$_{\mu\nu} =$
$\frac{8\pi G}{} T_{\mu\nu}$
$_{\mu\nu}^{\rho} =$
$(\rho c^2, p, p, p)$
$^2 =$
$c^2 t^2 -$
$a(t)^2 (\chi^2 +$
$r(\chi)^2 \Omega^2)$
χ
$\Omega^2 =$
$\theta^2 +$
$\sin^2\theta\phi^2$
$a(t)$
$r(\chi) =$
$f_K(\chi) =$
$\{ \sin\chi closedcase, positivecurvature$
$\chi flatcase$
$\sinh\chi opencase, negativecurvature$
$H\dot{a}/a$
H_0
$H_0 =$
$100h$,
$h \approx$
0.7
$H_0^{-1} \approx$
10
$cH_0^{-1} \approx$
4
$^2 =$
$\frac{8\pi G}{3}\rho -$
$\frac{Kc^2}{a^2}$
$\frac{\ddot{a}}{a} =$
$\frac{4\pi G}{3}\left(\rho + \frac{3p}{c^2}\right)$
$\rho_{crit}(t) =$
$\frac{3H(t)^2}{8\pi G}$
i
$i =$
$\Omega_i(t) =$
$\rho_i(t)/\rho_{crit}(t)$
$\rho(t) =$
$\sum_i \rho_i(t)$
$\Omega(t) =$
$\rho(t)/\rho_{crit}(t)$
$\Omega_{K,0} =$
$1-$
$\Omega_0 =$
$-Kc^2/H_0^2 a_0^2$

$$\overline{\overline{H_0 = \sqrt{\frac{\rho}{\rho_{crit,0}} + \Omega_{K,0}\left(\frac{a_0}{a}\right)^2}}}$$

$\rho(t)$
$\rho(a)$
$\rho =$
$n\epsilon$
n
ϵ
a
$n \propto$
a^{-3}
$\rho \propto$
a^{-3}
$\epsilon =$
$h\nu =$
$hc/\lambda \propto$
a^{-1}
$\rho \propto$
a^{-4}
a
$p =$
wpc^2
$\rho \propto$
$a^{-3(1+w)}$
$w =$
$\{ 0\ matter$
$1/3 radiation$
$-$
$1 vacuumenergy$

$$\overline{\overline{H_0 = \sqrt{\frac{\rho}{\rho_{crit,0}} + \Omega_{K,0}\left(\frac{a_0}{a}\right)^2} = \sqrt{\Omega_{m,0}\left(\frac{a_0}{a}\right)^3 + \Omega_{r,0}\left(\frac{a_0}{a}\right)^4 + \Omega_{\Lambda,0} + \Omega_{K,0}\left(\frac{a_0}{a}\right)^2}}}$$

$\Omega_{i,0}$
$\Omega_{m,0} \approx$
0.3
$\Omega_{r,0} \approx$
10^{-5}
$\Omega_{\Lambda,0} \approx$
0.7
$\Omega_{K,0} \approx$
0