Main Focus: Partial Coherence

- Partial coherence belongs to the subject statistical optics, which is usually left for the more advanced students, usually those with a mathematical flare.
- We will use a setup that can be treated rigorous with a scalar theory.
- Mutual Coherence Function:

$$\Gamma(P_1, P_2, \tau) := < V(P_1, t+\tau) V^*(P_2, t) >$$

- We will assume quasi monochromatic light:

$$\Gamma(P_1, P_2, \tau) \approx J(P_1, P_2) \exp(-2\pi i c\tau/\bar{\lambda})$$

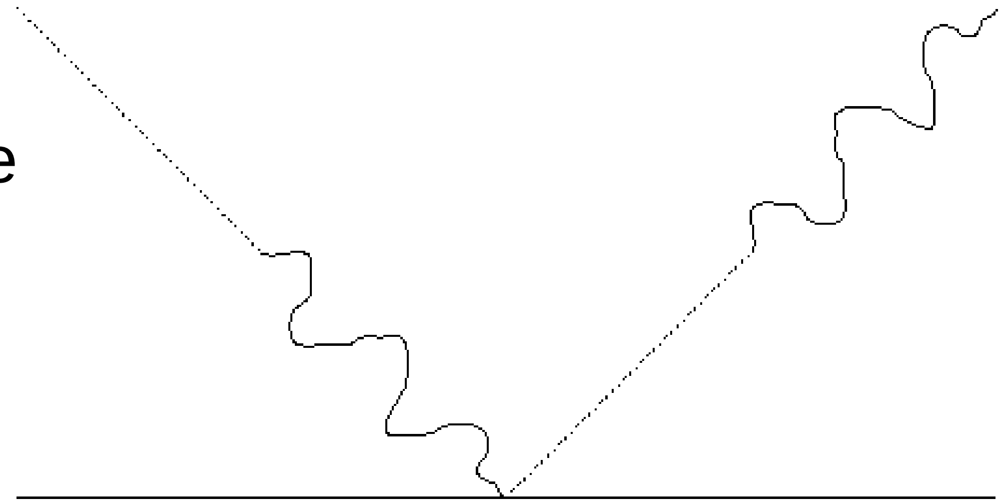
- Mutual Intensity Function: $J(P_1, P_2) := \Gamma(P_1, P_2, 0)$

Coherent and Incoherent Light

- Time invariance is desirable, so stationary ergodic conditions are a good assumption
- Coherent light: $J(P_1, P_2) = A(P_1)A^*(P_2)$
- Incoherent light: $J(P_1, P_2) = \delta(P_1 - P_2)I(P_1)$
- Most of us will have a clear notion of coherent light.
- But what about incoherent light?

Coherence Time and Coherence Length

- If each wave train is alone, it cannot interfere with another wave train



- The time or path difference until the light becomes incoherent is on the order of the duration or length of a single wave train
- The coherence time and the spectral width are related by an uncertainty relation $\Delta v \ \Delta t >= 1/(4\pi)$
- Quasi monochromatic light means a small Δv, so a quasi infinite coherence time and coherence length.