Quaternion Spin 2 Field Theory
Cosmological Density Ratios - Update
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Abstract
Further to the paper **[1]**, a more careful analysis of the calculation of the cosmological density ratios is wrong, this resulted from an incorrect Lagrangian for the Quaternion spinor. The Lagrangian presented in this paper is more in line with the standard formalism. With the release of the WMAP 9 year results **[2]** the predicted (WMAP) ratios are Dark matter 0.238 (0.236), Dark energy 0.714 (0.7181) and Baryonic 0.0476 (0.0461).

Quaternion Lagrangian
For each quaternion spinor i=1,2, the Lagrangian is

$$\mathcal{L}_i = \frac{1}{6}\, \mathrm{D}^{\mu} H_i^{\dagger} \mathrm{D}_{\mu} H_i - V\left(H_i^{\dagger} H_i\right) \quad \textbf{(1)}$$

The factor 6 arises from the interchange of the 2 tensor derivates, the asymmetry of H and the interchange of H_h and H^h

The potential $V\left(H_i^{\dagger} H_i\right)$ is given by

$$V\left(H_i^{\dagger} H_i\right) = a^2\left(H_i^{\dagger} H_i\right) - b^2\left(H_i^{\dagger} H_i\right)^2 \quad \textbf{(2)}$$

The dark matter density is

$$\rho_d = \frac{1}{2\,\kappa} \sum_{i=1}^{2} \frac{1}{6}\, \partial^0 H_i^{\dagger} \partial_0 H_i \quad \textbf{(3)}$$

The dark enegy density is

$$\rho_\Lambda = \frac{1}{2\,\kappa} \sum_{i=1}^{2} V\left(H_i^{\dagger} H_i\right) \quad \textbf{(4)}$$

A general form for the Quaternion spinor is

$$H = H(r)\, f\left(x_0 \lambda^{-1}\right) \quad \textbf{(5)}$$

Substituting **(5)** and $\mathrm{H}^{\dagger}\mathrm{H} = a^2 / 2\, b^2$ into **(3)** gives

$$\rho_d = \frac{1}{6\,\kappa} \frac{a^2}{2\, b^2} \frac{1}{\lambda^2} \left(\frac{g\left(x_0\lambda^{-1}\right)}{f\left(x_0\lambda^{-1}\right)} \right)^2 = \frac{1}{12\,\kappa} \frac{a^2}{b^2} \frac{1}{\lambda^2}\, h\left(x_0\lambda^{-1}\right) \quad \textbf{(6)}$$

The maxima of the potential $\frac{1}{2}\sum_{i=1}^{2} V\left(H_i^{\dagger} H_i\right)$ is the cosmological constant Λ

$$\Lambda = \frac{a^4}{4\, b^2} \quad \textbf{(7)}$$

Eliminating b from **(6)** gives

$$\rho_d = \frac{1}{3\,\kappa} \frac{\Lambda}{a^2} \frac{1}{\lambda^2}\, h\left(x_0\lambda^{-1}\right) \quad \textbf{(8)}$$

For $f\left(\mathrm{x}_0\lambda^{-1}\right) = \exp\left(\pm\, \mathrm{x}_0\lambda^{-1}\right)$ and $\lambda \rightarrow a^{-1}$ the Compton wavelength of dark matter, the dark matter density simplifies to

$$\rho_d = \frac{1}{3}\frac{\Lambda}{\kappa} \qquad \textbf{(9)}$$

Dividing **(9)** by the critical density ρ_c gives the dark matter density ratio Ω_d

$$\Omega_d = \frac{1}{3}\Omega_\Lambda \qquad \textbf{(10)}$$

From paper **[1]** (56) the baryonic density to dark matter density ratio is

$$\frac{\Omega_b}{\Omega_d} = \frac{1}{5} \qquad \textbf{(11)}$$

WMAP 9 year results **[2]** indicates that

$$\Omega_\Lambda + \Omega_d + \Omega_b = 1.0 \qquad \textbf{(12)}$$

Solving **(10)**, **(11)**, and **(12)** gives the following cosmological density ratios

$$\Omega_b = \frac{1}{21} = 0.0476,\ \Omega_d = \frac{5}{21} = 0.238,\ \Omega_\Lambda = \frac{5}{7} = 0.714 \qquad \textbf{(13)}$$

which are in agreement with the WMAP 9 year results **[2]** ($\Omega_b = 0.0461$, Ω_d=0.236, Ω_Λ=0.7181)

References

[1] Hickman, P. Quaternion Spin 2 Field Theory, 2012: vixra:1212.0102v3

[2] Larson, David et al, Nine Year Wilkinson Microwave Anisotropy Probe (WMAP) Observations: Cosmological Parameter Results, 2012, arXiv:1212.5226 v1 [asto-ph.CO]