

Three lecture

What is Photonics

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Fourth Stage

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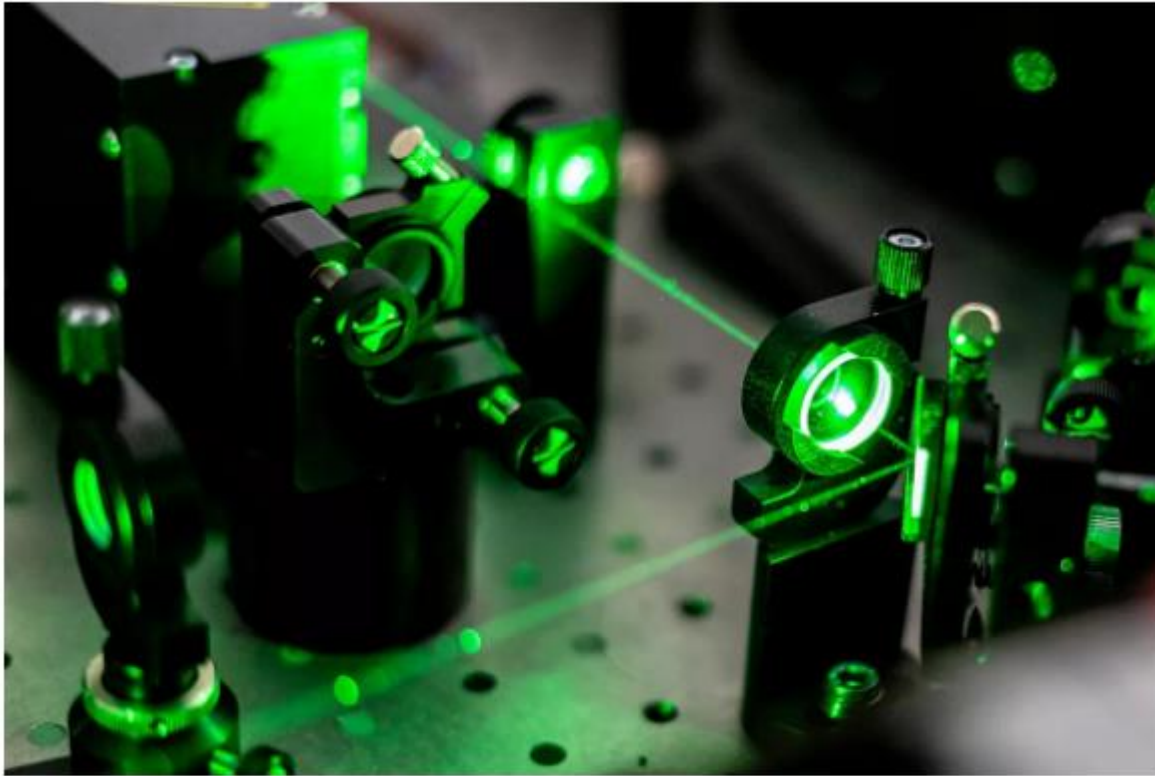
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Definition

- Photonics is the physical science of light waves. It deals with the science behind the generation, detection and manipulation of light.
- Light has a dual nature known as the wave-particle duality. That is to say that light has characteristics of both a continuous electromagnetic wave and a particle (photon). Which nature of light is operative depends on the kind of interaction being observed. For example, light bending through a lens or diffracting at the edge of an aperture is exhibiting its wave nature. Light being created or absorbed by a solid-state device such as a laser diode or charge-coupled device (CCD) detector is exhibiting light's particle nature.
- The term "photonics" came into wider use in the 1960's with the invention of the laser and later the laser diode. It was originally intended to describe a field where the goal was to use light to perform functions traditionally accomplished using electronics, thus the name. The term came into more popular use with the advent of fiber optic communications in the 80s.

Today, photonics refers to the creation, manipulation and detection of light in the service of practical applications where the particle nature of light is important.



❖ *What is the difference between optics and photonics?*

- ✓ Optics is a general area of physics covering a wide range of topics related to the study of light. Optics includes such subfields as geometrical optics, physical optics, and quantum optics. Photonics is a subset of the optics discipline.
- ✓ Geometrical optics, sometimes referred to as classical optics, is primarily concerned with the manipulation of light using devices such as lenses, mirrors and prisms. In geometrical optics, light is modeled using the ray approximation. In the ray approximation, light wave fronts are approximated as a collection of rays, each perpendicular to the wave front of light and representing the energy flow through the system. A typical application of geometrical optics would be the design of an imaging lens for a camera.

- ✓ Physical optics is the study of light where the wave nature is predominant. In physical optics the ray approximation is not valid since interference and diffraction effects must be accounted for. Physical optics tends not to include effects caused by the particle nature of light. A typical application of physical optics would be the production of holographic images.
- ✓ Quantum optics is the study of light phenomena where the particle, or quantum, nature of light is important. Quantum optics and photonics are closely related, but quantum optics tends to be more theoretical and photonics is more concerned with the design of practical applications. A typical area of study for quantum optics would be theoretical study of the physics of light creation at the p-n junction inside an LED.