A simplified view of the universe

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In this article, we consider, in a simple way, that the universe could be flat and infinite, and that the excited atoms of the galaxies would produce the redshift.

Key words: Flat infinite universe, excited atoms, light redshift.

1. Introduction

Generally, it is considered that the universe was originated in the Big Bang, and since then it is expanding. In that theory, the redshift of the light emitted from distant galaxies (the so-called cosmological redshift [1]) is interpreted as a Doppler effect and then considered as an indication of the expansion of the universe, following the law of Hubble. This empirical law is stated as $v_r = Hd$ where v_r is the velocity of recession, namely the speed at which a light source moves away from the observer, due to the expansion of the space between them; H is the constant of Hubble, and d is the distance between the observer and the light source. The light redshift parameter is defined as $z = \frac{\nu_e - \nu_o}{\nu_o}$, being ν_e and ν_o the light frequencies emitted and observed, respectively. For low values of z [1], $z = \frac{v_r}{c} = \frac{Hd}{c}$, being c the velocity of the light in the vacuum, therefore the (low) redshift of the galaxies is proportional to their distances to the observer.

However, we are going to consider, using only very elemental arguments, that the universe could be flat [1] and infinite in space, hence static [1] and without beginning nor end, and that the redshift in the light coming from the galaxies would be produced by their own excited atoms.

2. A flat infinite universe

For any particle on the surface of the universe, according to the classical mechanics of Newton, we have that [2, 3]

$$E = T + V = \frac{1}{2} m \left(\frac{dR}{dt} \right)^2 - \frac{GMm}{R} \tag{2.1}$$

being E, T and V the total, kinetic and potential energies of the particle, respectively, m its mass, M and R the mass and the radius of the universe, respectively, G the gravitational constant of Newton and t the time. For a homogeneous and isotropic universe

$$M = \rho \frac{4}{3} \pi R^3 \tag{2.2}$$

being ρ the mass density. Substituting (2.2) into (2.1), we obtain that

$$\left(\frac{dR}{Rdt} \right)^2 = \frac{8\pi G \rho}{3} - \frac{k}{R^2} \tag{2.3}$$

where $k = -\frac{2E}{m}$ is the constant of curvature.

If $T = -V$, where $T > 0$ and $V < 0$, then $E = T + V = 0$, $k = -\frac{2E}{m} = 0$ and $\rho = \frac{3}{8\pi G}\left(\frac{dR}{Rdt} \right)^2$. If $R = \infty$ (flat surface), $\rho = \frac{3}{8\pi G}\left(\frac{dR}{\infty dt} \right)^2 = 0$. If in addition the surface is infinite, $U = \sum E = \sum 0 = 0$. Also, $\vec{P} = \sum \vec{p} = 0$, being $\vec{p}$ the linear momentum, since all way has two opposite directions, and $\vec{L} = \sum \vec{\ell} = 0$, where $\vec{\ell} = \vec{r} \times \vec{p}$ is the angular momentum, since all rotation is clockwise or its contrary. Hence, for a flat infinite universe we have: $\sum T = -\sum V$, where $\sum T > 0$ and $\sum V < 0$, or generalizing, the positive energy create an equal negative gravitational energy, and $U = \sum E = 0$, $k = 0$, $R = \infty$, $\rho = 0$, $\vec{P} = 0$ and $\vec{L} = 0$. But as $\sum T = \infty$ and $\sum V = -\infty$, then $U = \Delta E$, $P = \left|\vec{P}\right| = \Delta p$ and $L = \left|\vec{L}\right| = \Delta \ell$, with $\Delta E \Delta t = h$, $\Delta p \Delta x = h$ and $\Delta \ell = h$, being h the constant of Planck and x a space coordinate, according to the uncertainty principle of Heisenberg. As $R = \infty$ and $M = \infty$, we assume, from (2.2), that the mass density is very low, $\rho \approx 0$ (from [4] (p. 487), $\rho = 10^{-29}\ g/cm^3$). As $E = k_B T_K$, being k_B the constant of Boltzmann and T_K the temperature of Kelvin, the absolute temperature of the universe would be $\Delta T_K = \frac{U}{k_B} = \frac{\Delta E}{k_B}$ (from [5], $\Delta T_K = 2.4^\circ K$).

This universe would be composed of radiation (pure energy) and matter, and both (energy/matter) would be transformed into each other by thermic processes (exo/endo, losing/gaining heat), in a non-end cycle.

3. The light redshift

As this universe is infinite, it is static and there is not any Big Bang, then the space is not expanding and the redshift would not be due to the expansion of the universe [1]. The excited atoms of the galaxies would produce it. The energy of an atomic electron is quantified [6] (pp. 119-120), $E_n = -\frac{me^4}{8\varepsilon_0 h^2}\left(\frac{1}{n^2}\right)$, $n = 1,2,3,...,\infty$, being m and e the mass and the electric charge of the electron, ε_0 the permittivity of the vacuum and n the quantum number of the orbit. $n = 1$ is the fundamental state, the others are excited states. The states with large values of n are very close to each other. When the electron jumps from E_i to E_f ($n_i > n_f$) emits a photon with a energy $h\nu = E_i - E_f$. The light redshift corresponds to low values of $\nu = \frac{E_i - E_f}{h}$ that in his turn correspond to high values of n_i and n_f. Then, we may assume that the atoms of the redshifted galaxies are more excited than the ones of the same elements on the Earth. Our main rule would be: the atoms, as more excited more redshift.

The Doppler and the gravitational shifts (both can be blue or red) [1] are also independent of the distance between the observer and the light source, but they would be less important because cannot explain the observed case [7] of a quasar (with high redshift, $z = 2.114$) in front of a galaxy (NGC 7319, with much lesser redshift, $z = 0.0225$). According to the law of Hubble, $z = \frac{v_r}{c} = \frac{Hd}{c}$, the quasar would be almost 94 (or $\frac{2.114}{0.0225}$) times more away from us than the galaxy, which not seems to be the case. Using our rule, the atoms of the quasar would be 94 times more excited than the ones of the galaxy.

But, according to the principle of minimum energy, the excitation of the atoms of a galaxy would decrease with the time, whenever the galaxy not be disturbed in excess (as for example, by a collision with other galaxy). And conversely, because of the processes of formation of the galaxies, the atoms of the young galaxies would be excited. Then, if we see the light of a galaxy shifted to the blue/red it might be because when the galaxy emitted its light was older/younger than our own galaxy. If the quasar would have been ejected from the nucleus of the galaxy, the quasar would be 94 times younger than the galaxy.

4. Conclusion

We conclude that the universe could be flat and infinite, and that the excited atoms of the galaxies would produce the redshift.

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