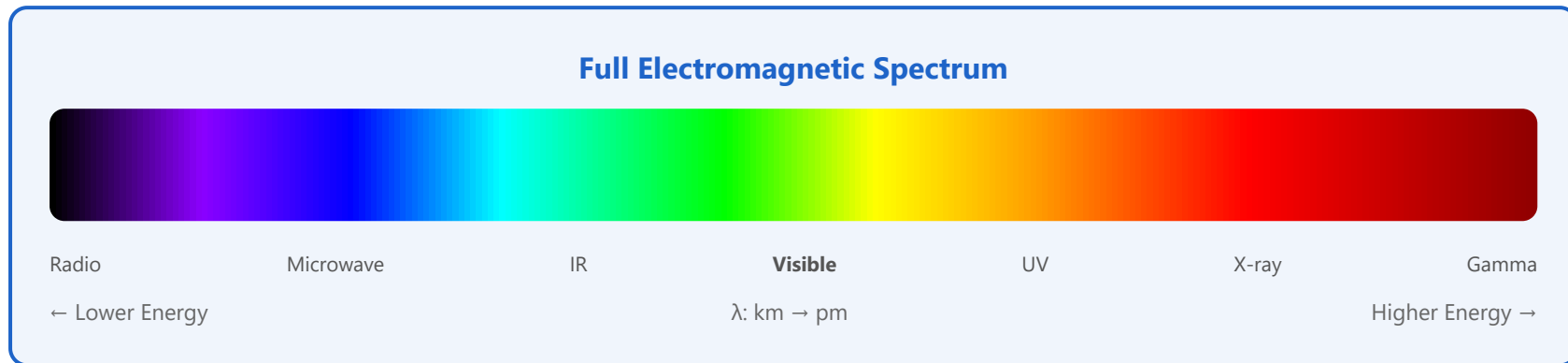


Electromagnetic Spectrum Overview



Spectrum Range

Radio waves → Microwaves → IR → Visible → UV → X-rays → Gamma rays
Frequency: 10^3 Hz to 10^{20} Hz | Wavelength: km to pm



Biological Windows

Visible: 400-700 nm

Vision, photosynthesis

NIR: 700-1000 nm

Deep tissue penetration

UV-A: 320-400 nm

Minimal DNA damage



Atmospheric Transmission

Transparent: Visible light, radio waves

Absorbed: Most UV, IR, X-rays

Ozone layer: Blocks harmful UV-C radiation



Medical Imaging Regions

X-ray: 0.01-10 nm

Radiography, CT scanning

Gamma: <0.01 nm

PET, SPECT imaging

Optical: Microscopy, endoscopy

Interactive Applications

- Spectral databases for reference
- Wavelength calculators
- Interactive spectrum explorers
- Energy conversion tools