

Cosmological Quantities and Relationships for the Standard Model, $\Lambda=0$

H, the Hubble constant, a function of time (value now = $H_0 = 72 \text{ km/sec/Mpc}$)

$$H = \frac{\dot{R}}{R}, \text{ where } \dot{R} = \frac{dR}{dt}.$$

ρ_c , the critical density = $\frac{3H^2}{8\pi G}$

ρ_c is a function of time, whose value now is 10^{-26} kg/m^3 , equivalent to about 6 H atoms per cubic meter (compare with the air in this room, which has about 10^{25} atoms per cubic meter).

Ω , the density parameter, a dimensionless quantity = ρ/ρ_c . For a non-flat universe ($k \neq 0$), Ω is a function of time, equal to $1 + \frac{k}{R^2 H^2}$.

q, the deceleration parameter, a dimensionless quantity = $-\frac{\ddot{R}}{RH^2}$.

Its value now, $q_0 = \Omega/2$. So a $q_0 > 1/2$ means a closed universe, $<1/2$ means an open universe and $=1/2$ means a boundary universe.