

● Natural Units

(36)

— You'll have noticed many factors of the speed of light c in all the examples, our formulas, etc

• Examples: for any particle, $p^0 = E/c$, $p_\mu p^\mu = -m^2 c^2$
 $E^2 = (mc^2)^2 + (\vec{p}c)^2$, etc

• We're using c as a unit conversion: putting all terms in the same dimensionality (i.e., everything an energy)

• This is because we've largely been following SI units
 $c_{SI} = 2.998 \times 10^8 \text{ m/s}$

— We can instead choose natural units where $c = 1$.

• Then length + time have the same dimensions $[L] = [T]$

• Similarly, energy, mass, momentum have the same units

$$[E] = [p] = [m]$$

• Really simplifies things because you don't need factors of c

$$p_\mu p^\mu = -m^2, \quad E^2 = \vec{p}^2 + m^2, \text{ etc}$$

• If you need factors of c (for SI units, for example), you just insert them as required by dimensional analysis.