Appendix A

Constants and Conversions

Fundamental Constants

Gravitational Constant: $G = 6.6726 \times 10^{-8}$ dyn cm^2 g^{-2}
$$= 6.6726 \times 10^{-8} \text{ gm}^{-1} \text{ cm}^3 \text{ s}^{-2}$$
$$= 6.6726 \times 10^{-8} \text{ erg cm g}^{-2}$$
$$= 2.959 \times 10^{-4} M_{\odot}^{-1} \text{ AU}^3 \text{ days}^{-2}$$

Speed of Light: $c = 2.99792458 \times 10^{10}$ cm s^{-1}

Planck's Constant: $h = 2\pi\hbar = 6.6261 \times 10^{-27}$ erg s
$$= 4.136 \times 10^{-21} \text{ MeV s}$$
$$\hbar = 1.0546 \times 10^{-27} \text{ erg s} = 6.5827 \times 10^{-22} \text{ MeV s}$$
$$\hbar c = 197.3 \text{ MeV fm} = 197.3 \times 10^{-13} \text{ MeV cm}$$

Electrical Charge Unit: $e = 4.8032068 \times 10^{-10}$ esu
$$= 4.8032068 \text{ erg}^{1/2} \text{cm}^{1/2}$$

Fine Structure Constant: $\alpha = 1/137$

Weak Coupling (Fermi) Constant: $G_{\text{F}} = 8.958 \times 10^{-44}$ MeV cm^3

Mass of Electron: $m_{\text{e}} = 9.1093898 \times 10^{-28}$ g
$$= 5.4858 \times 10^{-4} \text{ amu}$$
$$= 0.5109991 \text{ MeV/c}^2$$

Mass of Proton: $m_{\text{p}} = 1.6726231 \times 10^{-24}$ g
$$= 1.00727647 \text{ amu}$$
$$= 938.27231 \text{ MeV/c}^2$$

Mass of Neutron: $m_{\text{n}} = 1.6749286 \times 10^{-24}$ g
$$= 1.0086649 \text{ amu}$$
$$= 939.56563 \text{ MeV/c}^2$$

1 atomic mass unit (amu) $= 1.6605402 \times 10^{-24}$ g

Avogadro's Constant: $N_A = 6.0221367 \times 10^{23}$ mol^{-1}

Boltzmann's Constant: $k = 1.38065 \times 10^{-16}$ erg K^{-1}
$$= 8.617389 \times 10^{-5} \text{ eV K}^{-1}$$

Ideal Gas Constant: $R_{gas} \equiv N_A k = 8.314511 \times 10^7$ erg K^{-1} mole^{-1}

Stefan–Boltzmann Constant: $\sigma = 5.67051 \times 10^{-5}$ erg cm^{-2} K^{-4} s^{-1}

Radiation Density Constant: $a \equiv 4\sigma/c = 7.56591 \times 10^{-15}$ erg cm^{-3} K^{-4}
$$= 4.7222 \times 10^{-9} \text{ MeV cm}^{-3}\text{K}^{-4}$$

Planck Mass: $M_P = 1.2 \times 10^{19}$ GeV$/c^2$

Planck Length: $\ell_P = 1.6 \times 10^{-33}$ cm

Planck Timescale: $t_P = 5.4 \times 10^{-44}$ s

Planck Temperature: $T_P = 1.4 \times 10^{32}$ K

Solar Quantities

Solar Luminosity: $L_\odot = 3.827 \times 10^{33}$ erg/s

Solar Mass: $M_\odot = 1.989 \times 10^{33}$ g

Effective Surface Temperature: $T_\odot^{eff} = 5780$ K

Solar Radius: $R_\odot = 6.96 \times 10^{10}$ cm

Central Density: $\rho_\odot^{core} \simeq 160$ g/cm^3

Central Pressure: $P_\odot^{core} \simeq 2.7 \times 10^{17}$ dyn cm^{-2}

Central Temperature: $T_\odot^{core} \simeq 1.6 \times 10^7$ K

Color Indices: $B - V = 0.63$ $\qquad$ $U - B = 0.13$

Solar Constant: 1.1388×10^6 erg cm^{-2} s^{-1}

General Quantities

1 Tropical Year = 3.1556926×10^7 seconds = 365.24219 days

1 parsec (pc) = 3.0857×10^{18} cm

1 parsec (pc) = 206,265 AU= 3.2616 ly

1 light year (ly) = 9.4605×10^{17} cm

1 Astronomical Unit (AU) = 1.49598×10^{13} cm

Energy Per Gram from H $\rightarrow$ He Fusion = 6.3×10^{18} erg/g

Mass of Earth = $M_\oplus = 5.98 \times 10^{27}$ g

Conversion Factors

1 eV = $1.60217733 \times 10^{-12}$ ergs

$1\text{ J} = 10^7$ ergs

$1\text{ amu} = 1.6605402 \times 10^{-24}$ g

$1\text{ fm} = 10^{-13}$ cm

$0\text{ K} = -273.16$ Celsius

1 atomic unit $(a_0) = 0.52918 \times 10^{-8}$ cm

1 atmosphere (atm) $= 1.013250 \times 10^6$ dyn cm^{-2}

1 Pascal (Pa) $= 1\text{ N m}^{-2} = 10$ dyn cm^{-2}

1 arc second $= 1'' = 4.848 \times 10^{-6}$ radians $= 1/3600$ degree

$1\text{ Å} = 10^{-8}$ cm

1 barn (b) $= 10^{-24}$ cm^2

1 Newton (N) $= 10^5$ dyn

1 Watt (W) $= 1\text{ J s}^{-1} = 10^7$ erg s^{-1}

Opacity Units: $1\text{ m}^2\text{ kg}^{-1} = 10\text{ cm}^2\text{ g}^{-1}$