Magnitude

Logarithmic scale

Ancient Greeks - Hipparchus & Ptolemy

Six categories

1st magnitude - brightest

⋮

6th magnitude - dimmest

1st mag. brightness ≈ 100 6th mag. brightness

Modern astronomy

$\Delta m = 5 \Longrightarrow$ exactly factor of 100 in brightness

Brightness = energy / time · area

$= \frac{\text{power}}{\text{area}} : \frac{\text{watts}}{m^2}$

Visible magnitudes vs.
Bolometric magnitudes
↑
all parts of spectrum

Zero for magnitude scale.
Arbitrary: used to be Vega
actually $m = 0.03$

Apparent magnitude m
- as it looks from Earth

Absolute magnitude M
- as it looks from 10 parsecs away
= 32.6 light years

$$m = M + 5[\log_{10}(d) - 1]$$

d in parsecs

mag −5 is 100 times brighter than mag 0 object.

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mag −1 is $(100)^{1/5} = \sqrt[5]{100} = 2.511$ times brighter than mag 0.

E.g. Sun = Sol ⊙

$m_\odot = -27 \ (-26.8)$

How much brighter than Vega is the Sun?

⟹ Sun is $100^5 \times (2.5)^2$ times brighter than Vega

$10^{2.5}(2.5)^2 = 10^{10} \times 6.25$

Full moon $m = -13$

What is absolute magnitude $M_\odot$ for the sun?

$$M_\odot = m_\odot - 5\left[\log_{10}(d) - 1\right]$$

↑ in parsecs

$d = 1\,A.U. = 1.5\times10^{13}\,cm = 4.85\times10^{-6}\,pc$
$= 8\tfrac{1}{2}$ light minutes

$M_\odot = +4.77$

$m_{vega} = 0$ $\quad d_v = 25\,l.y.$
$= 7.66\,p.c.$

$M_{vega} = [redacted] + 0.58$

Vega is an A0 type star, intrinsically brighter than so!