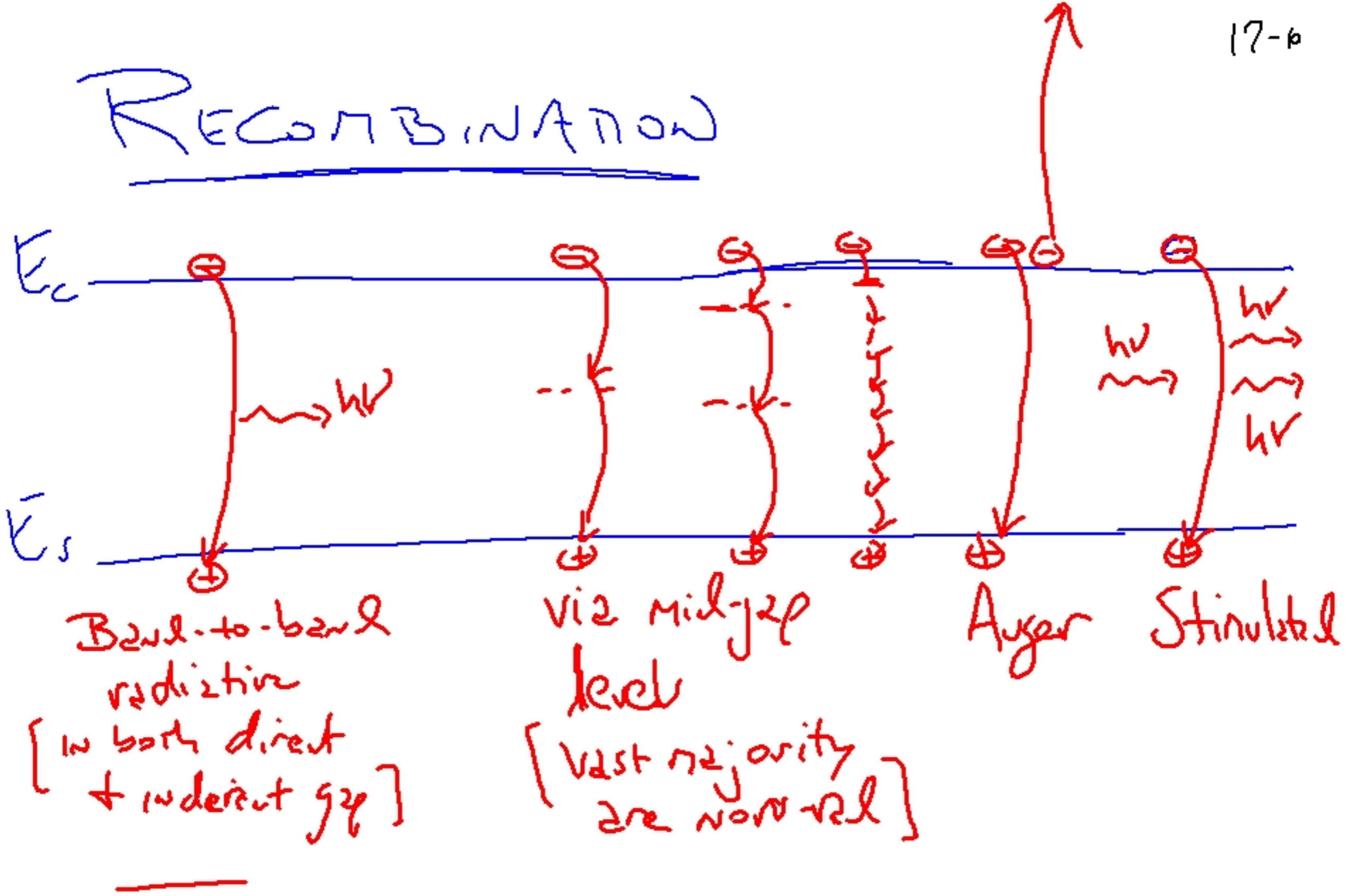
2-d photonic crystal



3-d photonic crystals

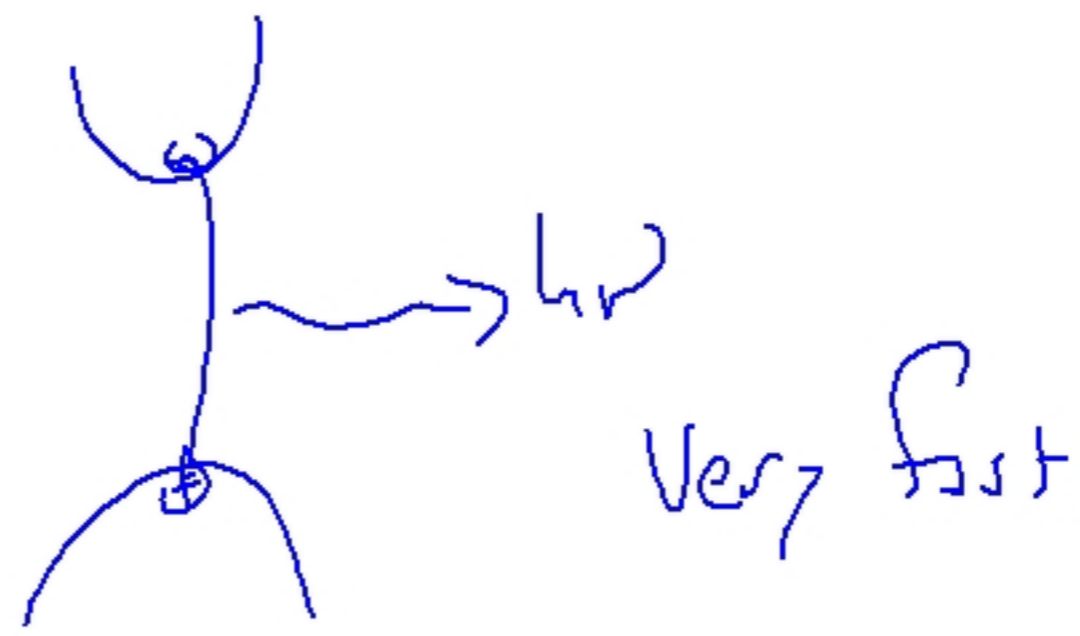


RECOMBINATION



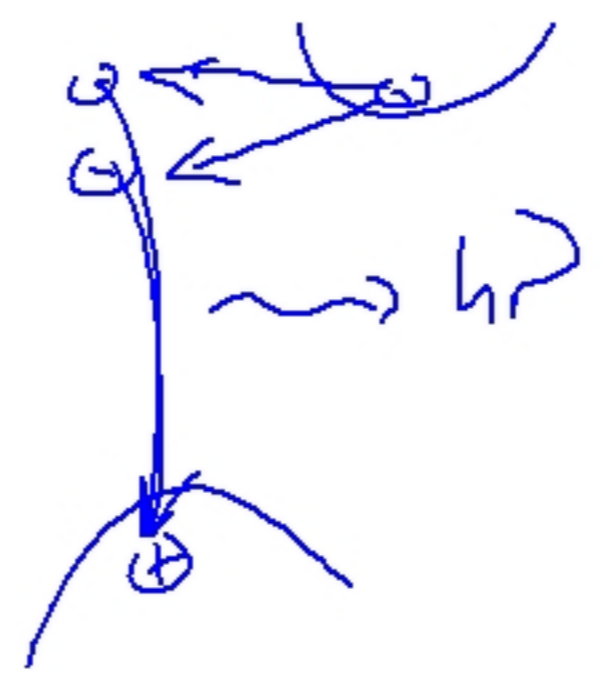
Back to band

Direct gap



Indirect gap

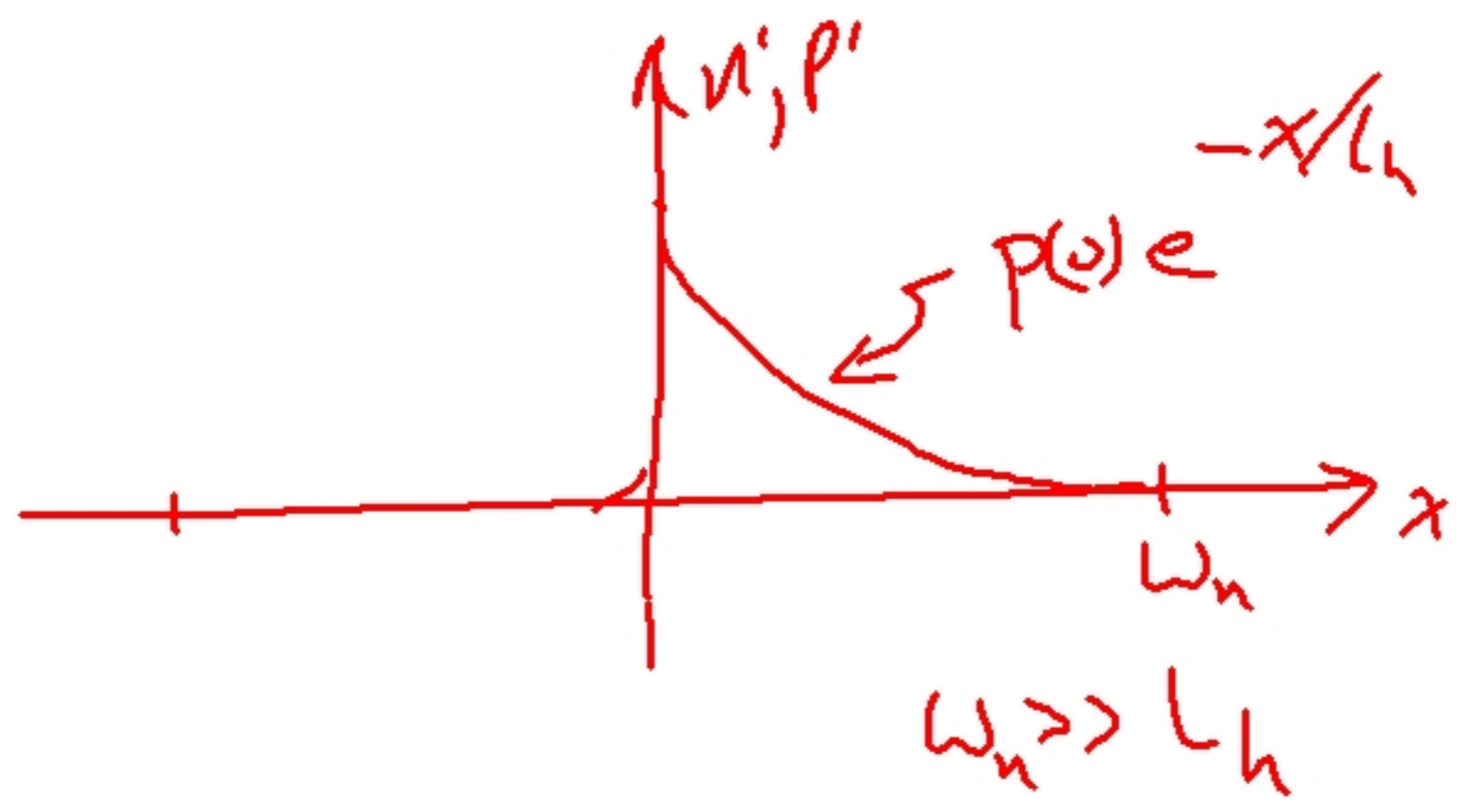
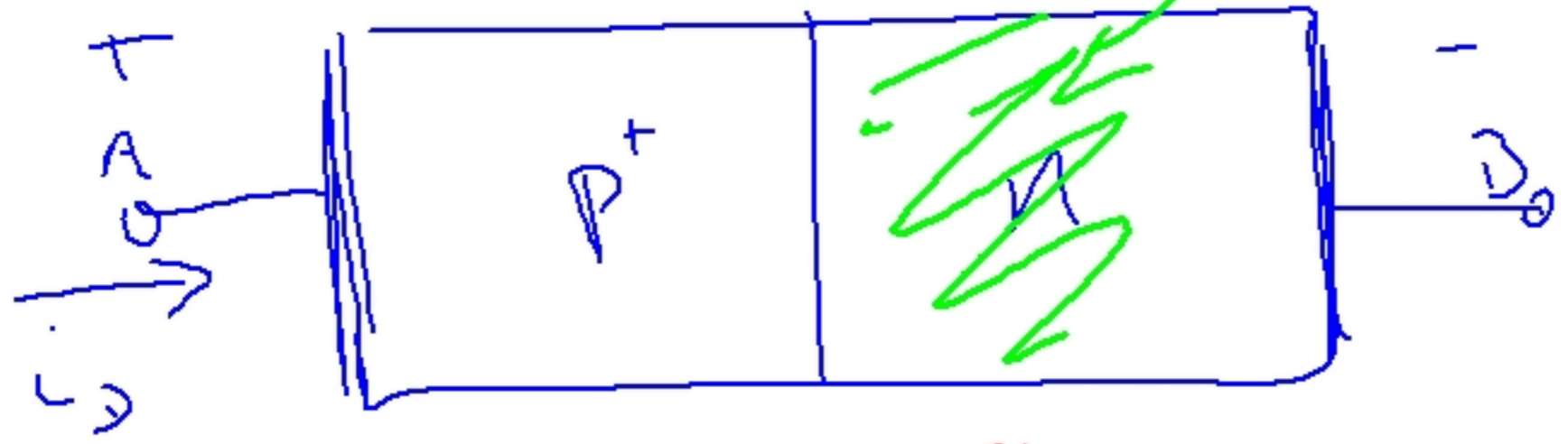
relatively
slow



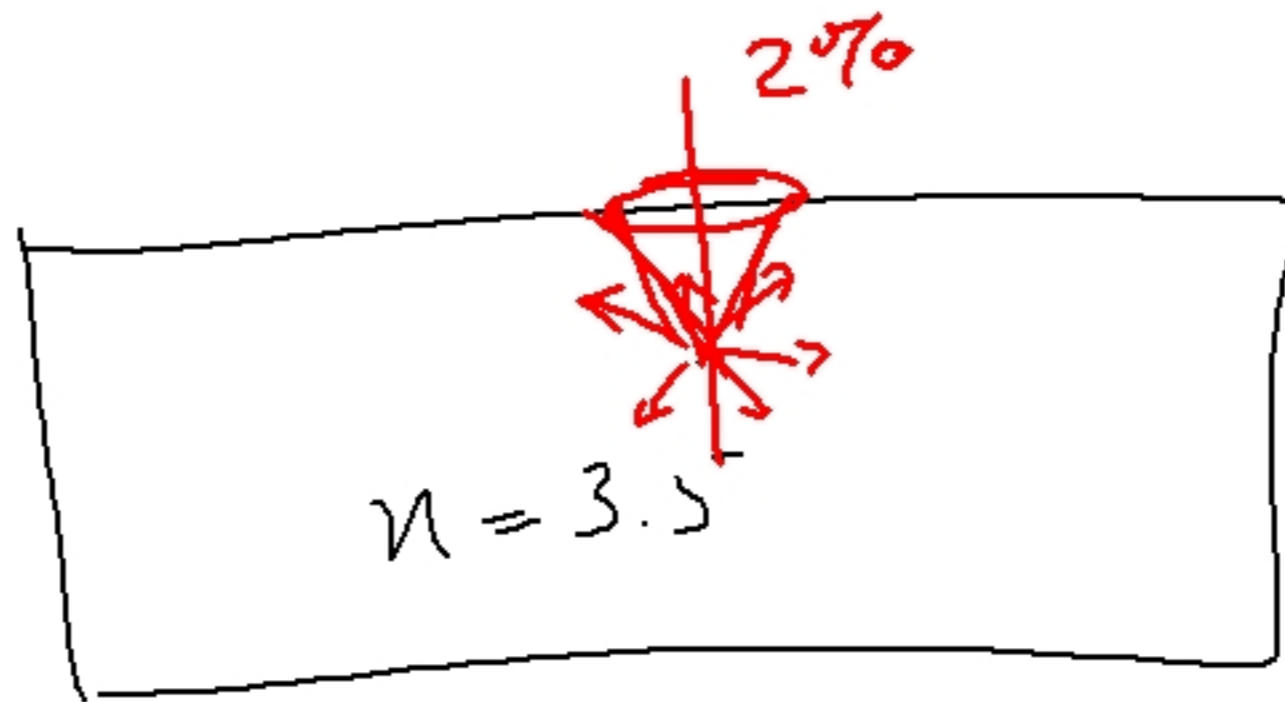
Light emitting diode

$$V_{AD} > 0$$

optical emission



- Issues
- structure and material to achieve efficient emission
 - 1 carrier in \Rightarrow 1 photon out
 - geometry that lets the light out + directed where we want it



$$n = 1.0$$

- ① 1 carrier \rightarrow 1 photon
- ② 1 photon created \rightarrow 1 photon coming out