Relativistic Mechanics

$$d\tau = \sqrt{1 - v^2/c^2}\, dt$$

τ = proper time, invariant

$\vec{v} = \frac{d\vec{l}}{dt}$, $\vec{n} = \frac{d\vec{l}}{d\tau}$ = proper velocity. (mixed quantity)

ordinary velocity

$\vec{\eta} = \frac{1}{\sqrt{1 - v^2/c^2}} \vec{v}$, $\eta^\mu = \frac{dx^\mu}{d\tau}$ proper 4-velocity

if $\tau = 89.58 \times 10^{-12}$ second (lifetime of K_S^0 meson)

$c\tau = 3 \times 10^8 \, m/sec \times 89.58 \times 10^{-12}$ sec

$= 2.68$ cm

Is mean life time a lab variable or a proper time variable?

$$\tau = \frac{1}{\Gamma} = \frac{1}{1 MeV} = 10^{-6} (eV)^{-1}$$

430 MeV
1.531 ps

1 GeV	$\simeq$	3.56 as	10^{-18}	1068 m	
1 MeV	$\simeq$	3.56 fs	10^{-15}	106.8 cm = 1 met 6.8 cm	1068 km
1 KeV	$\simeq$	3.56 ps	10^{-12}	0.1068 cm	
1 eV	$\simeq$	3.56 ns	10^{-9}	1.068 μm	
.001 eV	$\simeq$	3.56 μs	10^{-6}	1.068 nm	
		3560 as			

1 TeV

Γ τ $c\tau$

$D^{*\pm}$, 356 ps, 10.68 cm