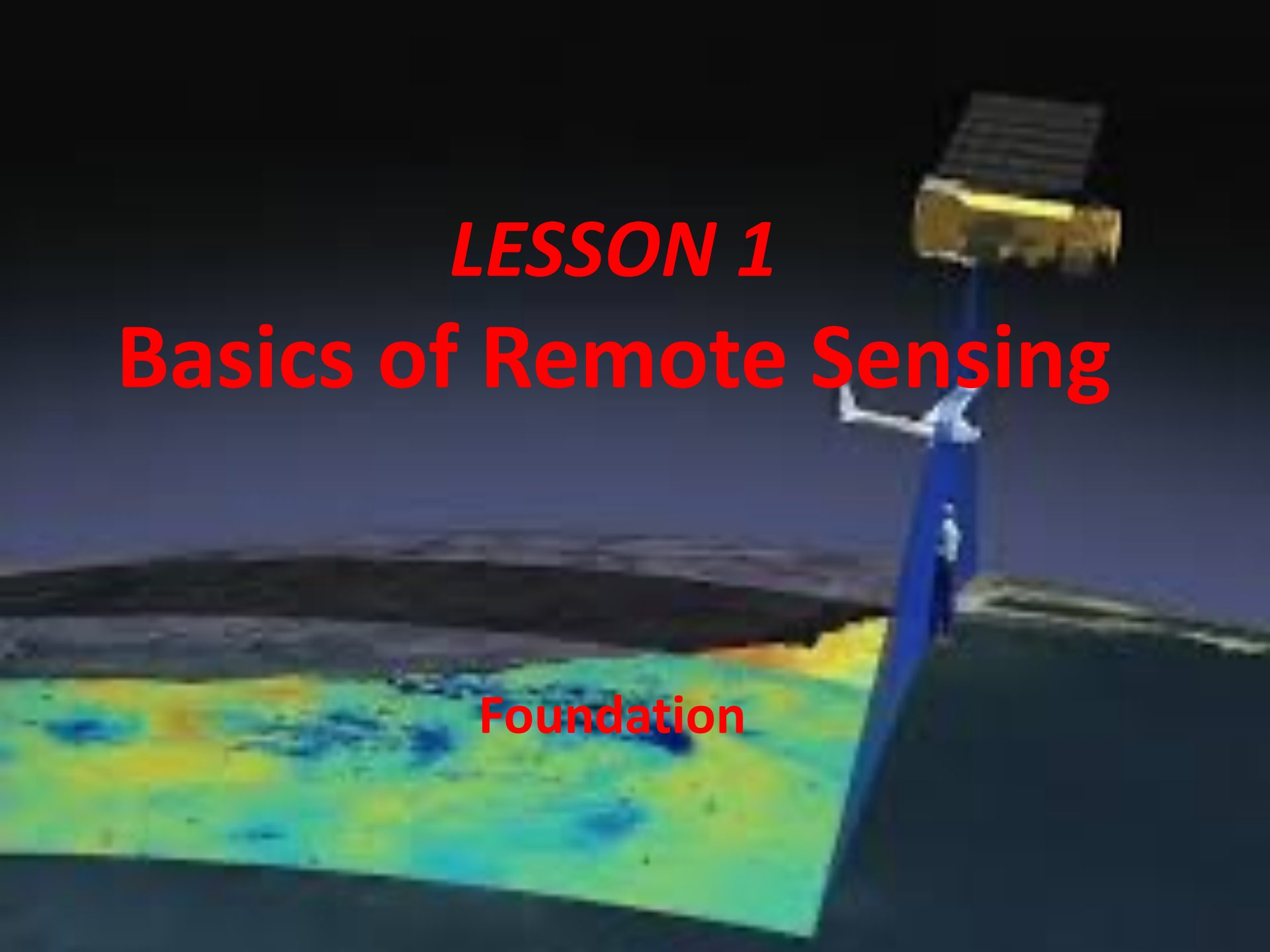
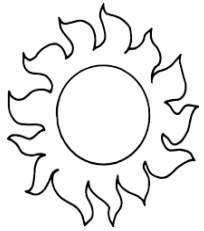


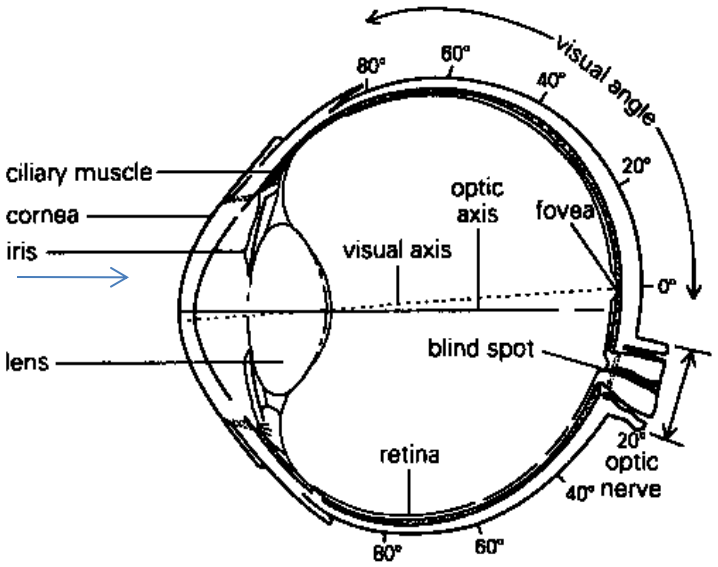
LESSON 1
Basics of Remote Sensing

Foundation

What is remote sensing ?

- Remote – away from or at a distance
- Sensing – detecting a property or characteristic

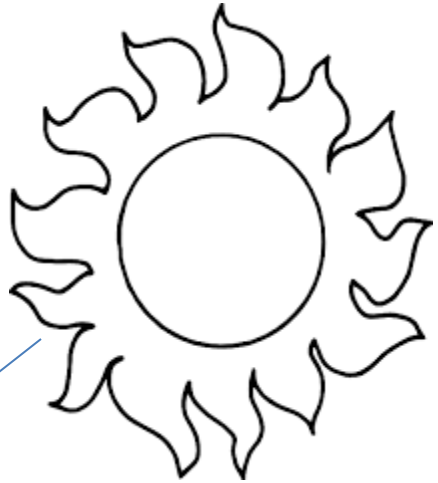


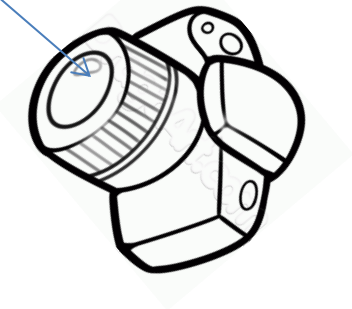


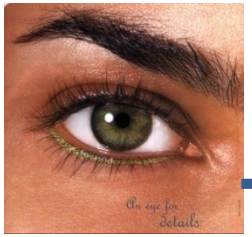
Process: Source of energy

What is remote sensing ?

- Remote – away from or at a distance
- Sensing – detecting a property or characteristic







INTERPRETATION

House/Hut

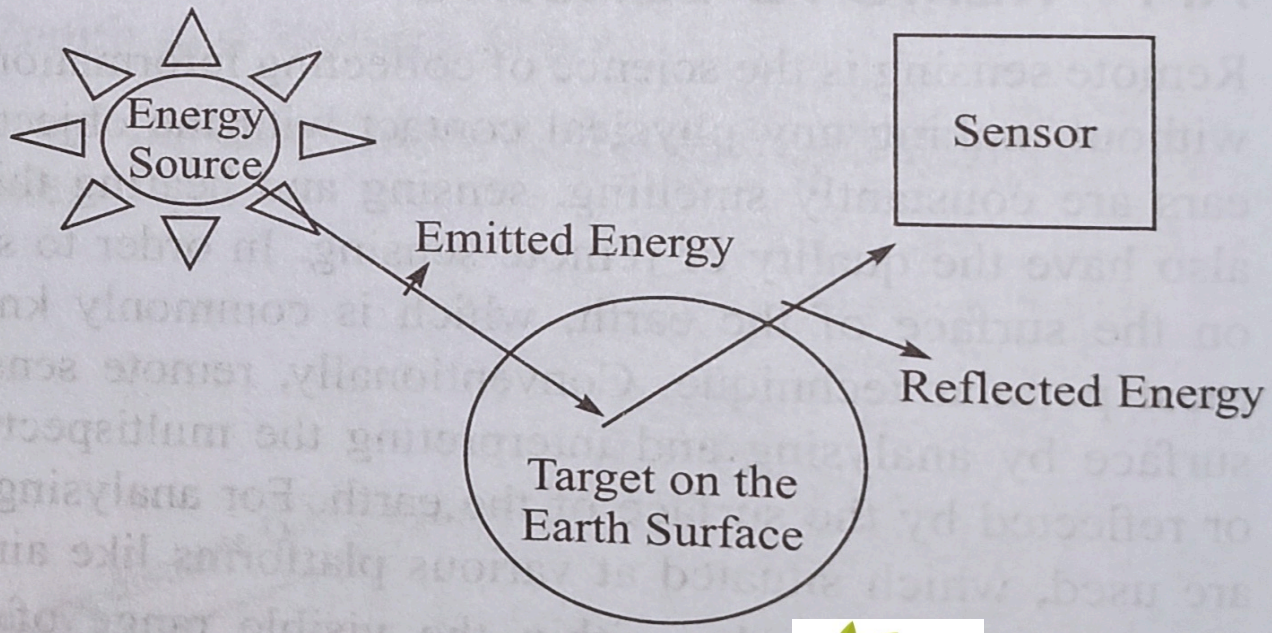


Fig. A.14 Components of [illegible] Sensing

- **Remote sensing requirement:**
- **Source of radiation**
- **Object to be detected**
- **Platform, Sensor and method of analysis**

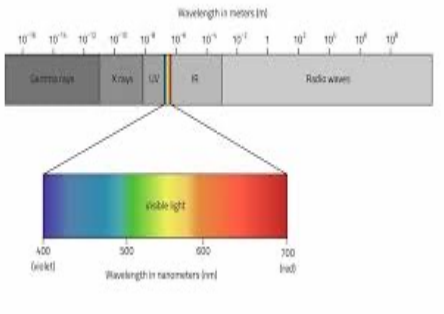
The term "remote sensing," first used in the United States in the 1950s by Ms.**Evelyn Pruitt** of the U.S. Office of Naval Research.

is now commonly used to describe the science—and art—of identifying, observing, and measuring an object without coming into direct contact with it..

- **"The art and science of obtaining information about an object without being in direct contact with the object" (Jensen 2000).**

Planck's Law Intensity of Radiation vs. Wavelength

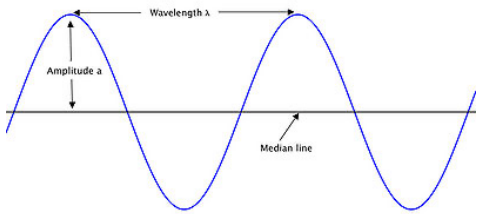
The intensity (I) of electromagnetic radiation at a given wavelength (□) is a complicated function of the wavelength and the temperature (T). h plank's constant 6.626 x 10^-34 (J.s) k Boltzmann's constant 1.380 x 10^-23 (J.K^-1). c velocity of light 2.998 x 10^8 (m.s^-1)

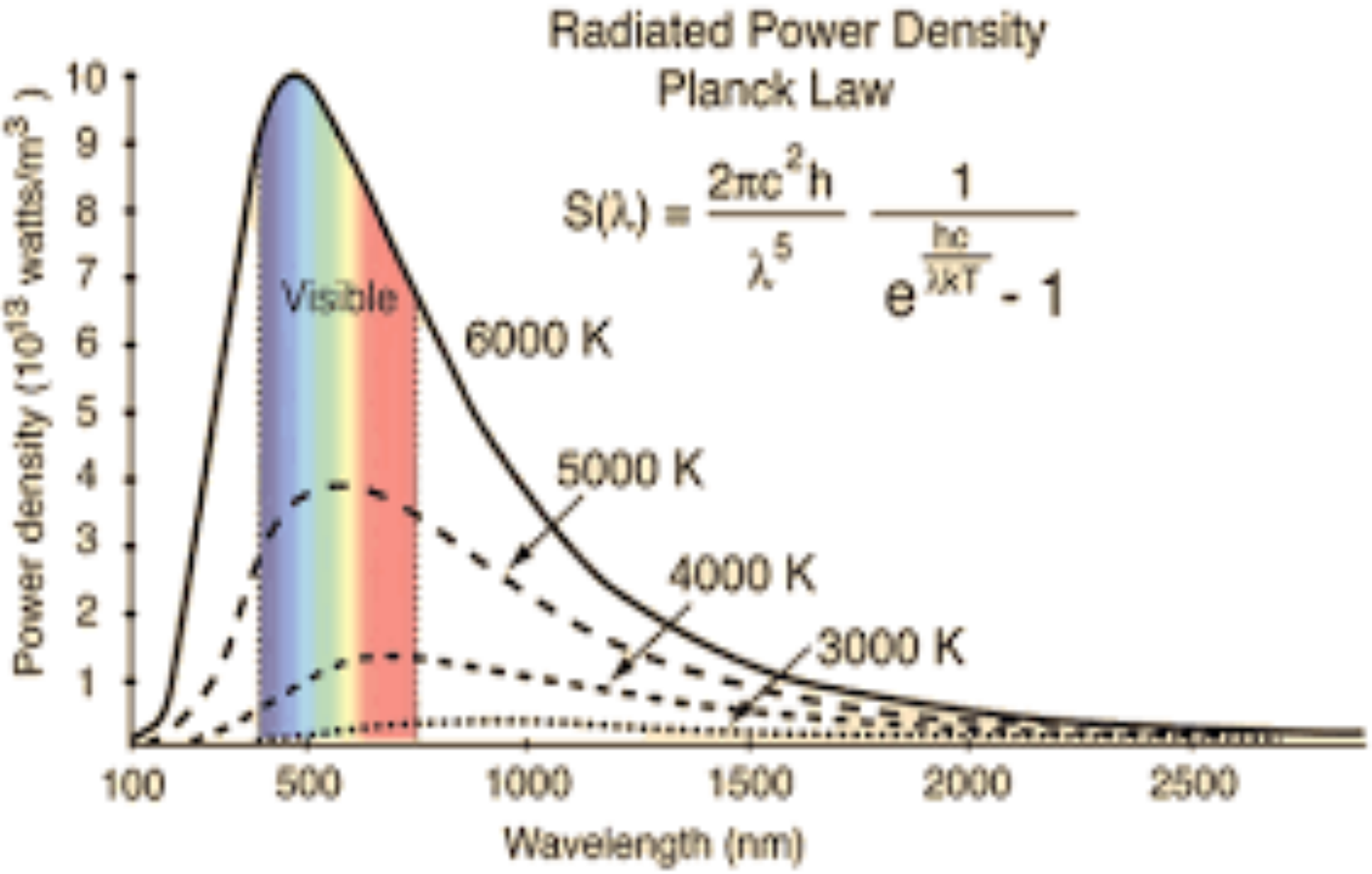


Planck's Law
Intensity of Radiation *vs.* Wavelength

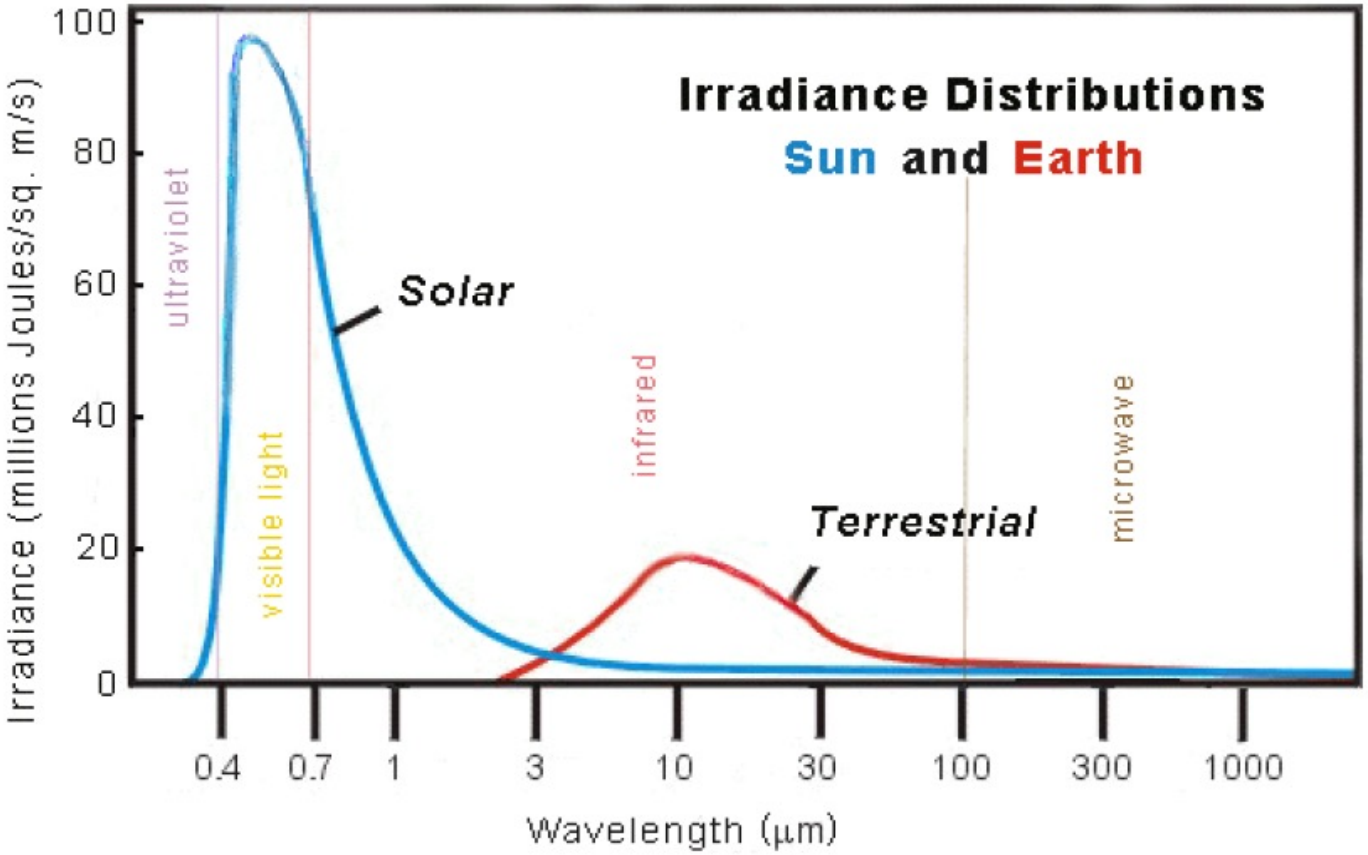
$$I(\lambda) = \frac{2\pi hc^2}{\lambda^5} \cdot \frac{1}{e^{hc/\lambda kT} - 1}$$

The intensity (I) of electromagnetic radiation at a given wavelength (λ) is a complicated function of the wavelength and the temperature (T).



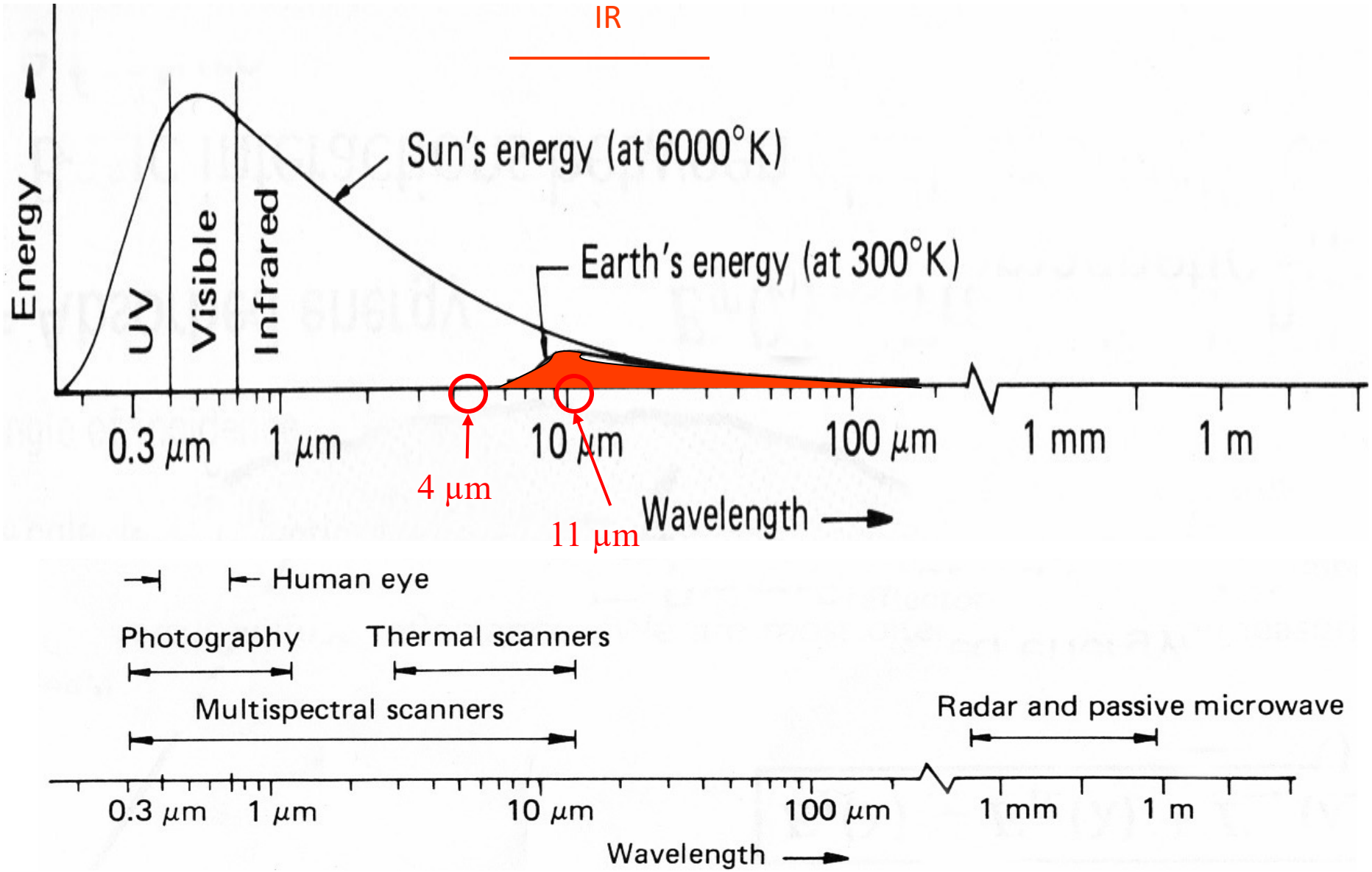


Power density is **the amount of power (time rate of energy transfer) per unit volume**.

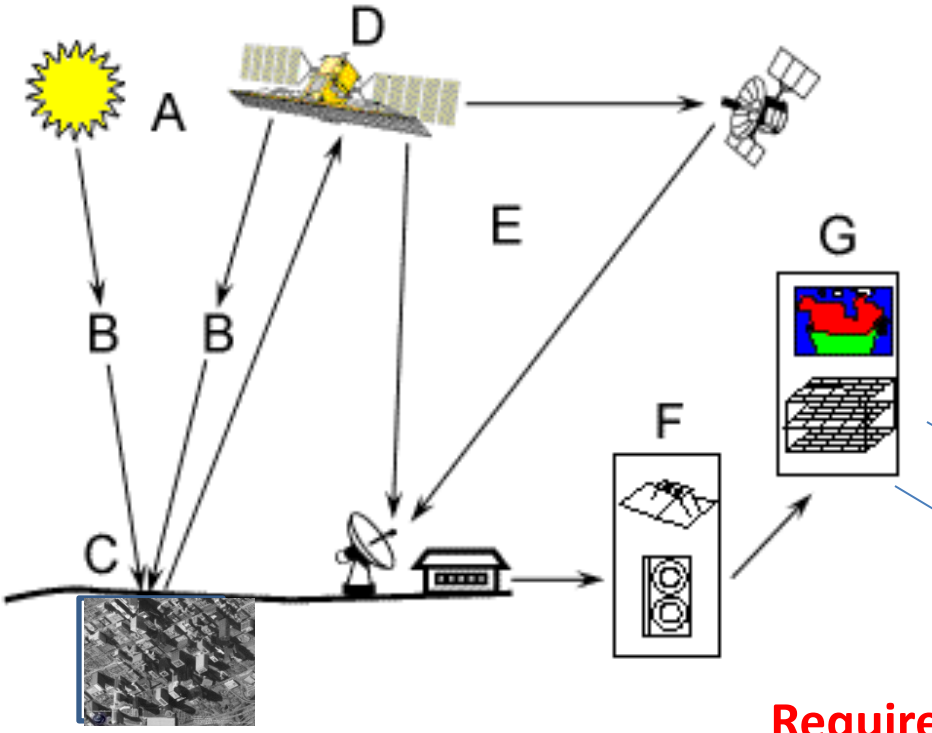


Solar irradiance (Power of EM radiation incident per unit area on a surface.
Almost 90 percent of energy is in range of .28 to 4.96 micrometer)
About 43 percent radiation is in visible wavelength (.4 to .7)
Maximum energy is 0.48 i.e green wave length

Spectral Characteristics of Energy Sources and Sensing Systems



What are components of Remote Sensing
OR What are the processes in remote sensing



Source: Canadian Centre for Remote Sensing

Energy Source or Illumination (A)

Radiation and the Atmosphere (B)

Interaction with the Target (C)

Recording of Energy by the Sensor (D)

Transmission, Reception, and Processing (E)

Interpretation and Analysis (F)

Application (G)

Requirement:

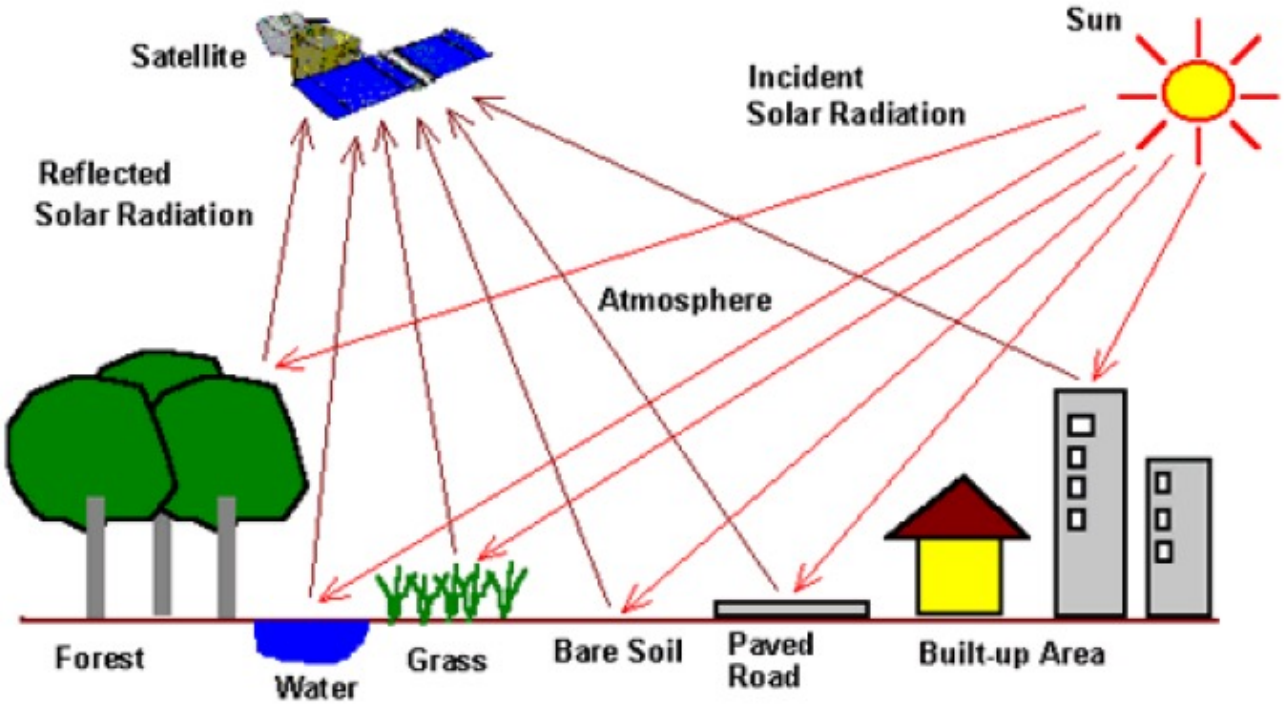
Source of energy - Sun
Object – Ground features
Sensor – camera etc
Data processing- covert data to a usable form
Image- Interpretation

Remote Sensing

Definition of remote sensing

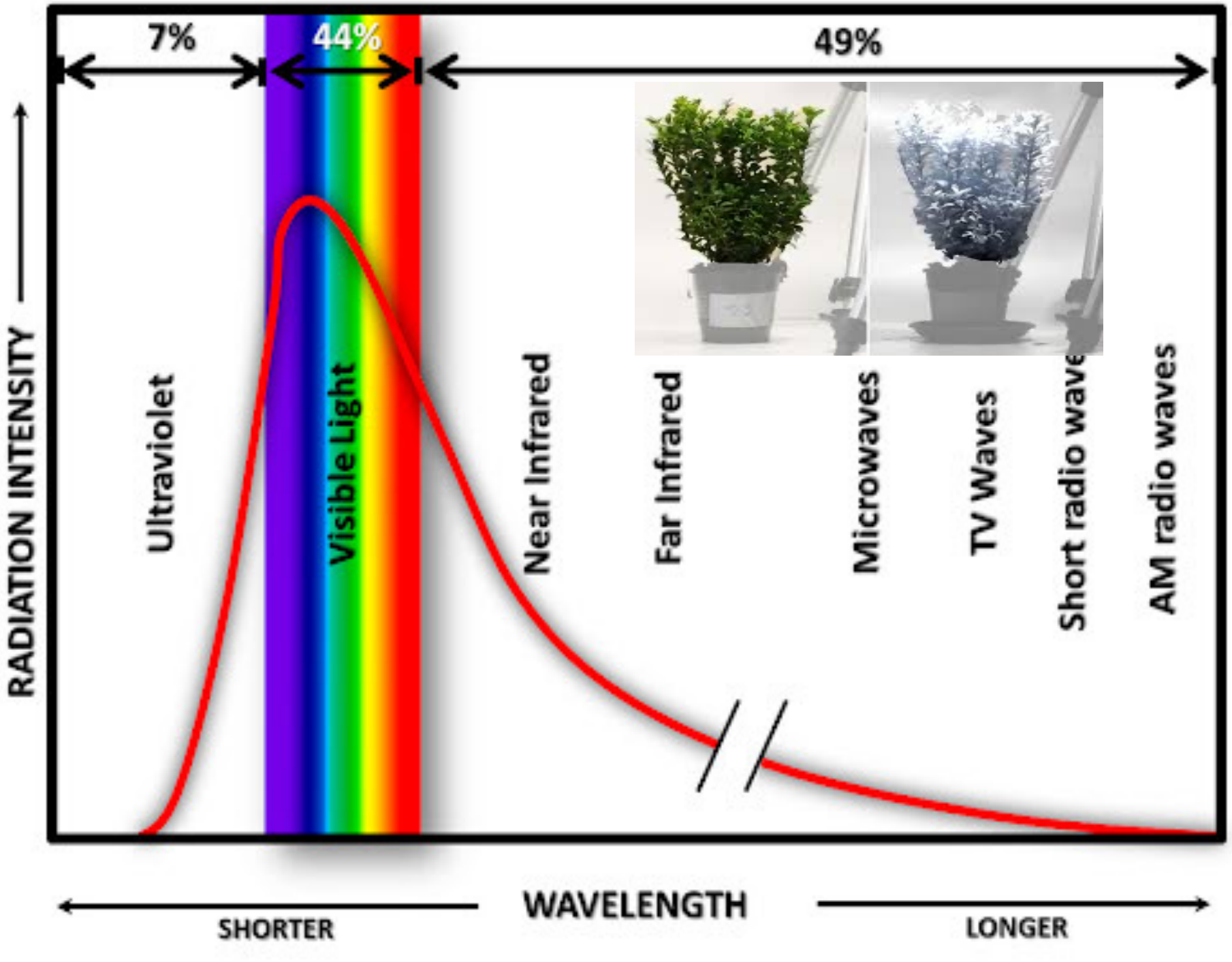
Remote sensing is the branch of science delivering information about objects through the analysis of data collected by spectral instruments that are not in physical contact with the objects of investigation.

The detection and recording instruments for this technology are known as **remote sensors**. The object being monitored is called **target**.



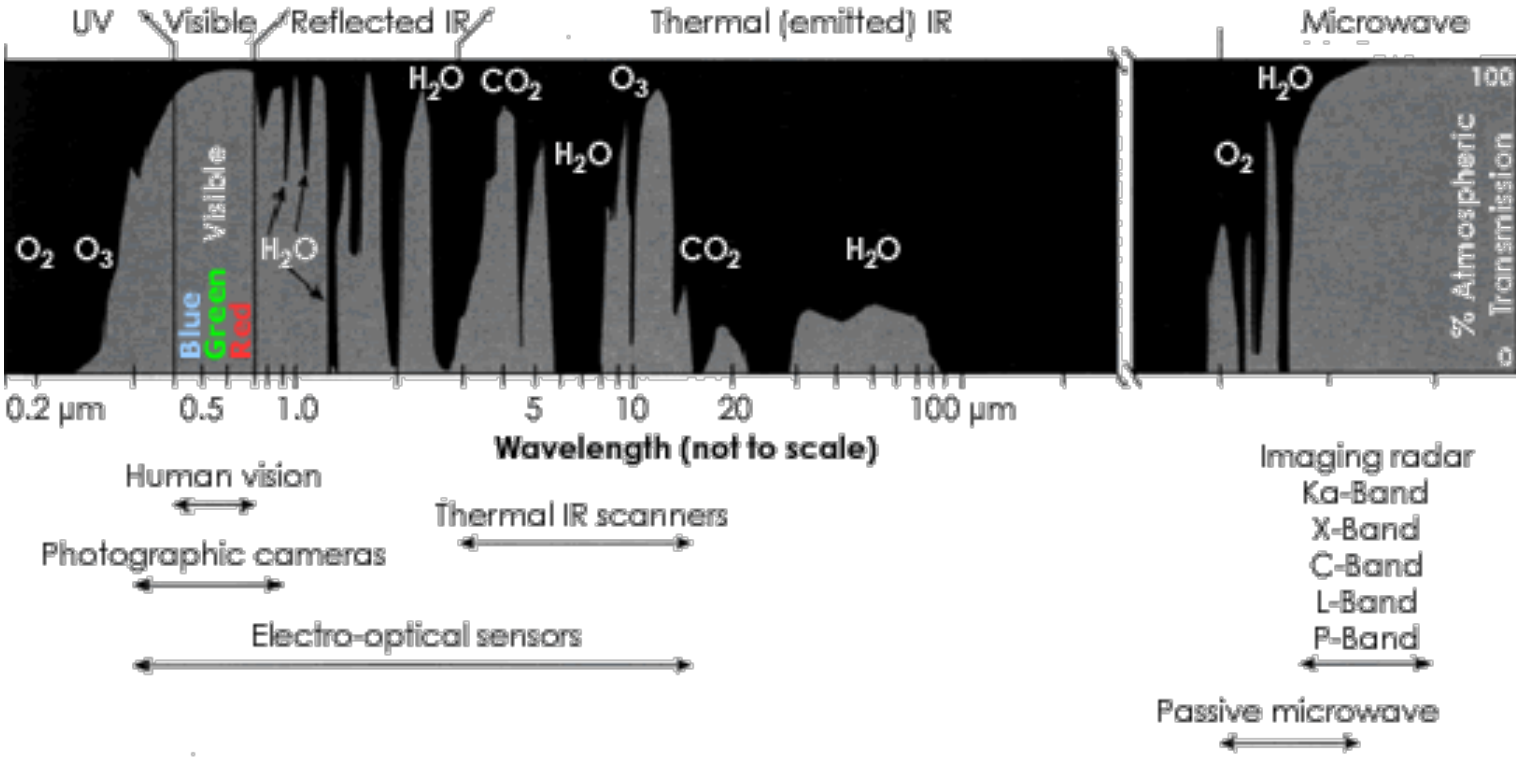
Basic Principles

- Remote sensing based on reflected electromagnetic energy
- Light energy characterized by *wavelength*
  - Each "color" of light has distinctive wavelength
  - Full range of wavelengths called *electromagnetic spectrum*
  - Our eyes sense light in the visible portion of spectrum


7%
44%
49%
RADIATION INTENSITY
Ultraviolet
Visible Light
Near Infrared
Far Infrared
Microwaves
TV Waves
Short radio wave
AM radio waves
SHORTER
WAVELENGTH
LONGER

Region	Wavelength (μm)	Remarks
Gamma rays	$< 3\times10^{-5}$	Not available for remote sensing. Incoming radiation is absorbed by the atmosphere
X-ray	3×10^{-5} - 3×10^{-3}	Not available for remote sensing since it is absorbed by atmosphere
Ultraviolet (UV) rays	0.03 - 0.4	Wavelengths less than 0.3 are absorbed by the ozone layer in the upper atmosphere. Wavelengths between 0.3- 0.4 μm are transmitted and termed as "Photographic UV band".
Visible	0.4 - 0.7	Detectable with film and photodetectors.
Infrared (IR)	0.7 - 100	Atmospheric windows exist which allows maximum transmission. Portion between 0.7 and 0.9 μm is called photographic IR band, since it is detectable with film. Two principal atmospheric windows exist in the thermal IR region (3 - 5 μm and 8 - 14 μm).
Microwave	10^3 - 10^6	Can penetrate rain, fog and clouds. Both active and passive remote sensing is possible. Radar uses wavelength in this range.
Radio	$> 10^6$	Have the longest wavelength. Used for remote sensing by some radars.

Effects of Atmosphere on the electromagnetic spectrum: Atmospheric windows for Remote Sensing

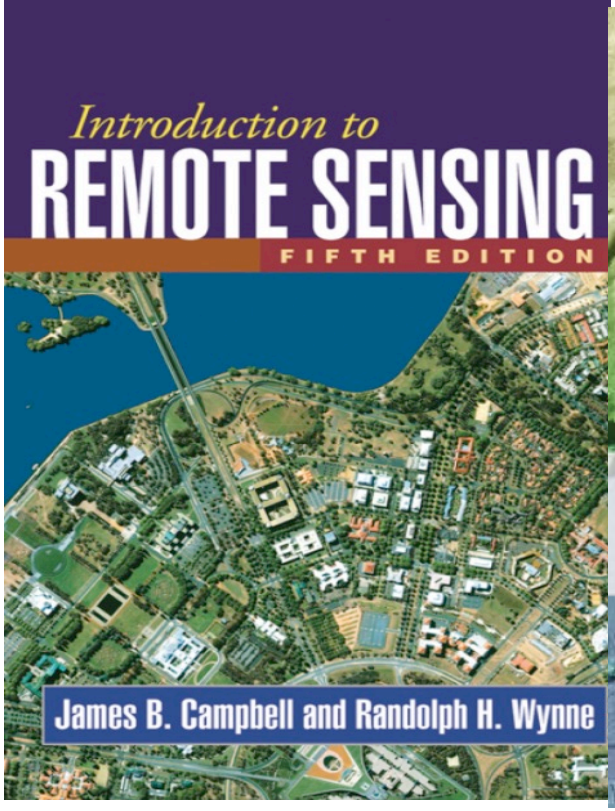


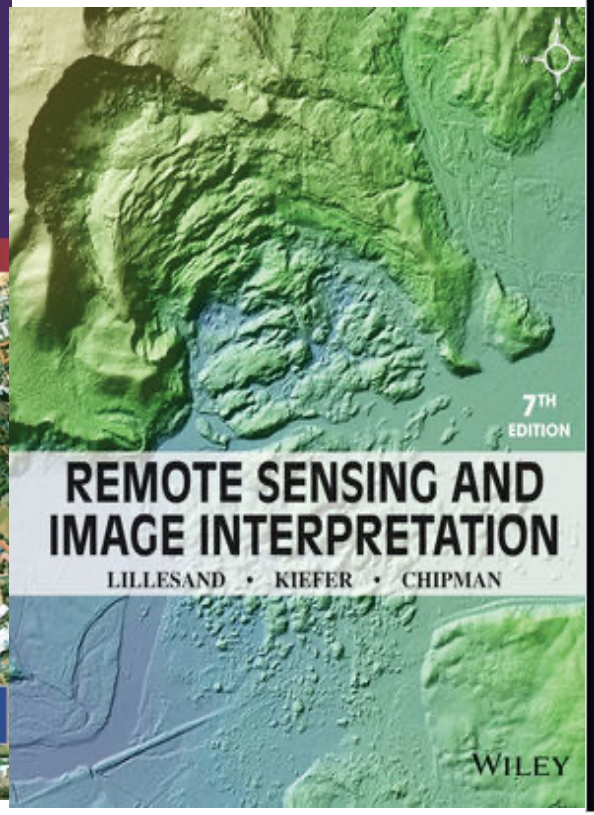
Links:
http://www.gisdevelopment.net/tutorials/tuman008.htm
http://earthobservatory.nasa.gov/Library/RemoteSensingAtmosphere/

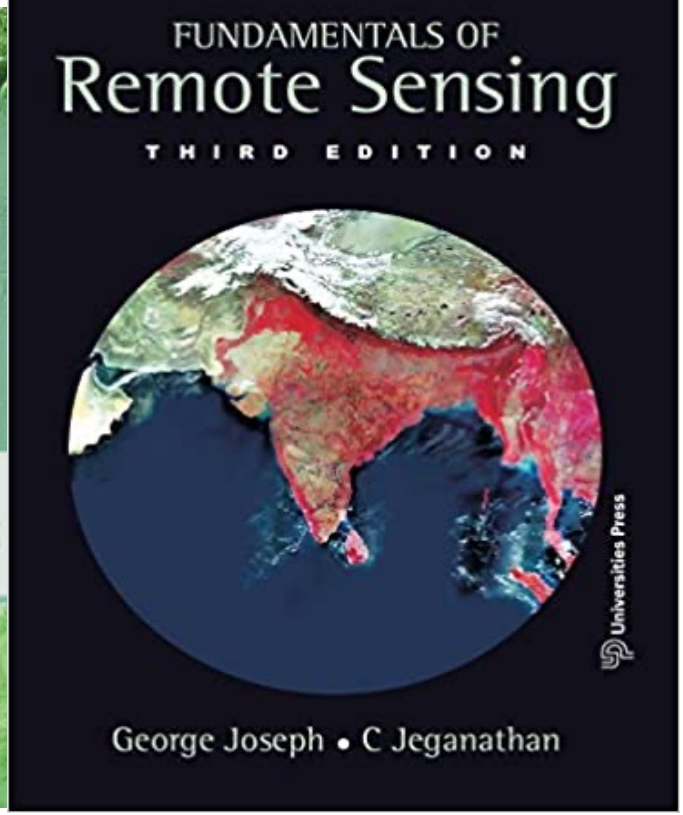
WHAT are different type of remote sensing?

Classification of Remote sensing:
Based on spectral region:
Optical/IR remote sensing (0.4 to 8.0 micometer)
Thermal remote sensing (8 to 12 micrometer)
Microwave remote sensing (.3 to 100 GHz)

The **micrometre** (**µm**) also commonly known as a micron, is unit of length equalling 1×10−6 metre







https://www.usna.edu/Users/oceano/pguth/md_help/html/satb8rlf.htm

https://appliedsciences.nasa.gov/join-mission/training/english/arset-fundamentals-remote-sensing

https://www.nrcan.gc.ca/maps-tools-and-publications/satellite-imagery-and-air-photos/tutorial-fundamentals-remote-sensing/9309

Further suggested reading

https://nptel.ac.in/content/storage2/courses/1/05108077/module1/lecture1.pdf
http://hillagric.ac.in:999/downloads/gis/notes/4-IntroductiontoRemoteSensing.pdf

Chapter 1: Remote sensing by Campbell and Wyne

Question Bank

1. What is remote sensing?
2. What are three main electromagnetic region of remote sensing.
3. Explain Planck's law. What is peak wavelength of emitted radiation from sun and earth.
4. Explain Components of Remote sensing