"$_0$" = TODAY

$H(t)$ = Hubble parameter

$H(t_0 = \text{today}) = H_0 = \frac{\dot{a}(t)}{a(t)}$

$\Delta r_c \cdot a = \Delta d = c \cdot \Delta t$

$\frac{\Delta r_c}{\Delta t} = \frac{c}{a(t)} \Rightarrow \frac{\lambda}{a} \sim \text{const}$

$\frac{\lambda_{obs}}{\lambda_{emit}} = \frac{a(t_{obs})}{a(t_{emit})} \overset{!}{=} 1 + z$

Violations of SR

a) There is a universal time! → defined by $H(t)$ IS at any given point

b) There is a preferred

c) speeds > c

→ position given by a fixed $\vec{r}_c = \frac{\vec{d}}{a(t)}$ $a(t)$ scale factor

$\vec{d}(t) = a(t)\,\vec{r}_c$

$\vec{r}_c$ ↑ dimensionless

$a(t) = \begin{cases} \text{radius of the Universe (if it has one)} \\ \text{arbitrary if it's flat} \end{cases}$