Concept Q.: Headlight Resolution

Is it easier to resolve two headlights at night or during the day?

1. At night
2. During the day
3. It doesn't matter
4. I don't know

Con. Q. Ans.: Headlight Resolution

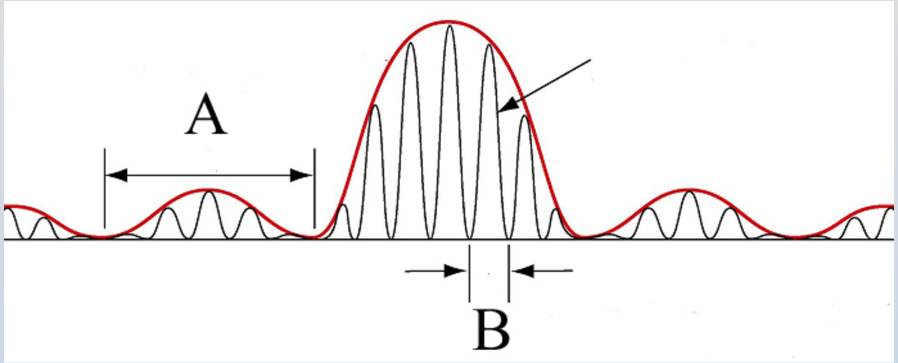
Answer: 1. It is easier to resolve at night

$$\alpha_{critical} = 1.22\,\lambda / D$$

You want this to be as small as possible to be able to distinguish objects (since to be distinguishable they must be further apart than this). Since your pupils are larger in the dark, at night *D* is bigger, α is smaller and you can better distinguish the headlights.

Con. Q.: Interference & Diffraction

Coherent monochromatic plane waves impinge on two long narrow apertures (width a) that are separated by a distance d (d >> a).

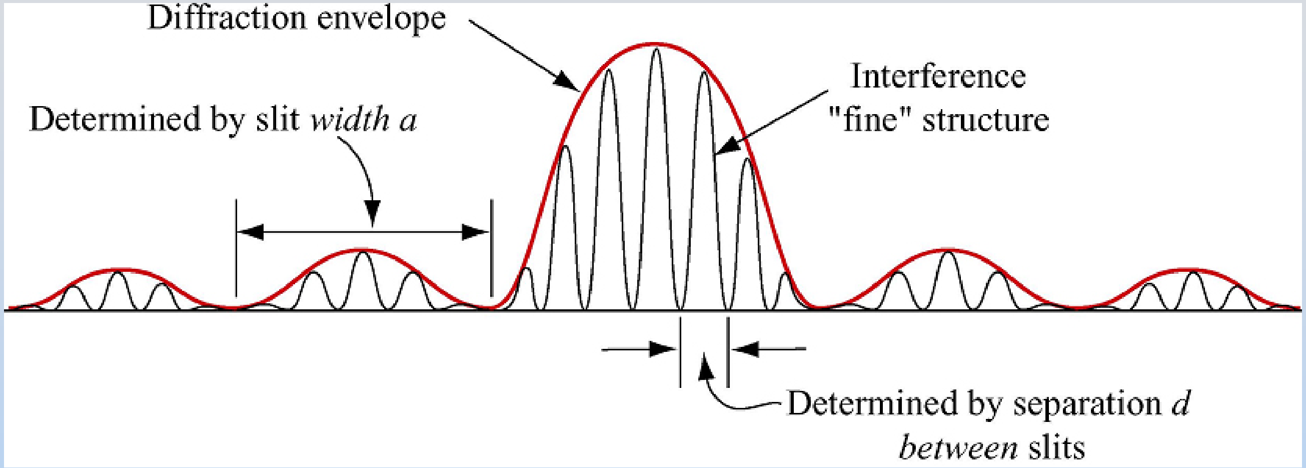


The resulting pattern on a screen far away is shown above. Which structure in the pattern above is due to the finite width a of the apertures?

1. The distantly-spaced zeroes of the envelope, as indicated by the length A above.
2. The closely-spaced zeroes of the rapidly varying fringes with length B above.
3. I don’t know

Concept Q. Ans.: Inter. & Diffraction

Answer: 1. The ‘envelope’ depends on slit width



You could infer this in two ways.

1) Slit width a << slit separation d. Angles and size scale inversely, so the bigger features come from a
2) Interference patterns are roughly equi-magnitude while diffraction creates a strong central peak. So the envelope is from diffraction.

Concept Question: Changing Colors

You just observed an interference pattern using a red laser. What if instead you had used a blue laser? In that case the interference maxima you just saw would be

1. Closer Together
2. Further Apart
3. I Don’t Know.

Concept Question Answer: Changing Colors

Answer: 1. Closer Together

$$d \sin\theta = m\lambda$$

Blue light is a higher frequency (smaller wavelength) so the angular distance between maxima is smaller for blue light than for red light

Concept Question: Lower Limit?

Using diffraction seems to be a useful technique for measuring the size of small objects. Is there a lower limit for the size of objects that can be measured this way?

1. Yes – but if we use blue light we can measure even smaller objects
2. Yes – and if we used blue light we couldn't even measure objects this small
3. Not really
.
4. I Don't Know

Concept Question Answer: Lower Limit?

Answer: 2. There is a lower limit, about λ

$$\sin\theta = m\frac{\lambda}{a}$$

Once the feature size a is as small as the light wavelength you can't go to an angle large enough to satisfy the above equation for any m > 0

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