Mathematics of Astronomy – formulas

Newton's Law of Gravity:

$$F_g = G.\frac{m_1.m_2}{R^2}$$

F_g: force of gravity [N]
G: universal gravitational constant 6,67.10^{-11} [N.m^2/kg^2]
$m_{1,2}$: mass of objects [kg]
R: distance between objects [m]

Kepler's third Law:

$$p^2 = \frac{a^3}{M}$$

p: orbital period [years]
a: semi-major axis of its orbit [AU]
M: solar masses []
1 AU = 149,6.10^6 km

Planck Energy:

$$E = h.f = \frac{h.c}{\lambda}$$

E: energy [J]
h: Planck constant 6,626.10^{-34} [J.s]
f: frequency [Hz]
c: speed of light 3.10^8 [m/s]
λ: wavelength [m]

Wien's Law:

$$\lambda_{peak} = \frac{b}{T}$$

λ_{peak}: peak wavelength [m]
b: constant 0,0029 [m.K]
T: temperature [K]

Stefan's Law:

$$L = SA.EF = 4.\pi.R^2.\sigma.T^4$$

L: luminosity [W]
SA: surface area [m^2]
EF: energy flux [W/m^2]
R: radius of sphere [m]
σ: Stefan's constant 5,67.10^{-8} [W/m^2.K^4]
T: temperature of blackbody [K]

Doppler equation:

$$\frac{\lambda_{app}}{\lambda_{true}} = 1 + \frac{v_{rec}}{c}$$

λ_{app}: apparent wavelength [m]
λ_{true}: true wavelength [m]
v_{rec}: recession speed [m/s]
c: speed of light 3.10^8 [m/s]

Escape speed:

$$v_{esc} = \sqrt{\frac{2.G.m}{R}}$$

v_{esc}: escape speed [m/s]
G: universal gravitational constant 6,67.10^{-11} [N.m^2/kg^2]
m: mass of the object from which other object escapes [kg]
R: distance between the center of the objects [m]

Schwarzschild radius:

$$R_s = \frac{2.G.m}{c^2}$$

R_s: size of the black hole event horizon [m]
G: universal gravitational constant 6,67.10^{-11} [N.m^2/kg^2]
m: mass of the singularity [kg]
c: speed of light 3.10^8 [m/s]

Hubble's Law:

$$v = H_0.d$$

v: galaxy recession speed [km/s]
H_0: Hubble constant 70[km/s/Mpc]
d: galaxy distance from us [Mpc]

Parallax:

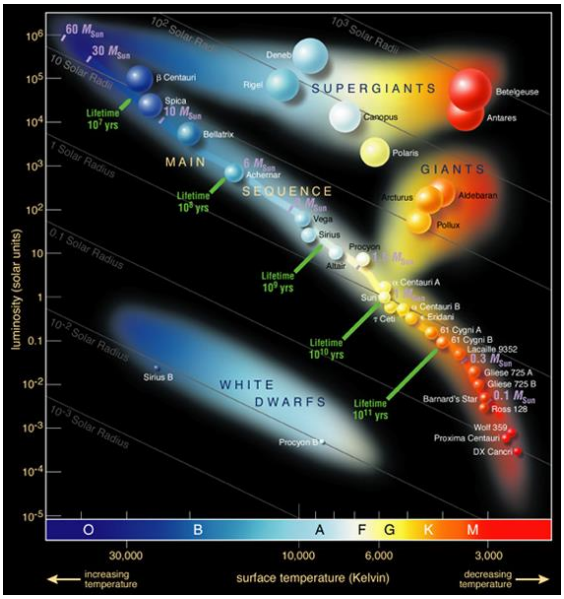
$$Parallax\ angle = 57{,}3°.\frac{baseline}{object\ distance}$$

Angular size:

$$Angular\ size = 57{,}3°.\frac{physical\ size}{distance}$$

Angular resolution:

$$Angular\ resolution = 57{,}3°.1{,}22.\frac{wavelength}{aperture}$$



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