PC4245
Particle Physics

Tutorial 1

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Question 1.

(a) From c, $\hbar$ and G (Newton's constant of universal gravitation), construct a quantity ℓ_p with the dimension of length, a quantity t_p with the dimension of time, a quantity m_p with the dimension of mass. These are known as *Planck length*, the *Planck time* and *Planck mass*, respectively, after Max Planck, who first published then in 1899 – the year before the eponynmous constant itself. Work out the actual numbers in meters, seconds, and kilograms. Also calculate the *Planck energy* ($E_p = m_p c^2$) in GeV. [These quantities set the scale at which quantum gravity is expect to be relevant.]

(b) What is the gravitational analog to the fine structure constant? Find the actual number, using

i. the mass of the electron,

ii. the Planck mass.

[This question is from the D J Griffiths, Introduction to Elementary Particles, 2nd Edition, Problem 12.9, page 420]

Solution: ■

Question 2. What is the Gell-Mann-Nishijima formula? Can it be generalized?

Solution: ■