

# LIGHT

## As a Particle

Atoms in the atmosphere of the earth absorb and release photons, resulting in the Aurora Borealis.



A solar sail propels a spacecraft because photons from the sun transfer their momentum to the ultralight sail.

Photo courtesy of ESA & DLR Projekt Gossamer

## What is Light?

Light is part of the electromagnetic radiation spectrum and is a form of energy. Light is usually considered to be the visible part of the spectrum. However, in physics, light is defined as all portions of the electromagnetic scale, including invisible forms such as infrared, ultraviolet, x rays, radio waves, and more.

Light energy can be described as a wave, a particle (or photon), or a combination of both (called the wave-particle duality). The observations of how light behaves with matter demonstrate its various properties as a wave, particle, or ray.

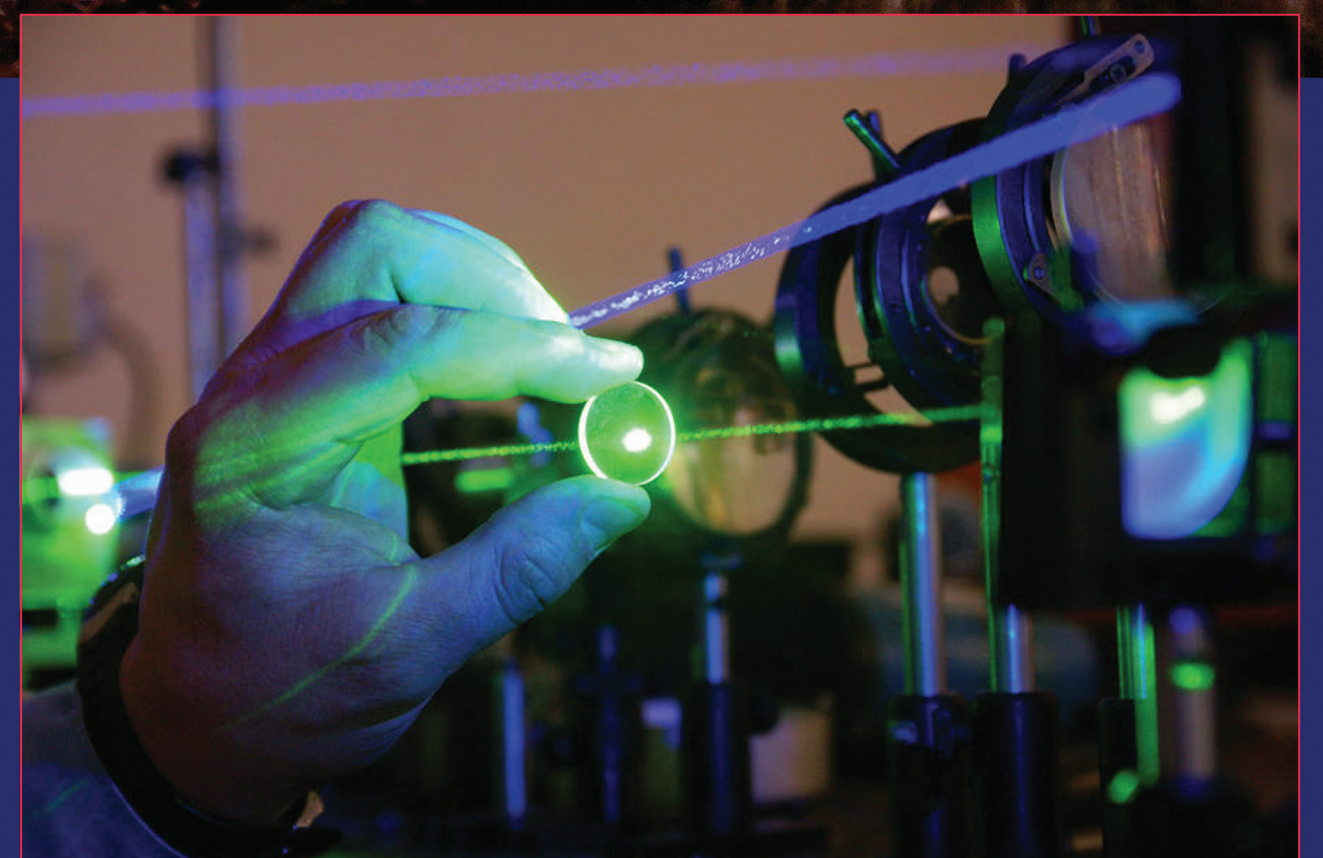
Particle properties of light include absorption, emission, and momentum and are studied and utilized in the field of Optics and Photonics. Besides enabling us to see, the use of light has expanded into areas that are critical to the health and quality of human life, such as in precision cancer treatments, defense and security devices, and new energy sources.

New discoveries in these fields open the door to addressing and solving the challenges of a modern world.

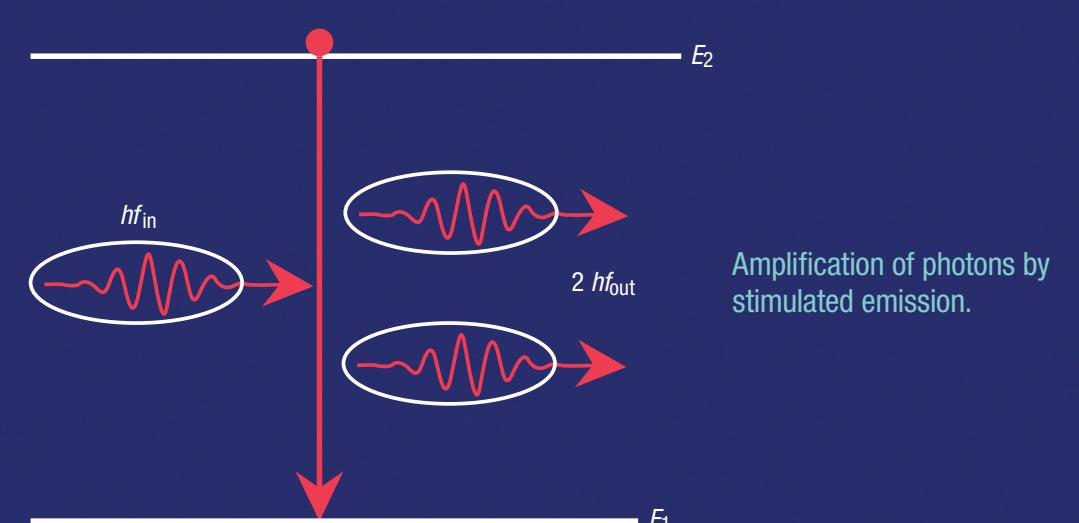
**Momentum**—Photons (or particles) have energy and momentum, and a photon's momentum can be seen to change when it hits a surface.

**Absorption**—Electrons inhabit discrete energy orbitals, which are regions around the nucleus of a particular atom where the electron can more frequently be found. Electrons will occupy the lowest energy orbital possible. Photons, acting like particles, hit that electron; the electron absorbs the energy and occupies a higher energy orbital of the atom.

**Emission**—An atom that has absorbed a photon is then in a temporary excited state, and unless continuing to absorb additional photons it will return to its original state upon which a photon maybe emitted.



Lasers are the result of the stimulated emission of photons, producing a very bright and intense beam of light.



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