Hubble volume and the fundamental interactions

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1. Hubble volume - Hubble mass

In modern cosmology, the shape of the universe is flat. In between the closed space and flat space, there is one compromise. That is 'Hubble volume'. Note that Hubble volume is only a theoretical and spherical expanding volume and is virtual. From Hubble volume one can estimate the Hubble mass. By coupling the Hubble mass with the Mach's principle, one can understand the origin of cosmic and atomic physical parameters.In the universe, if the critical density is $\rho_c \cong \left(3H_0^2/8\pi G\right)$ and the characteristic Hubble radius is $R_0 \cong (c/H_0)$, mass of the cosmic Hubble volume is $M_0 \cong c^3/2GH_0$. There exists a charged heavy massive elementary particle M_X in such a way that, inverse of the fine structure ratio is equal to the natural logarithm of the sum of number of positively and negatively charged M_X in the Hubble volume. Surprisingly it is noticed that, M_X mass is close to Avogadro number times the rest mass of electron. The mystery can be resolved only with further research, analysis, discussions and encouragement.

Concept-1: In the expanding cosmic Hubble volume, characteristic cosmic Hubble mass is the product of the cosmic critical density and the Hubble volume. If the critical density is $\rho_c \left(3H_0^2/8\pi G\right)$ and characteristic Hubble radius is $R_0 \cong (c/H_0)$, mass of the cosmic Hubble volume is $M_0 \cong \frac{c^3}{2GH_0}$.

Concept-2: There exists a charged heavy massive elementary particle M_X in such a way that, inverse of the fine structure ratio is equal to the natural logarithm of the sum of number of positively and negatively charged M_X in the Hubble volume. If the number of positively charged $(M_X)^+$ is $\left(\frac{M_0}{M_X}\right)$ and the number of negatively charged $(M_X)^-$ is also $\left(\frac{M_0}{M_X}\right)$ then $\frac{1}{\alpha} \cong \ln\left(\frac{M_0}{M_X} + \frac{M_0}{M_X}\right) \cong \ln\left(\frac{2M_0}{M_X}\right)$.

Concept-3: For any observable charged particle, there exists 2 kinds of masses and their mass ratio is $X_E \cong 295.0606339$. First kind of mass seems to be the 'gravitational or observed' mass and the second kind of mass seems to be the 'electromagnetic' mass. This idea can be applied to proton and electron. Note that gravitational and electromagnetic force ratio of M_X is X_E^2.

Concept-4: If $\hbar$ is the quanta of the gravitational angular momentum, then the electromagnetic quanta can be expressed as $\left(\frac{\hbar}{X_E}\right)$. Thus the ratio, $\left(\frac{\hbar}{X_E}\right) \div \left(\frac{e^2}{4\pi\epsilon_0 c}\right) \cong (X_E\alpha)^{-1} \cong 0.464433353 \cong \sin\theta_W$ where $\sin\theta_W$ is very close to the weak mixing angle.

Concept-5: In modified quark SUSY, if Q_f is the mass of quark fermion and Q_b is the mass of quark boson, then $\frac{m_f}{m_b} \cong \Psi \cong 2.2627062$ and $\left(1 - \frac{1}{\Psi}\right) Q_f$ represents the effective fermion mass. The number Ψ can be fitted with the following empirical relation $\Psi^2 \ln\left(1 + \sin^2\theta_W\right) \cong 1$. With this idea super symmetry can be observed in the strong interactions as well as electroweak interactions.

Concept-6: For electron, starting from infinity, its characteristic interaction ending range is $r_{ee} \cong \frac{e^2}{4\pi\epsilon_0(m_e/X_E)c^2} \cong X_E\frac{e^2}{4\pi\epsilon_0 m_e c^2} \cong 8.315\times10^{-13}$ m. Similarly, for proton, its characteristic interaction is $r_{ss} \cong \frac{e^2}{4\pi\epsilon_0(m_p/X_E)c^2} \cong X_E\frac{e^2}{4\pi\epsilon_0 m_p c^2} \cong 4.53 \times 10^{-16}$ m.

Concept-7: Ratio of electromagnetic ending interaction range and strong interaction ending rage can be expressed as $\frac{r_{ee}}{r_{se}} \cong \frac{GM_X^2}{\hbar c} \cong 635.3131866$. Thus if $r_{ee} \cong 8.315 \times 10^{-13}$ m,

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$r_{se} \cong 1.309 \times 10^{-15}$ m, $\left(\frac{r_{ee}}{r_{se}}\right)^2 \cong \left(\frac{GM_X^2}{\hbar c}\right)^2$. Interesting observation is $\frac{r_{ss}+r_{se}}{2} \cong 0.881 \times 10^{-15}$ m $\cong \mathrm{R_p}$. This can be considered as the mean strong interaction range!

Concept-8: For any elementary particle of charge e, electromagnetic mass (m/X_E) and characteristic radius R, it can be assumed as $\frac{e^2}{4\pi\epsilon_0 R} \cong \frac{1}{2}\left(\frac{m}{X_E}\right)c^2$. This idea can be applied to proton as well as electron. Electron's characteristic radius is $R_e \cong 2X_E \frac{e^2}{4\pi\epsilon_0 m_e c^2} \cong 1.663 \times 10^{-12}$ m and proton's characteristic radius is $R_p \cong 2X_E \frac{e^2}{4\pi\epsilon_0 m_p c^2} \cong 0.906 \times 10^{-15}$ m. This obtained magnitude can be compared with the rms charge radius of the proton.

2. Potential energy of electron in Hydrogen atom

Let E_p be the potential energy of electron in the Hydrogen atom. It is noticed that, $E_p \cong \frac{e^2}{4\pi\epsilon_0 a_0} \cong \left(\frac{\hbar c}{GM_X^2}\right)\frac{(\hbar/X_E)c}{\sqrt{R_e R_p}} \cong 27.12493044$ eV where a_0 is the Bohr radius. With 99.68% this is matching with $\alpha^2 m_e c^2 \cong 27.21138388$ eV. After simplification it takes the following form, $E_p \cong \left(\frac{\hbar c}{GM_X^2}\right)^2 \frac{\sqrt{m_p m_e}c^2}{2} \cong \alpha^2 m_e c^2$. Thus the Bohr radius can be expressed as $a_0 \cong \left(\frac{GM_X^2}{\hbar c}\right)^2 \frac{2e^2}{4\pi\epsilon_0\sqrt{m_p m_e}c^2}$. Here by considering the integral nature of the elementary charge e, Bohr radius in n^{th} orbit can be expressed as $a_n \cong \left(\frac{GM_X^2}{\hbar c}\right)^2 \frac{2(ne)^2}{4\pi\epsilon_0\sqrt{m_p m_e}c^2} \cong n^2 \cdot a_0$ where a_n is the radius of n^{th} orbit and $n = 1, 2, 3, ..$ Thus in Hydrogen atom, potential energy of electron in n^{th} orbit can be expressed as $\frac{e^2}{4\pi\epsilon_0 a_n} \cong \left(\frac{\hbar c}{GM_X^2}\right)^2 \frac{\sqrt{m_p m_e}c^2}{2n^2}$. Note that, from the atomic theory it is well established that, total number of electrons in a shell of principal quantum number n is $2n^2$. Thus on comparison, it can suggested that, $\left(\frac{\hbar c}{GM_X^2}\right)^2 \sqrt{m_p m_e}c^2$ is the potential energy of $2n^2$ electrons and potential energy of one electron is equal to $\left(\frac{\hbar c}{GM_X^2}\right)^2 \frac{\sqrt{m_p m_e}c^2}{2n^2}$.

3. Magnetic moments of nucleon

If $(\alpha X_E)^{-1} \cong \sin\theta_W$, magnetic moment of electron can be expressed as $\mu_e \cong \frac{1}{2}\sin\theta_W \cdot ec \cdot r_{ee} \cong 9.274 \times 10^{-24}$ J/tesla. It can be suggested that electron's magnetic moment is due to the electromagnetic interaction range. Similarly magnetic moment of proton is due to the strong interaction ending range. $\mu_p \cong \frac{1}{2}\sin\theta_W \cdot ec \cdot r_{se} \cong 1.46 \times 10^{-26}$ J/tesla and if proton and neutron are the the two quantum states of the nucleon, by considering the mean strong interaction range $\left(\frac{r_{ss}+r_{se}}{2}\right)$, magnetic moment of neutron can be fitted as $\mu_n \cong \frac{1}{2}\sin\theta_W \cdot ec \cdot \left(\frac{r_{ss}+r_{se}}{2}\right) \cong 9.82 \times 10^{-27}$ J/tesla

4. To fit the muon and tau rest masses

Using X_E charged muon and tau masses can be fitted with the following relation. If $E_W \cong \frac{m_e c^2}{X_E} \cong 1.731843735 \times 10^{-3}$ MeV, $m_l c^2 \cong \left[X_E^3 + \left(n^2 X_E\right)^n \sqrt{N}\right]^{\frac{1}{3}} E_W$ where $n = 0, 1, 2.$

5. Higg's charged fermion and its boson

For Higgs fermion, $M_{Hf}c^2 \cong \frac{1}{2} \cdot \left(\frac{GM_X^2}{\hbar c}\right)^2 \cdot m_e c^2 \cong 103125.417$ MeV and for Higgs boson, $M_{Hb}c^2 \cong \frac{M_{Hf}c^2}{\Psi} \cong \frac{1}{2} \cdot \left(\frac{GM_X^2}{\hbar c}\right)^2 \cdot \frac{m_e c^2}{\Psi} \cong 45576.1467$ MeV. Neutral Z boson rest mass can be fitted with the relation, $m_Z c^2 \cong \left(M_{Hb}c^2\right)^{\pm} + \left(M_{Hb}c^2\right)^{\mp} \cong 2M_{Hb}c^2 \cong 91152.293$ MeV.

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