

Nodes and Coherent Light

In order to have nodes visible on a screen, certain conditions must be met. To help explore the required conditions, we will use the **VInterference** program to show this.

1. Open up the **VInterference** program.
2. Go the **Animation Controls** tab and check **Show Instantaneous** box. This will show the energy of the wave as it hits the screen. Black means no amplitude hence no energy.
3. Hit the **Start Waves** button.
4. Notice that the waves intensity changes on many parts of the screen. Is there any part that is always bright? Always dark?
5. Treating the light as a wave, this is what we would see but the wave would be moving faster and our eyes would average out the intensity. To see this effect, select the **Show Average Amplitude**. Now let the interference average out. Notice how we can now see the where the nodes (dark bands) and antinodes (bright bands) are.
6. Go to the **Wavelengths** tab and set the amplitude to one of the waves to 2 while keeping the other at 10. Repeat the above process. Notice how there are no distinct nodes on the screen after letting the average amplitude to settle. Why is that?
7. Reset the waves so they have an amplitude of 10 again. Now check the **High Detail** box on the **Animation Controls** tab. You can see where the nodes are clearly and that they follow a nice straight line to the screen.
8. Stop the wave from moving and uncheck on the boxes on the animation tab. Go to the measurement tab and select the **Unmatched Wavelengths** option.
9. Set one wavelength to 26 and the other to 30. Predict what node pattern you might see when you select the high detail option? Once you have predicted, see if your prediction was right.
10. When you start the waves will a node pattern been seen on the screen when you average out the waves? Try and see. (Uncheck the high detail to speed up the process once you see what is happening to the nodes lines.)
11. Explain what you see and why we see the results that we do.
12. Reset both amplitudes to the 10.
13. Now change the phase shift on the **Wavelengths** tab. Select the **High Detail** option. What do you notice what happens to the nodes as you change the phase shift?
14. What happens when the phase shift is 180° ?
15. What happens when you now increase the separation of the point sources? Decrease the separation?
16. Would you see nodes on the screen if:
 - a. the phase constantly changed?
 - b. If the point separation constantly changed?
17. Summarize what you now know about what is needed to have a node appear on the same spot on a screen?
18. Look up what the definition of coherent light. Why must light be coherent to give interference patterns?