Time dependence of the masses of the pions

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Abstract

Recent work in Eddingtonian cosmology has demonstrated the relation of the visible mass of the universe to the spacial extent of the pions. Building on this finding, we find the masses of the pions themselves are dependent on the age of the universe.

It has recently been discovered [1] that the mass of the observable universe, when compacted down to the planck density

$$\rho_\mathrm{P} \equiv \frac{m_\mathrm{P}}{(\ell_\mathrm{P})^3} = \frac{c^5}{\hbar G^2} \tag{1}$$

occupies a sphere of approximately the size of the pion, taking as the pion radius its reduced compton wavelength

$$\lambda\!\!\!^{-}_\pi = \frac{\hbar}{m_\pi c}. \tag{2}$$

Miskinova and Shvilkin calculated the masses of Planck-density material occupied by the spheres of radius $\lambda\!\!\!^{-}_{\pi^0}$ and $\lambda\!\!\!^{-}_{\pi^+}$, defining,

$$M_0 \equiv \rho_\mathrm{P}\tfrac{4}{3}\pi(\lambda\!\!\!^{-}_{\pi^0})^3 \tag{3}$$
$$M_+ \equiv \rho_\mathrm{P}\tfrac{4}{3}\pi(\lambda\!\!\!^{-}_{\pi^+})^3; \tag{4}$$

and the mass of the universe, defining

$$M_\mathrm{U} \equiv \rho_\mathrm{U}\tfrac{4}{3}\pi(ct_\mathrm{U})^3, \tag{5}$$

with ρ_U the critical density of the universe and t_U the age of the universe.

Strikingly, M_0, M_+, and M_U are of similar magnitude. Let us define

$$\tan\theta_0 \equiv \frac{M_0}{M_\mathrm{U}} \approx 0.76 \tag{6}$$

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and

$$\tan\theta_+ \equiv \frac{M_+}{M_\mathrm{U}} \approx 0.69, \tag{7}$$

where all values of natural constants and masses are taken from [2]. We choose to call these two angles the Miskinova angle (θ_0) and the Shvilkin angle (θ_+). Their values are approximately 37° and 35° respectively.[2]

Neglecting the small difference between θ_0 and θ_+ for the moment, we define a common relation for either pion

$$\frac{M_\pi}{M_\mathrm{U}} \equiv \text{ぼ}^{-3}, \tag{8}$$

where ぼ (the hirigana character for the phoneme "bo") is Boscoverde's constant (currently known to be approximately 1.11). Expanding the left-hand side of equation (8), we find

$$\text{ぼ}^{-3} = \left(\frac{\hbar}{m_\pi t_\mathrm{U}}\right)^3 \frac{\rho_\mathrm{P}}{\rho_\mathrm{U}} \tag{9}$$

and therefore

$$m_\pi(t) = \text{ぼ}\,\frac{\hbar}{t}\left(\frac{\rho_\mathrm{P}}{\rho_\mathrm{U}}\right)^{\frac{1}{3}}. \tag{10}$$

This suggests that the pion had a reduced compton wavelength of approximately ℓ_P milliseconds after the big bang.

[1] Miskinova, N. A. and B. N. Shvilkin. "A possible relation of the mass of the universe with the characteristic size of elementary particles." arXiv: 1208.0824

[2] http://www.wikipedia.org

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[2] It is interesting to note that $\theta_0 \approx (\alpha^{-1} - 100)$.