2. ASTROPHYSICAL CONSTANTS

Table 2.1. Written and revised with the help of K.R. Lang, K.A. Olive, J. Primack, S. Rudaz, E. M. Standish, Jr., and M.S. Turner. The figures in parentheses after some values give the 1-standard deviation uncertainties in the last digit(s). While every effort has been made to obtain the most accurate current values of the listed quantities, the table does not represent a critical review or adjustment of the constants, and is not intended as a primary reference.

Quantity	Symbol, equation	Value	Reference
speed of light	c	$299\,792\,458$ m s^{-1}	defined [1]
Newtonian gravitational constant	G_N	$6.672\,59(85) \times 10^{-11}$ m^3 kg^{-1} s^{-2}	[2]
astronomical unit	AU	$1.495\,978\,706\,6(2) \times 10^{11}$ m	[3,4]
tropical year (equinox to equinox) (1994)	yr	$31\,556\,925.2$ s	[3]
sidereal year (fixed star to fixed star) (1994)		$31\,558\,149.8$ s	[3]
mean sidereal day		$23^{\rm h}\,56^{\rm m}\,04\overset{\rm s}{.}090\,53$	[3]
Jansky	Jy	10^{-26} W m^{-2} Hz^{-1}	
Planck mass	$\sqrt{\hbar c/G_N}$	$1.221\,047(79) \times 10^{19}$ GeV/c^2	uses [2]
		$= 2.176\,71(14) \times 10^{-8}$ kg	
parsec (1 AU/1 arc sec)	pc	$3.085\,677\,580\,7(4) \times 10^{16}$ m $= 3.262\ldots$ ly	[5]
light year (deprecated unit)	ly	$0.306\,6\ldots$ pc $= 0.946\,1\ldots \times 10^{16}$ m	
Schwarzschild radius of the Sun	$2G_N M_\odot/c^2$	$2.953\,250\,08$ km	[6]
solar mass	$M_\odot$	$1.988\,92(25) \times 10^{30}$ kg	[7]
solar luminosity	$L_\odot$	3.846×10^{26} W	[8]
solar equatorial radius	$R_\odot$	6.96×10^{8} m	[3]
Earth equatorial radius	$R_\oplus$	$6.378\,140 \times 10^{6}$ m	[3]
Earth mass	$M_\oplus$	$5.973\,70(76) \times 10^{24}$ kg	[9]
luminosity conversion	L	$3.02 \times 10^{28} \times 10^{-0.4\,M_b}$ W	[10]
		(M_b = absolute bolometric magnitude	
		= bolometric magnitude at 10 pc)	
flux conversion	$\mathscr{F}$	$2.52 \times 10^{-8} \times 10^{-0.4\,m_b}$ W m^{-2}	from above
		(m_b = apparent bolometric magnitude)	
$v_\odot$ around center of Galaxy	$\Theta_\circ$	$220(20)$ km s^{-1}	[11]
solar distance from galactic center	$R_\circ$	$8.0(5)$ kpc	[12]
Hubble constant†	H_0	$100\,h_0$ km s^{-1} Mpc^{-1}	
		$= h_0 \times (9.778\,13\ \text{Gyr})^{-1}$	[13]
normalized Hubble constant†	h_0	$0.5 < h_0 < 0.85$	[14,15]
critical density of the universe†	$\rho_c = 3H_0^2/8\pi G_N$	$2.775\,366\,27 \times 10^{11}\,h_0^2\,M_\odot$Mpc^{-3}	
		$= 1.878\,82(24) \times 10^{-29}\,h_0^2$ g cm^{-3}	
		$= 1.053\,94(13) \times 10^{-5}\,h_0^2$ GeV cm^{-3}	
local disk density	ρ_{disk}	3–12 $\times 10^{-24}$ g cm^{-3} $\approx$ 3–7 GeV/c^2 cm^{-3}	[16]
local halo density	ρ_{halo}	3–7 $\times 10^{-25}$ g cm^{-3} $\approx$ 0.2–0.4 GeV/c^2 cm^{-3}	[17]
density parameter of the universe†	$\Omega_0 \equiv \rho_0/\rho_c$	$0.1 < \Omega_0 < 2$	[18]
scaled cosmological constant†	$\lambda_0 = \Lambda c^2/3H_0^2$	$-1 < \lambda_0 < 2$	[19,20]
scale factor for cosmological constant†	$c^2/3H_0^2$	$2.853 \times 10^{51}\,h_0^{-2}$ m^2	
age of the universe†	t_0	$15(5)$ Gyr	[10]
	$\Omega_0 h_0^2$	≤ 2.4 for $t_0 \geq 10$ Gyr	[10]
		≤ 1 for $t_0 \geq 10$ Gyr, $h_0 > 0.4$	[10]
cosmic background radiation (CBR) temperature†	T_0	2.726 ± 0.005 K	[21]
solar velocity with respect to CBR		369.5 ± 3.0 km s^{-1}	[22]
energy density of CBR	ρ_γ	$4.647\,7 \times 10^{-34}\,(T/2.726)^4$ g cm^{-3}	[10]
		$= 0.260\,71\,(T/2.726)^4$ eV cm^{-3}	
number density of CBR photons	n_γ	$410.89\,(T/2.726)^3$ cm^{-3}	[10]
entropy density/Boltzmann constant	s/k	$2\,892.4\,(T/2.726)^3$ cm^{-3}	[10]

† Subscript 0 indicates present-day values.