

Figure 1.4 Spectral distribution of energy radiated from blackbodies of various temperatures. (Note that spectral radiant exitance M_λ is the energy emitted per unit wavelength interval. Total radiant exitance M is given by the area under the spectral radiant exitance curves.)

energy state is discrete not continuous

Black-body Radiation — Planck's Law

$$M_{\lambda T} = 2\pi hc^2 \lambda^{-5} \left(e^{\frac{hc}{\lambda kT}} - 1 \right)^{-1} \text{ (Wm}^{-2} \mu\text{m}^{-1}\text{)}$$

λ : Wavelength, T : Absolute Temperature

Wien's Displacement Law

$$\frac{dM_\lambda(T)}{d\lambda} = 0 \longrightarrow \lambda_{\max} \cdot T = \text{Const.} = 2898 \mu\text{m} \cdot \text{K}$$

Stefan-Boltzmann Equation

$$M = \int_0^\infty M_{\lambda T} d\lambda = \sigma T^4$$

1.4. ~~1.4.1~~

光的三原色

R (Red), G (Green), B (Blue)

物体的三原色

M (Magenta) 紫紅

C (Cyan) 靛藍

Y (Yellow) 黃色

二者之關係.

$R + B \rightarrow M$; $B + G \rightarrow C$; $R + G \rightarrow Y$

$M + C \rightarrow B$; $C + Y \rightarrow G$; $Y + M \rightarrow R$

$R + G + B \rightarrow \text{White}$

$M + C + Y \rightarrow \text{Black}$.



Absorption

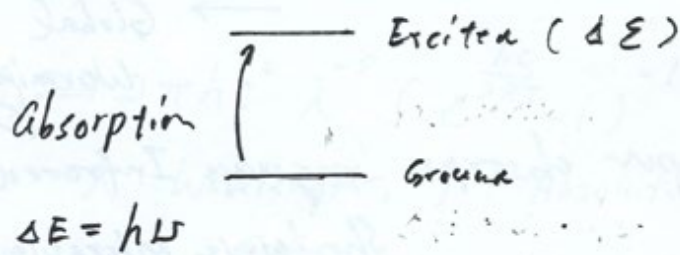
Molecule Energy State \rightarrow Discrete

Molecule absorption \rightarrow Resonance

\rightarrow Ground State to Excited State

Reverse \rightarrow ~~Excited~~ Excited to Ground State

\rightarrow radiation



1.4.2

Absorption (O_3 , CO_2 , Water Vapor)

O_3 absorbs UV \rightarrow Skin Burn

Destruction by \rightarrow Ozone Hole

CeF_4 , CFC, Plastic Foams, Aerosol Spray
(Phase out since 1987)

CO_2 absorbs Far Infrared \rightarrow Greenhouse effect

\rightarrow Global Warming

Water Vapor absorbs Longwave Infrared,
Shortwave Microwave

\rightarrow Desert vs. Tropics

\Rightarrow Atmospheric Window



1.4.3

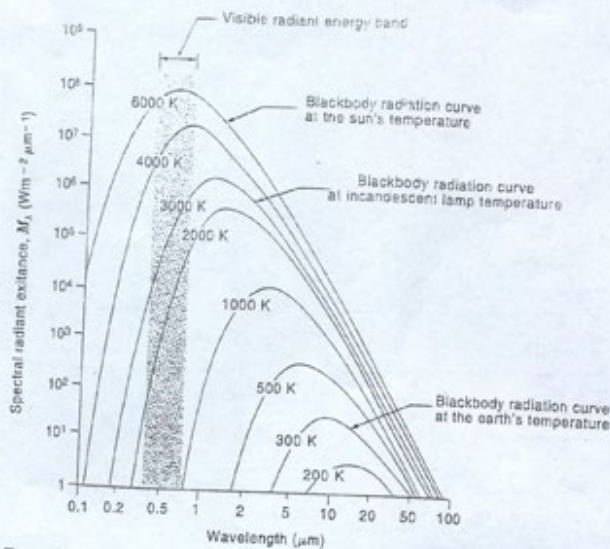


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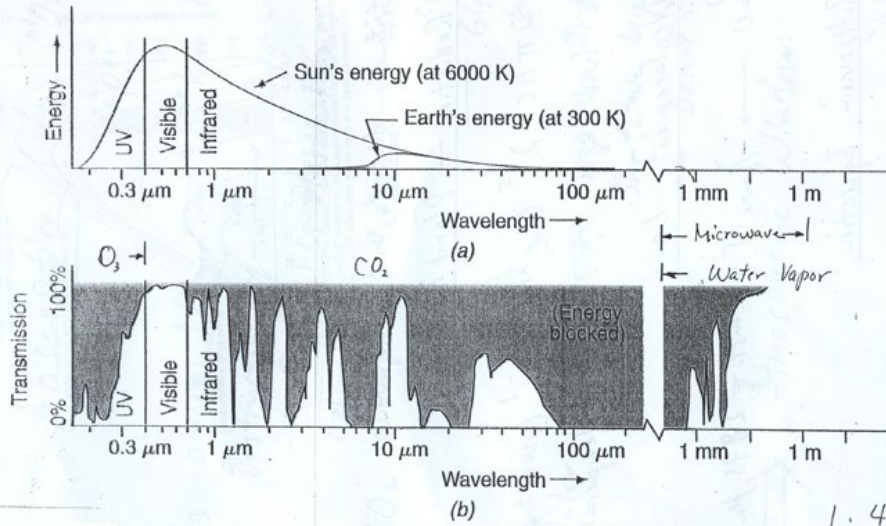
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(Lillesand et al, 2008)

1.4.5