

A.I Astrophysical constants

(Source : “The Physics and Chemistry of the Interstellar Medium” par A. G. G. M. Tielens)

Recall :

- S.I. (système international) units, or mks, are based on meters, kilograms and seconds.
- cgs units are based on centimeters, grams and seconds, and are often used in astronomy.

A.I.1 Physical constants

Symbol	Description	SI		cgs	
		Value	Unit	Value	Unit
c	Speed of light	2.9979×10^8	m s^{-1}	2.9979×10^{10}	cm s^{-1}
h	Planck’s constant	6.6261×10^{-34}	J s	6.6261×10^{-27}	erg s
k_B	Boltzmann’s constant	1.3807×10^{-23}	J K^{-1}	1.3807×10^{-16}	erg K^{-1}
σ_{SB}	Stefan-Boltzmann constant	5.6704×10^{-8}	$\text{W m}^{-2} \text{K}^{-4}$	5.6704×10^{-5}	$\text{erg s}^{-1} \text{cm}^{-2} \text{K}^{-4}$
G	Gravitational constant	6.674×10^{-11}	$\text{N m}^2 \text{kg}^{-2}$	6.674×10^{-8}	$\text{dyn cm}^{-2} \text{g}^{-2}$
$\mathcal{N}_A$	Avogadro’s number	6.0221×10^{23}	mol^{-1}	6.0221×10^{23}	mol^{-1}
m_e	Electron rest mass	9.1094×10^{-31}	kg	9.1094×10^{-28}	g
m_p	Proton rest mass	1.6726×10^{-27}	kg	1.6726×10^{-24}	g
m_u	Atomic mass unit	1.6605×10^{-27}	kg	1.6605×10^{-24}	g
e	Electron charge	1.602×10^{-19}	C	4.803×10^{-10}	esu
α	Fine-structure constant	7.2974×10^{-3}		7.2974×10^{-3}	

A.I.2 Astronomical constants

Symbol	Description	SI		cgs	
		Value	Unit	Value	Unit
AU	Astronomical unit	1.496×10^{11}	m	1.496×10^{13}	cm
ly	Light year	9.463×10^{15}	m	9.463×10^{17}	cm
pc	Parsec	3.086×10^{16}	m	3.086×10^{18}	cm
$L_{\odot}$	Solar luminosity	3.85×10^{26}	J s^{-1}	3.85×10^{33}	erg s^{-1}
$M_{\odot}$	Solar mass	1.989×10^{30}	kg	1.989×10^{33}	g
$R_{\odot}$	Solar radius	6.96×10^8	m	6.96×10^{10}	cm
$T_{\odot}$	Solar effective temperature	5.78×10^3	K	5.78×10^3	K
Jy	Jansky	1.00×10^{-26}	$\text{W m}^{-2} \text{Hz}^{-1}$	1.00×10^{-23}	$\text{erg s}^{-1} \text{cm}^{-2} \text{Hz}^{-1}$

A.I.3 Energy conversion factors

	erg	eV	K	cm ⁻¹	Hz
erg	1.00	6.242×10 ¹¹	7.243 ×10 ¹⁵	5.034×10 ¹⁵	1.509 ×10 ²⁶
eV	1.602 ×10 ⁻¹²	1.00	1.1604×10 ⁴	8064.4	2.418 ×10 ¹⁴
K	1.3806×10 ⁻¹⁶	8.617×10 ⁻⁵	1.00	0.695	2.084 ×10 ¹⁰
cm ⁻¹	1.9865×10 ⁻¹⁶	1.240×10 ⁻⁴	1.4389	1.00	2.9970×10 ¹⁰
Hz	6.626 ×10 ⁻²⁷	4.136×10 ⁻¹⁵	4.798 ×10 ⁻¹¹	3.336×10 ⁻¹¹	1.00

A.I.4 Angles and time

Quantity/symbol	Description	Value	Unit
deg	degree	1.7453 ×10 ⁻²	rad
arcmin	arcminute	2.90888×10 ⁻⁴	rad
arcsec	arcsecond	4.8481 ×10 ⁻⁶	rad
sq deg	degree ²	3.046 ×10 ⁻⁴	rad
yr	year	3.16×10 ⁷	s

A.I.5 Equivalences SI – cgs

Description	SI		cgs		
	Value	Unit	Value	Unit	
Length	1	m	1	×10 ²	cm
Velocity	1	m s ⁻¹	1	×10 ²	cm s ⁻¹
Force	1	N (Newton)	1	×10 ⁵	dyne
Pressure	1	Pa (Pascal)	1	×10 ⁻¹	dyne cm ⁻²
Energy	1	J (Joule)	1	×10 ⁷	erg
Charge	1	C (Coulomb)	2.9979×10 ⁹		esu
Magnetic flux density	1	T (Tesla)	1	×10 ⁴	gauss