

Awaiting the Measurements by the James Webb Space Telescope: ‘A Hitherto Unrecognized Principle of Nature’ Justifies the Cosmological Data

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Abstract — The James Webb Space Telescope’s measurements might bring the Standard Cosmological Model in stalemate. The cosmological data may have a microscopic cause and not the expanding of universe.

Keywords — Cosmological Parameters, Cosmological Forecasts, Large-Scale Structure.

I. INTRODUCTION

The only reliable interpretation of redshift that twentieth-century theories can give is through the expansion of the universe. On a cosmological scale, the General Theory of Relativity predicts that the universe can be static, collapse, or expand by inflation [1]. Assuming that the third version is valid, the Standard Cosmological Model and related models emerge. A second tacit assumption that has been made is that twentieth-century theories have the necessary completeness to justify cosmological data. This is why the scientific community has accepted a number of key interventions aimed at bringing the expanding universe into agreement with cosmological data. The best known is that of Dark Matter, the Inflation hypothesis and, recently, Dark Energy. Interventions in the Standard Cosmological Model followed the evolution of observation instruments. Almost every time we measured more accurately or at a greater distance, a new hypothesis for the Standard Cosmological Model followed, as a necessity to explain the unexpected new observation. So, today we have measurements for which there is no hypothesis that could bring them in line with the models that justify the redshift via the expansion of the universe. The most characteristic of these measurements is that of Riess for the two values of the Hubble constant [2]. The difference between the two values is large while the accuracy of the measurements does not allow a possible intermediate value. These measurements are completely incompatible with the models that justify the redshift via the expansion of the universe. If redshift is a consequence of the expansion of the universe, the Hubble constant necessarily has one value. For example, the two values measured by Riess give two values for the age of the universe, the one we know at 13.8 billion years and a second at 15 billion years.

II. RECENT MEASUREMENTS DO NOT AGREE WITH THE STANDARD COSMOLOGICAL MODEL

In December 2017 the results of the observations of three scientific teams over extremely long distances are announced, almost simultaneously. In the context of the Standard Cosmological Model these observations are made at a short distance from the Big Bang. The measurements do not match the timeline of evolution of the universe predicted by the Standard Cosmological Model. The first observation concerns an oversized black hole just 690 million years after the Big Bang [3]. The second observation concerns a pair of galaxies to be 800 million years from the Big Bang [4]. The third observation concerns the 21cm absorption line of hydrogen near the Big Bang [5]. The observation shows that stars existed and formed a 21cm photon background just 180 million years after the Big Bang. These recent measurements add to the Standard Cosmological Model's inability to justify the flatness of the universe, the absence of magnetic monopoles from the universe, and to solve the horizon problem.

III. A ‘HITHERTO UNRECOGNIZED PRINCIPLE OF NATURE’ JUSTIFIES THE COSMOLOGICAL DATA

Every substantial, decisive expansion of our knowledge in theoretical physics is related to at least one hitherto unknown, unrecognized principle of nature. Hubble's suggestion that redshift “represents a hitherto

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unrecognized principle of nature” [6] is coming back to the fore as never before. In 2007 the principle of self-variation was proposed as a possible cause of cosmological data [7]. A strictly defined increase in the rest masses and the electric charges of particles over time. Combining the principle of self-variation with the principle of conservation of energy/momentum and the equation of the Special Theory of Relativity for the resting mass of particles results in an axiomatic foundation of theoretical physics, the Theory of Self-Variation [8]. At the cosmological scale, the theory predicts and justifies the cosmological data known to date.

The redshift shows that some physical quantity in the universe, which, at first, we would expect to be constant, changes over time. This change is recorded in the spectrum of distant astronomical objects, as we observe the universe as it was in the past. The expansion of the universe could be the cause of the redshift of distant astronomical objects. But it is not the only possible cause. The linear electromagnetic spectrum depends on five parameters, the rest mass and the electric charge of the electron, the electrical permeability of the vacuum, the speed of light in vacuum and the Planck constant. An appropriate change of one or more of these parameters would result in the redshift of the linear spectrum of distant astronomical objects in a static universe. The wavelength of a linearly emitted photon wave is inversely proportional to the rest mass and the fourth power of the electron charge. According to the theory of Self-Variation, the rest mass and the electric charge of the electron increase over time. Therefore, due to self-variation, the wavelength of a photon emitted by an atom in a distant astronomical object is greater than the wavelength of the photon emitted by the corresponding atom on Earth. This results in a redshift of distant astronomical objects. In the context of the theory of Self-Variation, redshift has a microscopic rather than a macroscopic cause. The equation of the theory of Self-Variation for redshift gives Hubble's empirical law. The prediction for more than one Hubble constant is also remarkable.

The theory of Self-Variation predicts as the beginning of the universe almost the opposite of the Big Bang, the "Vacuum State". Let us look at this situation through the equations that give the total energy of the universe. In all equations of the theory of Self-Variation on a cosmological scale we can go back in time as much as we want, regardless of whether the universe is finite or infinite. Thus, we can calculate the initial total energy of the universe as given by the equations of the theory of Self-Variation on a cosmological scale. Calculations show that the rest energy of the particles, the overwhelming percentage of energy in the universe, tends to zero in the primordial universe. As a consequence of the principle of conservation of energy, this result is valid at any time, in any phase of the evolution of the universe. The increase of the resting energy of the particles is balanced by a form of energy for which we know its properties and its distribution in spacetime. The equations of the theory of Self-Variation allow the total energy of the universe to be equal to zero. All structures in the universe, from the microcosm to the large structures of matter on a cosmological scale, correspond to a negative dynamic energy. If we include it in the total sum of energy of the universe, it could be equal to zero. In any case, the energy content of the universe tends to be equal to zero. This is why the universe is flat. The observed flatness of the universe is not a problem in the theory of Self-Variation but a clear prediction. For the same reason the gravitational interaction cannot play the role assigned to it by the Standard Cosmological Model. Gravity can cause neither the collapse nor the expansion of the universe. Its role is limited to the creation of large structures of the universe, on the scale of distances where the consequences of self-variation are negligible. The equations of the theory of Self-Variation give a continuous and smooth evolution of the universe from the Vacuum State to the form we observe today. This development occurs as a consequence of self-variation. The part of the universe we observe today is the most recent result of this evolution. In addition, the equations of the theory of Self-Variation give information about the state and evolution of the universe even at distances greater than those delimited by the part of the universe that we can observe today through electromagnetic radiation. This allows us to "see" the universe in a past time of over 13.8 billion years, a time period in which the Standard Cosmological Model does not provide information.

As a consequence of self-variation, eight parameters of astrophysics, which in the theories of the twentieth century are considered constant, depend on the redshift, that is, on the distance of the distant astronomical object that we observe. The equations of the theory of Self-Variation on a cosmological scale give the rest mass of the electron and the particles in general, the electric charge of the electron and the particles in general, the ionization energy of the atoms, the degree of excitation of atoms, the Thomson and Klein-Nishina scattering coefficients, the energy resulting from hydrogen fusion and nuclear fission, the fine structure constant, the Bohr radius and generally the position uncertainty of particles in spacetime, as a function of redshift. A whole set of observations recorded in the cosmological data is due to the dependence of these parameters on redshift; Cosmic Microwave Background Radiation, ionization of atoms in the early universe, absence of magnetic monopoles from the universe, increased luminosity distances of type Ia supernovae, explanation of the large structures of the matter of the universe, variation of the fine structure constant, Olbers paradox. Also, “the horizon and flatness problems” are not problems in the Theory of Self-Variation but clear, simple predictions.

IV. COSMOLOGICAL SCALE EQUATIONS

We quote the equations provided by the theory of self-variation in a cosmological scale. The proofs of the equations are given in Chapter 16 of the reference [8].

The redshift z of the distant astronomical objects is calculated using (1).

$$z = \frac{A}{1-A} \left(1 - \exp\left(-\frac{kr}{c}\right) \right) \quad (1)$$

where r is the distance of the distant astronomical object, A a dimensionless parameter and k a constant, H the Hubble parameter.

$$A \rightarrow \Gamma \quad (2)$$

$$(A \rightarrow 1 \wedge A < 1)$$

$$\frac{dA}{dt} = \dot{A} = kA > 0 \quad (3)$$

$$\frac{kA}{1-A} = H \quad (4)$$

The ionization and excitation energies X_n of atoms as a function of redshift z of the distant astronomical objects:

$$X_n(r) = X_n(z) = \frac{X_n}{1+z} \quad (5)$$

$$X_n(r \rightarrow \infty) = X_n \cdot (1-A) \quad (6)$$

where X_n are the laboratory values of ionization and excitation of the atom.

The number of excited atoms in a gas in a state of thermodynamic equilibrium is given by (7).

$$\frac{N_n}{N_1} = \frac{g_n}{g_1} \exp\left(-\frac{X_n}{KT}\right) \quad (7)$$

where N_n is the number of atoms at energy level n , X_n the excitation energy from the 1st to the n^{th} energy level, $K = 1.38 \times 10^{-23} \text{JK}^{-1}$ Boltzmann's constant, T the temperature in degrees Kelvin, and g_n the multiplicity of level n , i.e. the number of levels into which level n is split apart inside a magnetic field. In a distant astronomical object, Boltzmann's equation depends on the redshift z :

$$\frac{N_n}{N_1} = \frac{g_n}{g_1} \exp\left(-\frac{X_n}{KT(1+z)}\right) \quad (8)$$

The Thomson σ_T and Klein-Nishina σ scattering coefficients as a function of redshift of the distant astronomical objects:

$$\frac{\sigma_T(z)}{\sigma_T} = \frac{\sigma(z)}{\sigma} = (1+z)^2 \quad (9)$$

$$\frac{\sigma_T(r \rightarrow \infty)}{\sigma_T} = \frac{\sigma(r \rightarrow \infty)}{\sigma} = \frac{1}{(1-A)^2} \quad (10)$$

where σ_T, σ are the laboratory values.

The rest mass m_0 of the electron as a function of the redshift z of distant astronomical objects:

$$m_0(z) = \frac{m_0}{1+z} \quad (11)$$

$$m_0(r \rightarrow \infty) = m_0 \cdot (1-A) \quad (12)$$

where m_0 is the laboratory value.

The position-momentum uncertainty Δx and the Bohr radius R_{Bohr} as a function of redshift z of the distant astronomical objects:

$$\Delta x(z) = (1+z) \cdot \Delta x \quad (13)$$

$$\Delta x(r \rightarrow \infty) = \frac{\Delta x}{1-A} \quad (14)$$

$$R_{Bohr}(z) = (1+z) \cdot R_{Bohr} \quad (15)$$

$$R_{Bohr}(r \rightarrow \infty) = \frac{R_{Bohr}}{1-A} \quad (16)$$

A. A Possible Variation of Redshift

The redshift in (1) comes from the Self-variation of the rest mass and the electric charge of the electron. The redshift in the main volume of the linear spectrum we observe from distant astronomical objects, is actually caused by this effect. Today, however, we have the capability to perform high sensitivity measurements of the effects of the Self-variation. The structure of matter predicted by theory of Self-variation must be taken into account in these measurements. This structure could influence the parameters k, A, H of (1). In such a case, we will obtain different values for these parameters, for different material particles p :

$$A_p \rightarrow 1^- \quad (17)$$

$$(A_p \rightarrow 1 \wedge A_p < 1)$$

$$\frac{dA_p}{dt} = \dot{A}_p = k_p A_p > 0 \quad (18)$$

$$\frac{k_p A_p}{1-A_p} = H_p \quad (19)$$

$$m_{0,p}(z_\gamma) = \frac{m_{0,p}}{1+z_\gamma} \quad (20)$$

The energy of the γ radiation that comes from nuclear reactions, and not from accelerated / decelerated electrons, depends on the particles that take part in the reaction. In this case, (1) takes the form (21).

$$z_\gamma = \frac{A_p}{1-A_p} \left(1 - \exp\left(-\frac{k_p r}{c}\right) \right) \quad (21)$$

The production of energy $E(z_\gamma)$ in the Universe is mainly through hydrogen fusion and nuclear reactions. Therefore, the energy produced in the past at distant astronomical objects was smaller than the corresponding energy E produced today in our galaxy:

$$\Delta m_{0,p}(z_\gamma) c^2 = \frac{\Delta m_{0,p} c^2}{1+z_\gamma} \quad (22)$$

$$E(z_\gamma) = \frac{E}{1+z_\gamma} \quad (23)$$

V. DISCUSSION

Cosmological data record the consequences of self-variation since we observe the universe as it was in the past. The James Webb Space Telescope has thirty times the resolution of the Hubble Space Telescope and much higher resolution than ground-based telescopes. We conjecture that from the first observations that James Webb will make on a cosmological scale, it will confirm self-variation and its consequences.

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