

OPTICS, 114210 - Homework Exercises

H. Interferometry

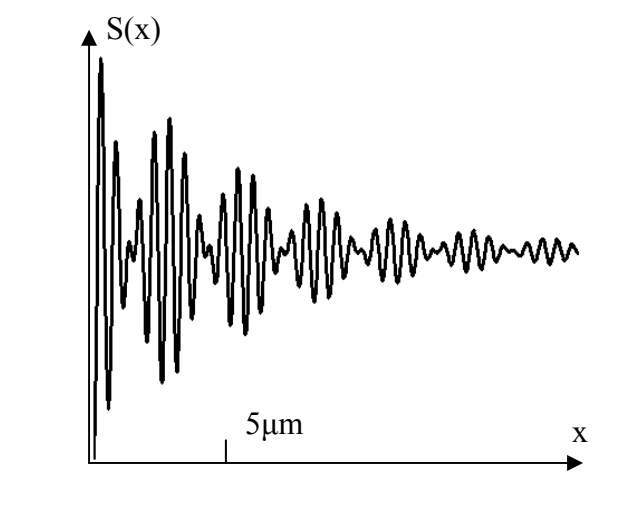
1. A Fabry-Perot interferometer is constructed from two plates each having intensity reflection coefficient 95% and transmission coefficient 4%, separated by a parallel air space.

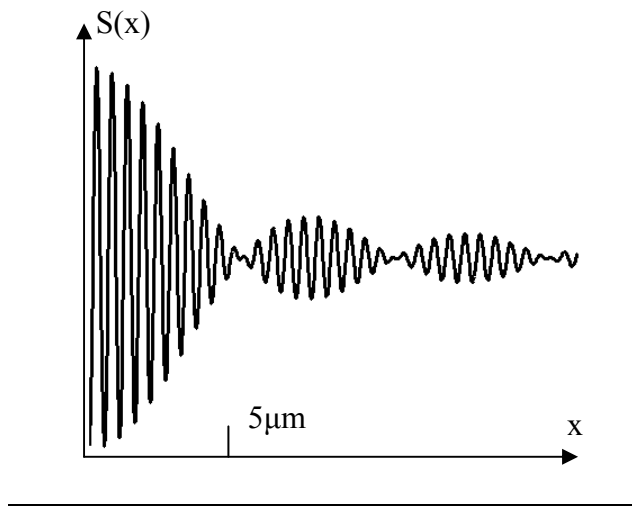
- (a) what are the maximum and minimum intensities transmitted at any angle, as fractions of the incident intensity?
- (b) The interferometer is used to investigate a spectral doublet consisting of two components with mean wavelength 500nm and separation 0.01nm. What is the smallest spacing between the plates which will enable the two components to be resolved?
- (c) What will be the order of diffraction m_0 at normal incidence when the components are just resolved?
- (d) What is the angular radius of the first ring around the normal (order m_0-1)?

2. Why does a soap film become black in reflected light as its thickness approaches zero?

Light reflected from a thicker film has a spectrum which peaks at wavelengths 666nm, 545nm and 462nm when viewed at normal incidence. It has refractive index 1.4. What is its thickness?

3. A Fourier transform spectrometer is constructed from a Michelson interferometer in which the interferogram is sampled as one of the mirrors is translated linearly along the x-axis. The two interferograms $S(x)$ below were obtained from two different sources. What can you deduce about the spectrum of each source?





4. In a Michelson interferometer one mirror is plane and the other is concave with a radius of 2.0m. What interference pattern is observed (in a region conjugate to the mirrors)?

5. A Fabry-Perot interferometer has two plates consisting of crystal surfaces, separated by air. One plate is atomically flat, but the other is crossed by a linear crystal step of height 3.0nm. Each plate is coated with a uniform layer of reflectivity 98% (intensity). What spacing between the plates is necessary so that the crystal step can be observed?

6. How could you use a Fabry-Perot interferometer as a notch filter, i.e. a filter which transmits all light in a given spectral region except for a defined spectral line?

