Conservation of Energy in a Static Universe

Alexey Shlenov
Budapeshskaya 66-1-77
192286 Leningrad
USSR

An analysis of contradictions in the theory of universal expansion leads to the conclusion that the universe is stationary and Euclidean, and that the cosmic redshift is not expansion-related. As an alternative explanation for the redshift, an exponential redshift-distance relation based on conservation of energy is considered.

Introduction

It is a well known fact that a change in the wavelength, λ, or the frequency, ν, of transverse photons may be caused by different mechanisms:

- displacement of the source of emission relative to the observer (Doppler Effect);
- effects due to an inhomogeneous gravitational field;
- an interaction of photons with other matter or with radiation.

In the latter case, the degree of redshift is expressed by the Hubble law, written as follows (Hubble & Tolman 1935):

$$\frac{\Delta l}{l} = \frac{H}{c}\Delta r \tag{1}$$

$$z = \frac{l}{l_0} - 1 = \exp\left(\frac{H}{c}r\right) - 1 \tag{2}$$

where H is the Hubble constant, c is the velocity of light, z is the cosmic redshift, and Δr and r represent distance.

Relations (1) and (2) have not been investigated properly, in part because of the difficulties involved in verifying them directly by astronomical methods. Certainly, conventional methods are effective within the range $z < 0.5$, *i.e.* in a region where equation (2) does not differ significantly from the generally accepted linear formula for Hubble's law:

$$z = \frac{H}{c}r \tag{3}$$

Astronomical methods have been used to improve the estimate of Hubble's constant (Sandage & Tammann 1974). When $z \geq 0.5$, redshift values are the preferred method for determining distances to extragalactic objects. In such cases, the distance calculation must be made on the basis of one or another universe model.

To resolve this dilemma, we shall examine a physical interpretation of relations (1) and (2) (Shlenov 1989a), derive some simple corollaries and compare them with observational findings.

Physical representation

The following physical representation will be used.

The universe is presumed to neither expand nor contract; instead, it is in a steady state in which matter is neither created nor destroyed. This infinite universe contains within itself a substance which is in

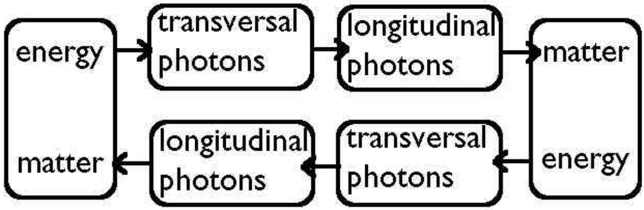

Figure 1 – The cycle of energy from matter through longitudinal photons and back to matter.

perpetual motion. It is filled with radiation in the form of transverse photons ($\nu >> H$) and longitudinal photons ($\nu \cong H$), which manifest themselves as gravitation, electrostatics and magnetostatics. These phenomena are described by relative integral theorems (Shlenov, 1988, 1989b).

The photons travel at velocity c. Matter radiates transverse photons. In a volume $V \geq 10^{81}$ cm^3, the energy radiated during a unit of time is $E_{rad} = \varepsilon_{av}\rho_{av}V$, where ε_{av} is the mean power radiated by a unit of mass and ρ_{av} is the mean density of matter. The energy of transverse photons being transformed into the energy of longitudinal photons is $E_1 = E_{rad}$. The energy of longitudinal photons being returned back to substance is $E_2 = E_1$ (see Figure 1).

The energy density of longitudinal photons is considerably higher than the energy density of the cosmic microwave background radiation ε_F or the energy density of galactic radiation ε_g:

$$e_{11} \cong r_{av}c^2 >> e_F \tag{4}$$

Newton's and Coulomb's laws may thus be explained as resulting from a balance of exterior pressure by longitudinal photons.

Theoretical relations

In working out the implications of this model, we shall limit ourselves to the simplest relations that can be compared with currently available observational data.

The formal application of a differential Poisson's equation $\Delta\Psi = 4\pi G\rho_{av}$ (where Δ is Laplace's operator, Ψ is the gravitational potential and G is the gravitational constant) to stable masses leads to Seeliger's paradox, which appears as follows:

- The results of an analysis of acceleration become dependent on the alternative origins of coordinate systems and/or on the magnitudes of integration constants.
- By moving a test mass (singularity) from the coordinate origin, it is theoretically possible to derive any pre-determined acceleration.

By assuming Poisson's equation for spherical coordinates, Einstein was able to derive a cosmological equation which is connected to a number of paradoxes.

- The big bang theory and its primordial singularity are contradicted by the weak and perfect cosmological principles.
- The notion that the universe has a "radius", a "birth" and a "death" are untenable.
- Faster-than-light velocities are impossible when the rate of expansion is zero.
- According to general relativitiy, the characteristics of the cosmic microwave background radiation (F) imply that the earth lies at a singular point at the centre of the universe.

Using the above, we derive and solve a kinematic equation for a photon. Accordingly, we include the photon energy $h\nu$ and relativistic photon mass $h\nu/c^2$ in Poisson's equation, and write (Shlenov 1989a):

$$\Delta G\Psi = -4\pi G\left(\rho - \rho_{av}\right) \tag{5}$$

$$\begin{aligned}\frac{\partial^2 E}{\partial r^2} &= c\frac{\partial^2 P}{\partial r^2} = c^2\frac{\partial^2 m}{\partial r^2} = h\frac{\partial^2 \nu}{\partial r^2} = \frac{h}{2\pi}\frac{\partial^2 \omega}{\partial r^2} \\ &= \frac{E}{c^2}\frac{\partial^2\Psi}{\partial r^2} = \frac{P}{c}\frac{\partial^2\Psi}{\partial r^2} = m\frac{\partial^2\Psi}{\partial r^2} \\ &= \frac{h\nu}{c^2}\frac{\partial^2\Psi}{\partial r^2} = \frac{h\omega}{2\pi}\frac{\partial^2\Psi}{\partial r^2}\end{aligned} \tag{6}$$

$$\left.\begin{aligned}\frac{\partial^2\Psi}{\partial r^2} &= \frac{4\pi G}{3}\rho_{av} \\ z &= \exp\left(\frac{Hr}{c}\right) - 1 \\ H &= \sqrt{\frac{4\pi G}{3}\rho_{av}}\end{aligned}\right\} \tag{7}$$

Boundary conditions may be established by analyzing the following integrals for infinite values or values appropriate to galaxies, as follows:

$$\begin{aligned}E_1 &= \frac{H}{c}\varepsilon_{av}\rho_{av}V\int_0^\infty \exp\left(-\frac{H}{c}r\right)\mathrm{d}r \\ &= \varepsilon_{av}\rho_{av}V = E_{rad}\end{aligned} \tag{8}$$

$$\begin{aligned}\varepsilon_F &= \frac{\varepsilon_{av}\rho_{av}}{c}\int_0^\infty \exp\left(-\frac{H}{c}r\right)\mathrm{d}r \\ &= \frac{\varepsilon_{av}\rho_{av}}{H}, \quad G = \frac{3H}{4\pi}\frac{\varepsilon_{av}}{\varepsilon_F}\end{aligned} \tag{9}$$

$$\varepsilon_g = \frac{\varepsilon_{av}\rho_g}{c}\int_0^{R_g}\exp\left(-\frac{H}{c}r\right)\mathrm{d}r \cong \frac{\varepsilon_{av}\rho_g}{c}R_g \tag{10}$$

where ρ_g is the mean mass density of a galaxy g, R_g/c is the mean time within which a radiated photon leaves the galaxy g, and $1/H$ is the time constant of the photon.

Combining these relations with the law of conservation of energy yields the following relations:

$$\varepsilon_{av} = \begin{cases} \dfrac{\varepsilon_F}{\rho_{av}}H = \dfrac{E_{rad}}{\rho_{av}V} = \dfrac{E_1}{\rho_{av}V} = \dfrac{E_2}{\rho_{av}V} \\[2ex] \dfrac{L_g}{M_g} = \dfrac{E_{g2}}{M_g} = \dfrac{\varepsilon_g}{\rho_g}\dfrac{c}{R_g} \end{cases} \tag{11}$$

where L_g and M_g are the luminosity and mass of a galaxy g, and E_{g2} is the energy of longitudinal photons absorbed by the matter in the galaxy during a unit of time.

The magnitude of an object may therefore be related to its redshift by the following equation:

$$m_v \geq -2.5\log\frac{A}{\ln^2(1+z)} \tag{12}$$

where A is a coefficient to be determined by observation.

Observational confirmation

It can readily be shown that relations (7) through (12) are confirmed by observational findings (Oort 1958, Roberts 1969, Narlikar &

Wickramsinghe 1967, Hoyle & Wickramsinghe 1967, Smart 1973, Sandage & Tammann, 1974, 1975):

$$H \cong 1.6 \cdot 10^{-18}\,\mathrm{sec}^{-1}, \quad \mathbf{r}_{av} \cong 10^{-29}\, g\ cm^{-3}$$

$$\mathbf{e}_F = 4 \cdot 10^{-13}\, erg\ cm^{-3}, \quad G = 6.673 \cdot 10^{-8}$$

$$\mathbf{e}_{Gal} = 5 \cdot 10^{-13}\,\mathrm{erg}\ cm^{-3}, \quad M_o = 2 \cdot 10^{33}\,\mathrm{gr}$$

$$L_o = 3.9 \cdot 10^{33}\,\mathrm{erg\ sec}^{-1}$$

$$M_{Gal} \cong 5 \cdot 10^{11} M_o = 10^{45}\, gr, \quad \mathbf{r}_{Gal} = 10^{-24} - 10^{-23}\, gr\ cm^{-3}$$

$$\frac{R_{Gal}}{c} \cong 10^{12}\,\mathrm{sec}, \quad \frac{\mathbf{e}_{Gal}}{\mathbf{r}_{Gal}} \frac{c}{R_{Gal}} \cong \frac{L_o}{20 M_0},$$

$$\frac{\mathbf{e}_F}{\mathbf{r}_{av}} H \cong \frac{L_0}{20 M_0}, \quad \frac{M_g}{L_g} \cong \frac{20 M_0}{L_0}$$

In particular, the relation $M_g/L_g \cong 20\ M_o/L_o$ is the average for a whole range of galaxies (Oort 1958, Tammann 1974), while spiral galaxies (*Sg*) and elliptical galaxies (*Eg*) exhibit the following relations:

$$\frac{M_{Eg}}{L_{Eg}} > \frac{20 M_0}{L_0}, \quad \frac{M_{Sg}}{L_{Sg}} < \frac{20 M_0}{L_0}$$

Relation (12) is confirmed by radiogalaxy data (Sandage and Tammann 1974a,b). The data on quasars (Burbidge & Burbidge 1967, Hewitt & Burbidge 1987) is summarized in tables I and II.

Table I Characteristics of bright quasars (Burbidge & Burbidge 1967)

	OBSERVATIONS		CALCULATIONS	
OBJECT	**z**	**m_v**	**(12a)**	**r (Gpc)**
3C 273	0.158	12.8	12.1	0.9
PKS 2344+09	0.677	15.97	14.9	3.1
3C 454.3	0.859	16.1	15.3	3.8
PKS 0122-00	1.070	16.0	15.6	4.4
PHL 1377	1.436	16.46	16.1	5.4
PKS 0237-23	2.223	16.63	16.6	7.1

$$m_v = -2.5 \log \frac{3 \cdot 10^{-7}}{\ln^2(1+z)} \tag{12a}$$

Table II Characteristics of more bright quasars (Hewitt & Burbidge 1987)

	OBSERVATIONS		CALCULATIONS	
OBJECT	**z**	**m_v**	**(12b)**	**r (Gpc)**
3CR 273	0.158	12.86	11	0.9
OJ287	0.306	14	12.3	1.6
3C 29.45	0.729	14.41	13.9	3.3
TON 490	1.637	15.4	15.2	5.9
TON 1530	2.051	15.49	15.5	6.8
SR	3.41	16.5	16.1	9.0

$$m_v = -2.5 \log \frac{8 \cdot 10^{-7}}{\ln^2(1+z)} \tag{12b}$$

Conclusion

Analysis suggests that the conservation mechanism presented in this work is quite plausible. Energy radiated by matter is transmitted to a "mediator", which returns it to matter.

However, current findings from observational astronomy offer evidence that elliptical galaxies absorb more energy than they radiate, while spiral and irregular galaxies radiate more energy than they absorb. It would be of interest to compare these findings to recent evolutionary schemes for galaxies (Jaakkola 1989a, b).

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