"0" = TODAY

\[ H(t) = \text{Hubble parameter} \]

\[ H(t_0 = \text{today}) = H_0 = \frac{a(t)}{a(t)H} \]

\[ \Delta r_c \cdot a = \Delta d = c \cdot \Delta t \]

\[ \frac{\Delta r_c}{\Delta t} = \frac{c}{a(t)} \Rightarrow \frac{2}{a} \sim \text{const} \]

\[ \frac{d \text{obs}}{d \text{univ}} = \frac{a(t_0 \text{obs})}{a(t_0 \text{univ})} \leq 1 + z \]

Violations of SR

a) There is a universal time! \( \rightarrow \) defined by \( H(t) \)

b) There is a preferred IS at any given point

c) speeds < c

\[ \begin{align*}
\theta(t) &= a(t) \sqrt{\frac{R_c}{a(t)}} \\
\text{position given by a fixed} \rightarrow &= \frac{\text{dimensions}}{a(t)} \\
R(t) &= \text{radius of the Universe} (\text{if it has one}) \text{ arbitrary if it's flat} \\
a(t) &= \text{arbitrary if it's flat}
\end{align*} \]