Bilkent University Phys 325 Fall 2020

Approximate relations involving fundamental constants

Speed of light: $c \approx 3 \times 10^8 \text{m/s}$

Electron rest energy: $E_0 = m_e c^2 \approx 0.5\text{MeV}$

Proton rest energy: $E_{0p} = m_p c^2 \approx 1\text{GeV}$

Photon energy: $E = pc, \quad p = h/\lambda, \quad E = hc/\lambda, \quad hc/(0.5\mu\text{m}) \approx 2.5\text{eV}$

(0.5μm wavelength is in the visible part of the optical spectrum.)

Electron wavelength: $\lambda = h/p = h/\sqrt{2m_e E} \approx \sqrt{1.5\text{eV}/E}\,\text{nm}$

Boltzmann constant: $E = k_B T, \quad k_B(300\text{K}) \approx 26\text{meV}$

Stefan-Boltzmann law: $J = \sigma T^4, \quad \sigma(300\text{K})^4 \approx 460\text{W/m}^2$

Wien displacement law: $\lambda_{max} = a/T, \quad a/(5800\text{K}) \approx 0.5\mu\text{m}$

(Temperature of the surface of the Sun: $T_\odot \approx 5800\text{K}$)

Compton wavelength: $\lambda_c = h/(m_e c) \approx 0.024\text{Å}$