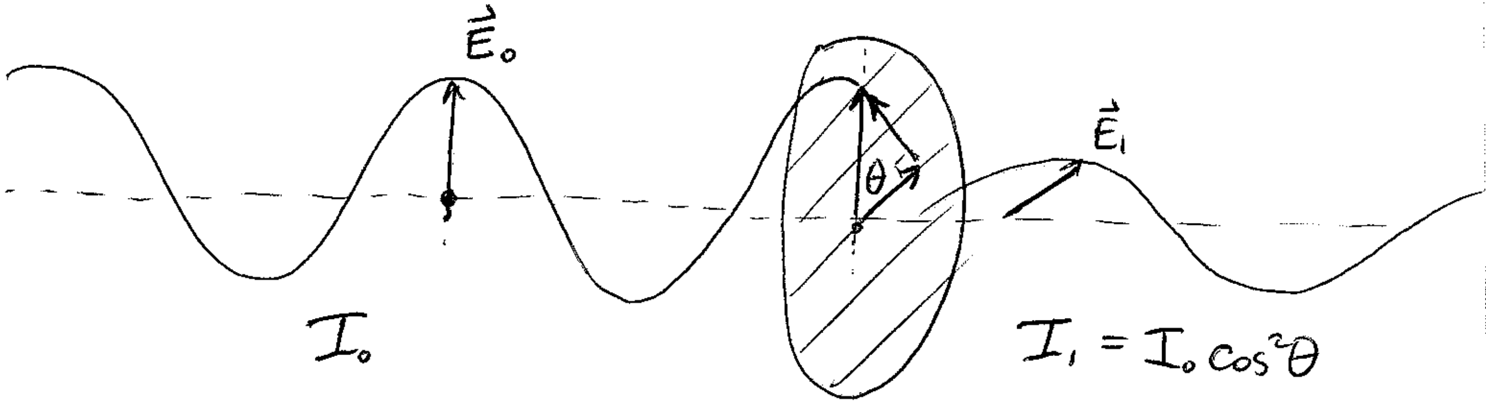
CLICKER

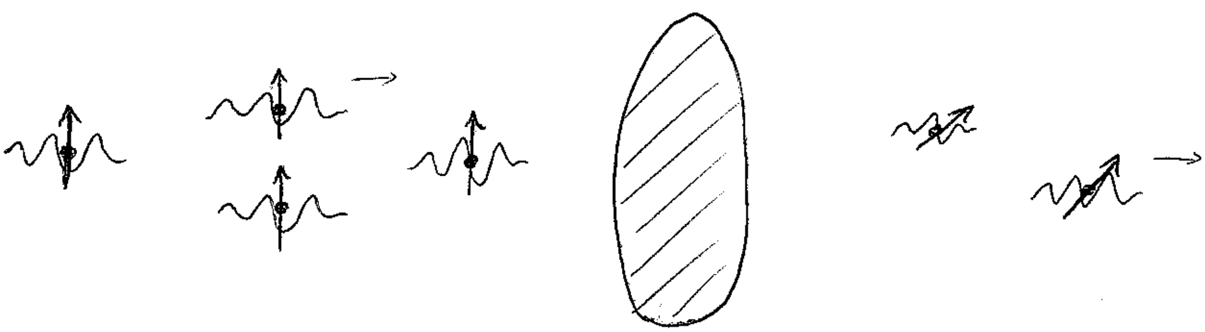
LAST TIME:



classical picture:

incoming wave → SUPERPOSITION of
- light polarized parallel → transmitted
- light pol. perpendicular → absorbed

Photon picture:

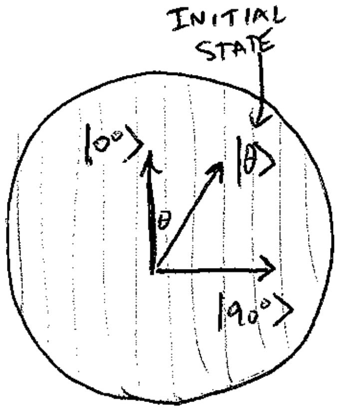


Each photon has PROBABILITY $\cos^2\theta$ of going through CLICKER

Mathematical model: represent polarization state by UNIT VECTOR.

notation: ↑ = $|0°\rangle$ ↗ = $|30°\rangle$ → = $|90°\rangle$

CLICKER.



To calculate probability:

- write state as superposition of unit vectors parallel and perpendicular to polarizer.

$$|\theta\rangle = \cos\theta|0°\rangle + \sin\theta|90°\rangle$$

squared coeffs = probabilities for 2 outcomes

Prob $\cos^2\theta$ → photon acts just like $|0°\rangle$ photon → transmitted & becomes $|0°\rangle$

Prob $\sin^2\theta$ → photon acts just like $|90°\rangle$ photon → absorbed

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INTERPRETATION:

For 0° polarizer, states $|0°\rangle$ and $|90°\rangle$ are special

- can predict what will happen
- these are EIGENSTATES for the experiment.

General state $|\theta\rangle$ is a QUANTUM SUPERPOSITION of the two eigenstates → outcome uncertain.

When photon hits polarizer, it <u>completely changes</u> into one of the eigenstates & behaves that way

→ this is <u>random</u> with probability given by squared coefficient in superposition.

This is the basic framework of quantum mechanics: applies to any experiment / measurement.

e.g. measure position of an electron

eigenstates → electrons w. definite positions

e.g. $|x_1\rangle$ $|x_2\rangle$ $|x_3\rangle$

general state → superposition of these

e.g. $\frac{1}{\sqrt{3}}|x_1\rangle + \frac{1}{\sqrt{3}}|x_2\rangle + \frac{1}{\sqrt{3}}|x_3\rangle$

perform measurement:

prob $\frac{1}{3}$: find electron at x_1

prob $\frac{1}{3}$: " " " x_2

prob $\frac{1}{3}$: " " " x_3

location of electron not determined until we do measurement.