Homework 4

AST 422 Spring 2007

. last updated: May 1, 2007

(4.a) Starting from Ryden eq 5.7, show eq 5.9.

(4.b) Discuss the implication if
i) $\omega = 0 \rightarrow v/c << 1 \rightarrow$ matter $\rightarrow$ eq 5.10
ii) $\omega = 1/3 \rightarrow v \approx c \rightarrow$ radiation $\rightarrow$ eq 5.11 ($\sim E = \sigma T^4$, where $T = T_0(1+z) = T_0/a$)

(4.c) Discuss the curvature only case ($\epsilon = 0, \omega = -1/3$) and its possible solutions of $a(t)$ as functions of κ. (Ryden § 5.2)

(4.d) Starting from Ryden eq 5.39 (for $\kappa = 0$), show:
i) eq 5.40
ii) eq 5.41
iii) eq 5.43
iv) eq 5.44
And discuss.

(4.e) Starting from Ryden eq 5.51 (same equation as 5.41), Show and discuss about the eq 5.52 and 5.54.
(Lookbacktime $t_e(z)$)

(4.f.1) Show that in the matter dominated universe,
i) $a(t) \propto t^{2/3}$
ii) $t_0 = \frac{2}{3}H_0^{-1}$
iii) $d_p(z) =$ eq 5.60

(4.f.2) Show that in radiation dominated universe,
i) $a(t) \propto t^{1/2}$
ii) $t_0 = \frac{1}{2}H_0^{-1}$
iii) $d_p(z) =$ eq 5.65

(4.f.3) Show that in Λ dominated universe,
i) $a(t) \propto e^{t/H_0^{-1}}$
ii) $t_0 = \infty$
iii) $d_p(z) =$ eq 5.79

(4.g) Show that with equation 5.61, $\theta = \frac{D}{d_p}$ is minimum for $z = 1.25$ in a $\omega = 0, \Omega = 1$ universe.

(4.h) Show eq. 5.78 & 5.79 and discuss. (Actually this should be solved as a part of 4.f.3.)