Answer on Question #52230, Physics, Optics

Question

Why is it so much easier to perform interference experiments with a laser than with an ordinary light source?

Answer

In order to observe interference in light waves, the following conditions must be met:

• The sources must be **coherent**—that is, they must maintain a constant phase with respect to each other.

• The sources should be **monochromatic**—that is, of a single wavelength.

If two lightbulbs are placed side by side, no interference effects are observed because the light waves from one bulb are emitted independently of those from the other bulb. The emissions from the two lightbulbs do not maintain a constant phase relationship with each other over time. Light waves from an ordinary source such as a lightbulb undergo random phase changes in time intervals less than a nanosecond.

Therefore, the conditions for constructive interference, destructive interference, or some intermediate state are maintained only for such short time intervals. Because the eye cannot follow such rapid changes, no interference effects are observed.

Properties of Laser Light

The light from a laser is **monochromatic**, which means that it is of a particular wavelength, or of a single color.

The beam is **coherent**, which means that each photon is in synchrony with the other photons, or the patterns of their waves are aligned with each other, thus increasing the intensity of the light emitted.

It is also highly directional, which means that the light emitted is very tight, concentrated, and intense. In contrast, the light from a flashlight or a light bulb, for example, is comparatively diffuse and weak, since the light emitted is scattered in many directions.

Thus, laser beam perfectly fulfills the conditions required for the observation of interference.