Chapter (1) Introduction to Laser

**BOOKS:**

2. Siegman: Lasers.

The word LASER is an acronym for

*Light Amplification by Stimulated Emission of Radiation.*

Lasers can be ...

- based on solid, liquid, or gaseous media ...
- big or small, expensive or cheap ...
- high or low power, 
- pulsed or continuous (CW)
- at wavelengths anywhere from the far IR to the X-ray region.
**Properties of Laser light:**

1. Monochromaticity.

![Diagram](attachment:image.png)

2. High degree of temporal coherence and spatial coherence.

![Diagram](attachment:image.png)

Coherent waves are waves that maintain the relative phase between them.
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3. Directionality.

The far field diffraction angle is \( \theta \approx \frac{\lambda}{d} \)

Where:
\( d \): diameter of the output beam.
\( \lambda \): wavelength of the laser light.

4. High radiation intensity (up to \( 10^{13} \) W). High photon density in a narrow spectral range.

Key processes in LASERS:
- Stimulated emission must dominate over spontaneous (\( B_{ik} > A_k \))
- Stimulated emitted photons have same wavelength, same phase (spatial and temporal) and same direction that generating photon.
- Number of photons in upper level must be larger than in lower level.
- The inversion of population must compensate losses.