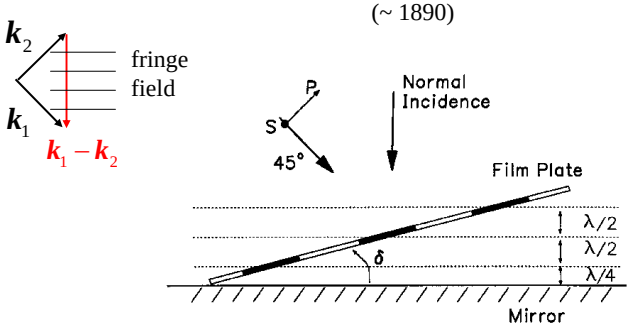
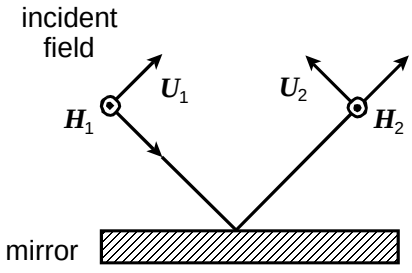
The Wiener Experiment

(~ 1890)



Our discussion so far has been limited to wave combination using the electric field. However, there is also a magnetic component of the EM wave. The question answered by this experiment is, "Do optical detectors respond to the electric field, the magnetic field, or both?" A simple polarized plane wave illuminates a mirror as shown above. A thin plate coated with a photographic film is placed at a shallow angle above the plate.

The Wiener Experiment: Magnetic Interference



$$\boldsymbol{U}_1 \bullet \boldsymbol{U}_2 = 0 \qquad p_{12} = 0$$

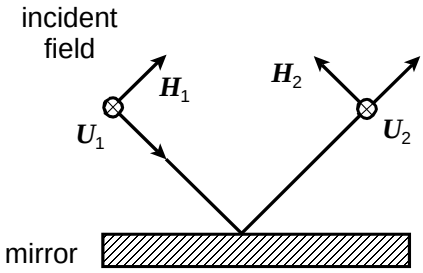
$$\boldsymbol{H}_1 \bullet \boldsymbol{H}_2 \neq 0$$

observation:
no lines in film

This configuration exhibits a fringe field for the magnetic component and crossed fields (no fringe field) for the electric component.

Since no exposure modulation was observed in the film, we conclude that the detector does not respond to the magnetic field.

The Wiener Experiment: Electric Interference



$$\boldsymbol{U}_1 \bullet \boldsymbol{U}_2 \neq 0 \qquad p_{12} \approx 1$$

$$\boldsymbol{H}_1 \bullet \boldsymbol{H}_2 = 0$$

observation:
lines in film

This configuration exhibits a fringe field for the electric component and crossed fields (no fringe field) for the magnetic component.

Since exposure modulation was observed in the film, we conclude that the detector does respond to the electric field. This is true for most detectors.