

Interference - What Really Counts

We have seen that the amplitudes from two or more physical paths interfere if nothing else distinguishes the two paths.

Example: (2-slits)

ψ_{upper} is the amplitude corresponding to a photon traveling through the upper slit and arriving at point y on the screen.

ψ_{lower} is the amplitude corresponding to a photon traveling through the lower slit and arriving at point y on the screen.

If these processes are **distinguishable** (*i.e.*, if there's some way to know which slit the photon went through), **add the probabilities**:

$$P(y) = |\psi_{\text{upper}}|^2 + |\psi_{\text{lower}}|^2$$

If these processes are **indistinguishable**, **add the amplitudes and take the absolute square** to get the probability:

$$P(y) = |\psi_{\text{upper}} + \psi_{\text{lower}}|^2$$

What does “distinguishable” mean in practice?