

## Particle Nature of light

Energy carried by light is better explained using a particle model.

### Photon

- small, massless particle of light.
- used to explain the nonuniform distribution of energy detected in experiments with light.
- only exist when  $v = c$

### Photon Energy

$$E = hf$$

$h$  = plank's constant  $6.626 \times 10^{-34} \frac{\text{J}}{\text{Hz}}$

$f$  = frequency ( $\text{Hz}$ )

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Light propagates via absorption and emission.

Absorption

- occurs when an atom absorbs a photon and enters an excited state.

Emission

- occurs when an atom emits a photon and enters a less excited state.

Excited State

An atom is said to be in an excited state if electrons have been moved to higher energy levels.

Ground State

An atom is said to be in a ground state when all electrons occupy the lowest possible energy levels.

The nucleus of an atom may also be in an excited state or ground state.

In the nucleus, nucleons can occupy different energy levels.

### Scattering

- the process of absorption followed by emission.

### Dissipative Absorption

- the process of absorption and transfer to kinetic energy of photons of a certain frequency.
- kinetic energy of a given atom or molecule contributes to thermal energy and temperature if it is random.

### Nonresonant elastic scattering

- process by which photons are transferred without a move to an excited state.

- electron cloud oscillates, emitting & absorbing a photon.

### Electromagnetic Spectrum

Low frequency to high frequency.

Radio waves	Source currents
Infrared	Molecular Vibrations
Light (visible)	outer electrons
Ultraviolet	} Inner electrons
X-rays	
γ-rays	Nuclei