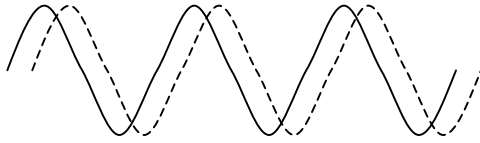


Tutorial for PHYS210. Lecture 4. Interference and diffraction.

1. What is the phase difference between the following two waves?



A: 0° B: 10° C: 60° D: 120°

If the two waves overlap, what kind of interference do you get?

2. A diffraction grating is used to analyse the spectrum from a Mercury-Cadmium lamp.

The grating has 600 lines per mm.

a) What is the line spacing in nm?

On a screen 2m from the grating, the distance between the 0st order maximum and the 1st order maximum of the mercury blue line is 54 cm.

b) What is the deflection angle?

c) What is the wavelength?

d) For the green spectral line, is the distance between the 0st and 1st maximum larger or smaller than for the blue line?

3. Yellow light with a wavelength of 600nm is incident perpendicularly on a lens made of glass with $n=1.55$

a) What fraction of the light is reflected?

b) If the lens is under water ($n=1.33$), what fraction of the light is reflected?

A thin coating of magnesium fluoride ($n=1.38$) is applied to the lens to reduce the reflections

c) What is the wavelength of the light inside the coating?

d) What thickness should the coating be to achieve optimal reduction of reflections?

4. A satellite with a 100 cm diameter telescope is used to observe the earth

a) What is the diffraction limit of angular resolution for green light ($\lambda=550\text{nm}$)?

b) What is the smallest size detail that can be seen from an altitude of 200km?

Extra questions on diffraction and interference

- 1) Monochromatic red light 600nm falls on a diffraction grating. The angle between the 0st and the 1st diffraction maximum is 20 degrees.
- What is the distance between the lines on the grating?
 - How many lines per mm does it have?
 - What is the angle between the 0st and the 2nd diffraction maximum?

The red light source is replaced by a light source with half the energy per photon.

- What is the wavelength of this light?
- What type of optical radiation is this light?
- What is the angle between the 0st and the 1st diffraction maximum for this light?

2) Someone designs a lens coating to reduce reflections of ultraviolet light. Should the coating be thinner or thicker than a coating used for visible light?

- 3) A gaseous light source has 2 spectral lines, one at 450nm and one at 650nm
- What are the colours of the individual spectral lines?
 - What is the colour of the light from this light source?
 - The light falls on a piece of glass ($n=1.65$) with a 115nm coating ($n=1.41$). Which of the two spectral lines will have the strongest reflection?