New Cosmological Data and the Values of the Fundamental Parameters
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Effect of Spin-Gravity Interaction on the Cosmological Parameters

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1. Introduction

Cosmological information is usually carried by, and extracted from massless spinning particles, *"carriers of cosmological information"*. The photon (spin 1-particle) is a good candidate representing one type of these carriers. Recently, the neutrino (spin $\frac{1}{2}$-particle) entered the playground as another type. We expect, in the near future, that a third type of carriers, the graviton (spin 2-particle), to be used for extracting cosmological information. Two factors affect the properties of these carriers. The first is the source of the carrier. The second factor is the trajectory of the carrier, in the cosmic space, from its source to the receiver. The first factor implies the information carried, which reflect the properties of the source. The second factor represents the impact of the cosmic space-time on the properties of the carrier. So, information carried by these particles contain, a part connected to their sources, and another part related to the space-time through which these particles traveled.

Cosmological parameters are quantities extracted from the information carried by the above mentioned particles. Consequently, the values of such parameters are certainly affected by the second factor. It is the aim of the present work to explore the impact of this factor on these parameters.

2. Spin-Dependent Cosmological Parameters

In the context of general relativity (GR), the trajectories of massless particles are assumed to be null-geodesics of the metric. Consequently, these trajectories are spin independent. Recently, three path equations in the absolute parallelism (AP)-geometry were derived (Wanas, Melek & Kahill 1995). Generalizing these equations, the author constructed the following path equation (Wanas 1998)

$$\frac{dZ^\mu}{d\tau} + \{^{\mu}_{\rho\sigma}\} Z^\rho Z^\sigma = -\frac{n}{2}\alpha\gamma \;\; \Lambda_{(\rho\sigma).}^{\;\;\;\;\;\;\mu} \;\; Z^\rho Z^\sigma, \qquad (1)$$

where $\Lambda^{\mu}_{.\alpha\beta}$ is the torsion of AP-space, n is a natural number taking the values $0, 1, 2, 3...$ for particles with spins $0, \frac{1}{2}, 1, \frac{3}{2}, ...$ respectively, α is the fine structure constant ($= \frac{1}{137}$), γ is a dimensionless parameter of order unity, fixed by the results of the COW-experiment (Wanas, Melek & Kahill 1998). The torsion term is suggested to represent a type of interaction between the quantum spin of the moving particle and the background gravitational field. For macroscopic objects with negligible rotation, or microscopic spinless particles, $n = 0$.

Kermack, McCrea & Whittaker (1933) developed two theorems on null-geodesics which were applied to get the standard red-shift of relativistic cosmology, using the following formula,

$$\frac{\lambda_o}{\lambda_1} = \frac{{}^1\eta^\mu \rho_\mu}{{}^0\eta^\mu \varpi_\mu}, \tag{2}$$

where ${}^1\eta^\mu$ is the transport vector along the null-geodesic Γ connecting two observers A and B, evaluated at A, ${}^0\eta^\mu$ is the transport vector evaluated at B, ρ^μ is the unit tangent along the trajectory of A, ϖ^μ is the unit tangent along the trajectory of B, λ_1 is the wave length of the spectral line as measured at A, λ_o is the wave length of the spectral line as measured at B, and Γ represents the trajectory of a massless particle from A (source) to B (receiver). If the universe is expanding then $\lambda_o > \lambda_1$. It can be shown that the two theorems, mentioned above, are applicable to any null-path. So, they can be used for massless spinning particles following the trajectory (1).

In order to evaluate the red-shift using (2) one has to know first the values of the vectors used in this formula. Such vectors are obtained as solutions of the spin-dependent path equation (1). Robertson (1932) constructed two geometric AP-structures for cosmological applications. Using one of these strutures, and performing the necessary calculations we get,

$$\frac{\lambda_o}{\lambda_1} = (\frac{R_o}{R_1})^{(1-\frac{n}{2}\alpha\gamma)} \quad (3).$$

Now, we define the spin-dependent scale factor as,

$$R^* = R^{(1-\frac{n}{2}\alpha\gamma))}. \tag{4}$$

Using R^*, in place of R in the standard definitions of the cosmological parameters, we can list the resulting spin-dependent parameters in Table 1. The second column of this Table, gives the values of the parameters as if they are extracted from massless spinless particles. The values of the parameters extracted from photons should match the values listed in column 4. It is worthy of mention that the matter parameter is not affected by the spin-gravity interaction. This is due to its independence on Hubble's parameter.

There are strong evidences for the existence of the spin-gravity interaction on the laboratory scale (Wanas, Melek & Kahill 1998), (using the results of the COW-experiment), and on the galactic scale (Wanas, Melek & Kahill 2000), (using the data of SN1987A). Now, to verify the existence of this interaction on the cosmological scale, observations of one parameter at least, using two different types of carriers, are needed. For example, if we observe neutrinos and photons to get Hubble's parameter, a discrepancy of order 0.001 would be expected.

Table 1: Spin-Dependent Cosmological Parameters

Parameter	Spin-0	Spin-$\frac{1}{2}$ (neutrino)	Spin-1 (photon)	Spin-2 (graviton)
Hubble	H_o	$(1-\frac{\alpha}{2})H_o$	$(1-\alpha)H_o$	$(1-2\alpha)H_o$
Age	τ_o	$\frac{\tau_o}{(1-\frac{\alpha}{2})}$	$\frac{\tau_o}{(1-\alpha)}$	$\frac{\tau_o}{(1-2\alpha)}$
Acceleration	A_o	$(1-\frac{\alpha}{2})(A_o-\frac{\alpha}{2}H_o)$	$(1-\alpha)(A_o-\alpha H_o)$	$(1-2\alpha)(A_o-2\alpha H_o)$
Deceleration	q_o	$\frac{(q_o-\frac{\alpha}{2H_o})}{(1-\frac{\alpha}{2})}$	$\frac{(q_o-\frac{\alpha}{H_o})}{(1-\alpha)}$	$\frac{(q_o-\frac{2\alpha}{H_o})}{(1-2\alpha)}$

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